City of Richmond

Agenda

Public Works & Transportation Committee

Anderson Room, City Hall
6911 No. 3 Road

Wednesday, July 23, 2014
4:00 p.m.

Pg. # ITEM

MINUTES

PWT-6 ***Motion to adopt the minutes of the meeting of the Public Works & Transportation Committee held on Wednesday, June 18, 2014.***

NEXT COMMITTEE MEETING DATE

Wednesday, September 17, 2014, (tentative date) at 4:00 p.m. in the Anderson Room

ENGINEERING AND PUBLIC WORKS DEPARTMENT

1. **FLOOD PROTECTION UPDATE 2014**
(File Ref. No. 10-6060-04-01) (REDMS No. 4265796)

PWT-23 See Page **PWT-23** for full report

Designated Speaker: Lloyd Bie

STAFF RECOMMENDATION

That the staff report titled, Flood Protection Update 2014, dated June 23, 2014, from the Director, Engineering, be received for information.

2. **EAST RICHMOND AGRICULTURAL WATER SUPPLY**
(File Ref. No. 10-6060-04-01) (REDMS No. 4266052)

PWT-31 See Page **PWT-31** for full report

Designated Speaker: Lloyd Bie

STAFF RECOMMENDATION

That the report titled East Richmond Agricultural Water Supply Update 2013 as attached to the staff report titled East Richmond Agricultural Water Supply, dated June 27, 2014, from the Director, Engineering, be used as input in the five year capital program process.

3. **FRASER RIVER DREDGING AND ENVIRONMENTAL CONSIDERATIONS FOR STEVESTON HARBOUR AND STURGEON BANK**
(File Ref. No. 10-6150-01) (REDMS No. 4239913)

PWT-114 See Page **PWT-114** for full report

Designated Speakers: Lloyd Bie and Lesley Douglas

STAFF RECOMMENDATION

That the staff report titled Fraser River Dredging and Environmental Considerations for Steveston Harbour and Sturgeon Bank, dated June 30, 2014, from the Director, Engineering, be received for information.

4. **CIGARETTE BUTT RECYCLING PROGRAM**
(File Ref. No. 10-6370-01) (REDMS No. 4245647)

PWT-121 See Page **PWT-121** for full report

Designated Speaker: Suzanne Bycraft

STAFF RECOMMENDATION

(1) That the staff report titled Cigarette Butt Recycling Program, from the Director, Public Works, dated June 25, 2014, be received for information; and

(2) That staff work with Vancouver Coastal Health Authority on strategies to reduce cigarette butt litter at the locations identified in the staff report titled Cigarette Butt Recycling Program, from the Director, Public Works, dated June 25, 2014.

5. **REPORT 2013: ACHIEVING GOALS THROUGH COMMUNITY ENGAGEMENT**
(File Ref. No. 10-6375-05) (REDMS No. 4258490)

PWT-131 See Page **PWT-131** for full report

Designated Speaker: Suzanne Bycraft

STAFF RECOMMENDATION

That the annual report titled, Report 2013: Achieving Goals Through Community Engagement be endorsed and made available to the community through the City's website and through various communication tools including social media channels and as part of community outreach initiatives.

6. **GRAYBAR ROAD DRAINAGE AND SANITARY MAIN REPLACEMENT**
(File Ref. No. 10-6000-01) (REDMS No. 4255539)

PWT-192 See Page **PWT-192** for full report

Designated Speaker: Milton Chan

STAFF RECOMMENDATION

That funding of $325,000 from the Sanitary Utility Reserve and $275,000 from the Drainage Utility Reserve be included as an amendment to the 5 Year Financial Plan (2014-2018) to complete the Graybar Road Drainage and Sanitary Main Replacement Project.

7. **2014 CORPORATE ENERGY MANAGEMENT UPDATE**
(File Ref. No. 10-6000-01) (REDMS No. 4258807)

PWT-196 See Page **PWT-196** for full report

Designated Speaker: Levi Higgs

STAFF RECOMMENDATION

That the staff report titled 2014 Corporate Energy Management Program Update, dated June 25, 2014, from the Director of Engineering, be received for information.

8. **ELECTRIC VEHICLE PROMOTION AT COMMUNITY EVENTS**
(File Ref. No. 10-6000-01) (REDMS No. 4258974)

PWT-210

See Page **PWT-210** for full report

Designated Speaker: Brendan McEwan

STAFF RECOMMENDATION

That the City's participation in the Emotive electric vehicle initiative, as described in the staff report titled Electric Vehicle Promotion at Community Events, dated June 16, 2014, from the Director, Engineering, be endorsed.

9. **ALEXANDRA DISTRICT ENERGY UTILITY EXPANSION PHASE 3**
(File Ref. No. 10-6600-10-02/2014) (REDMS No. 4180584 v. 25)

PWT-214

See Page **PWT-214** for full report

Designated Speaker: Alen Postolka

STAFF RECOMMENDATION

That:

(1) the expansion of the Alexandra District Energy Utility include additional geoexchange fields in the West Cambie Neighbourhood Park, with supplemental conventional energy systems for back up, as presented in the staff report titled Alexandra District Energy Utility Expansion Phase 3, dated July 3, 2014, from the Director, Engineering, be endorsed; and

(2) capital submissions totalling $12.3M for design, construction and commissioning of the ADEU Phase 3 be submitted for Council's consideration as part of the City's Five Year Financial Plan (2015-2019).

Pg. # ITEM

10. **MANAGER'S REPORT**

ADJOURNMENT

City of Richmond

Minutes

Public Works & Transportation Committee

Date:	Wednesday, June 18, 2014
Place:	Anderson Room Richmond City Hall
Present:	Councillor Linda Barnes, Chair Councillor Derek Dang Councillor Linda McPhail Councillor Harold Steves Mayor Malcolm Brodie
Absent:	Councillor Chak Au
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 & Transportation Committee held on Thursday, May 22, 2014, be adopted as circulated.

CARRIED

NEXT COMMITTEE MEETING DATE

Wednesday, July 23, 2014, (tentative date) at 4:00 p.m. in the Anderson Room

PLANNING & DEVELOPMENT DEPARTMENT

1. **GEORGE MASSEY TUNNEL REPLACEMENT – STATUS UPDATE AND PROPOSED PROJECT OBJECTIVES**
(File Ref. No. 01-0150-20-THIG1/2014) (REDMS No. 4228713)

In reply to queries from Committee, Donna Chan, Manager, Transportation Planning advised that (i) the Ministry of Transportation and Infrastructure (MOTI) opened a project office in Richmond, which includes an area where members of the public may obtain additional information regarding the Project, and (ii) kiss-and-ride is another term for a drop-off zone adjacent to a transit hub.

Discussion ensued and it was suggested that the proposed recommendation and staff report also be forwarded to Richmond Members of the Legislative Assembly (MLAs).

In reply to queries from Committee, Victor Wei, Director, Transportation, advised that staff have had ongoing discussions with business stakeholders and the Richmond Chamber of Commerce regarding concerns related to the Project; therefore, at this time, staff do not believe there is a need for a dedicated advisory committee.

Ms. Chan commented on data provided by the MOTI, noting that staff are awaiting a detail breakdown of the statistics. Also, she advised that the MOTI utilized sophisticated Bluetooth technology to collect this data, and noted that personal information was not collected as part of this research.

Discussion ensued regarding how effective the proposed new bridge will be at addressing traffic flow concerns; it was noted that the Project must address traffic congestion along the entire corridor and simply not shift congestion from one area to another.

Mr. Wei commented on the preliminary concept of the proposed new bridge and advised that (i) the MOTI is considering an 8 to ten lane bridge, with outside lanes skewing off at existing and potentially additional future interchanges along the corridor.

The Chair commented on her visit to the project office, noting that the project scope is solely for a new bridge as no decisions have been made in regards to additional interchanges, and road improvement beyond those required to accommodate the proposed new bridge. Also, the Chair requested that statistical information be forwarded to all members of Council as it becomes available.

In reply to queries from the Chair, Mr. Wei advised that the iconic bridge objective encompasses two notions: (i) to design a bridge that acts as a visual gateway to Richmond, and (ii) to celebrate all modal uses, including sustainable transportation.

It was moved and seconded

(1) That the proposed project objectives for the replacement of the George Massey Tunnel as described in the staff report dated May 23, 2014 from the Director, Transportation be endorsed and forwarded to the Ministry of Transportation & Infrastructure for its consideration in the development of a preferred project scope of improvements; and

(2) That the above Council resolution and a copy of the above report be forwarded to Richmond MLAs, TransLink, the Corporation of Delta and the Cities of Surrey, White Rock and Vancouver for information.

CARRIED
Opposed: Cllr. Steves

2. CAR2GO - CITY CENTRE CAR-SHARE PILOT PROGRAM

(File Ref. No. 10-6455-00) (REDMS No. 4234234)

Katie Ferland, Business Development Liaison, accompanied by Sonali Hingorani, Transportation Engineer, provided background information.

In reply to queries from Committee, Ms. Ferland provided the following information:

- Car2Go is the last car share company in the Metro Vancouver region to enter Richmond's market;
- when selecting its next service location, Car2Go considers various factors such as population density, accessibility to transit and so forth;
- Car2Go pays for all parking fees on behalf of their users; and
- Car2Go's marketing program will focus on details such as where to obtain vehicles, and where to park vehicles.

Ms. Ferland spoke of Car2Go's program, noting that Car2Go users receive membership cards with embedded chips. These cards allow members to access any Car2Go vehicle by tapping the vehicle. Also, she commented on costs, fuel use, and a mobile application that enables members to reserve vehicles.

It was moved and seconded
That:

(1) the business terms (the "Business Terms") specified in Attachment 2 of the staff report titled, Car2Go – City Centre Car-Share Pilot Program, dated May 28, 2014, from the Director, Transportation, for the purpose of entering into an Agreement between Car2Go Canada Ltd. and the City of Richmond for the use of public parking spaces on a one-year trial basis be approved;

(2) the Chief Administrative Officer and the General Manager, Planning and Development be authorized to execute an Agreement based on the Business Terms; and

(3) staff be directed to monitor the outcomes of the pilot program and report back to Council after one year of implementation.

CARRIED

ENGINEERING & PUBLIC WORKS DEPARTMENT

3. **2013 ANNUAL WATER QUALITY REPORT**
(File Ref. No. 10-6000-01) (REDMS No. 4227330)

It was moved and seconded
That the 2013 Annual Water Quality Report, dated May 27, 2014, from the Director, Public Works, be received for information.

The question on the motion was not called as the Chair commended staff for the work that they do to ensure that Richmond residents continually receive the best quality water.

In reply to queries from Committee, Bryan Shepherd, Manager, Water Services, advised that the 2013 Annual Water Quality report is available on the City website. Also, Mr. Shepherd noted that staff have been metering the tap water stations in order to collect data regarding their use.

The question on the motion was then called and it was **CARRIED**.

4. **NATIONAL PUBLIC WORKS WEEK – UPDATE**
(File Ref. No. 10-6000-01) (REDMS No. 4240804)

In reply to a query from Committee, Tom Stewart, Director, Public Works, advised that staff have discussed the possibility of extending the hours of the Public Works Open House due to its success.

It was moved and seconded
That the staff report titled National Public Works Week – Update, dated May 27, 2014, from the Director, Public Works, be received for information.

CARRIED

5. **PROPOSED POLICY FOR MANAGEMENT OF WASTE AND RECYCLABLE MATERIALS FROM CITY FACILITIES DEMOLITION AND CONSTRUCTION ACTIVITIES**
(File Ref. No. 10-6370-00) (REDMS No. 4239937)

In reply to queries from Committee, Suzanne Bycraft, Manager, Fleet and Environmental Programs, advised that (i) if the proposed policy is approved, staff will partner with local builders on a trial basis to gather feedback on four single-family home projects, and (ii) staff will report back to Committee in fall 2014 with the findings of the trial and recommended next steps.

Discussion ensued regarding the recycled building materials market, and Ms. Bycraft noted that industry often follows demand created by the implementation of a new regulation.

It was moved and seconded
That a new policy respecting the Management of Waste and Recyclable Materials from City Facilities Demolition and Construction Activities, as outlined in Attachment 1 to the staff report titled, Proposed Policy for Management of Waste and Recyclable Materials from City Facilities Demolition and Construction Activities, dated June 5, 2014, from the Director, Public Works, be adopted.

CARRIED

6. **LETTER SUPPORTING CONTINUATION OF CLEAN ENERGY VEHICLES REBATE**
(File Ref. No.) (REDMS No. 4221373)

It was moved and seconded
That a letter supporting the continuation of the Clean Energy Vehicles for British Columbia be sent to the BC Minister of Energy and Mines and Responsible for Core Review under the Mayor's signature, with copies to Richmond MLAs, and Metro Vancouver members.

CARRIED

7. **MANAGER'S REPORT**

(i) Parks Division Update

Mr. Stewart updated Committee on a matter related to Legionnaires' disease and spoke of a lunch-and-learn session scheduled for staff.

(ii) Works on Wheels Tours

Robert Gonzalez, General Manager, Engineering and Public Works, provided background information and introduced Dielle Saldanha, Public Works Clerk, and Pratima Cheung, Engineer-In-Training.

Ms. Saldanha and Ms. Cheung then spoke of Works on Wheels, an interactive bus tour showcasing some of Richmond's Engineering and Public Works projects. The tours provided a behind-the-scenes look at projects like the Alexandra District Energy Utility, the Williams Road Drainage Pump Station, and Fire Hall No. 4.

Ms. Saldanha and Ms. Cheung commented on the success of the tours, highlighting that public feedback was overwhelmingly positive.

Ms. Saldanha and Ms. Cheung distributed information regarding Works on Wheels (attached to and forming part of these Minutes as Schedule 1) and in reply to queries from Committee, advised that feedback received indicates a strong desire for additional tours and for tours of other infrastructure projects.

ADJOURNMENT

It was moved and seconded
That the meeting adjourn (4:57 p.m.).

CARRIED

Certified a true and correct copy of the Minutes of the meeting of the Public Works & Transportation Committee of the Council of the City of Richmond held on Wednesday, June 18, 2014.

Councillor Linda Barnes
Chair

Hanieh Berg
Committee Clerk


Works on Wheels
Infrastructure Bus Tour & Harvest Power
Itinerary
Agenda


Works on Wheels
Infrastructure Bus Tour &
Harvest Power
Prezi

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Agenda

- Itinerary
- Resources
- Attendance
- Budget
- Overall Assessment of the Tour
- Suggestions for Future Tours
- Conclusion

Itinerary

WOW: May 24th, 2014

- ADEU
- Firehall No. 4
- Williams Rd PS

Duration: 1.5 hrs

WOW: June 7th & 8th, 2014

- Works Yard
- ADEU
- Firehall No. 4
- Watermain Project
- West Richmond CC
- Williams Rd PS
- Recycling Depot

Duration: 2.5 hrs

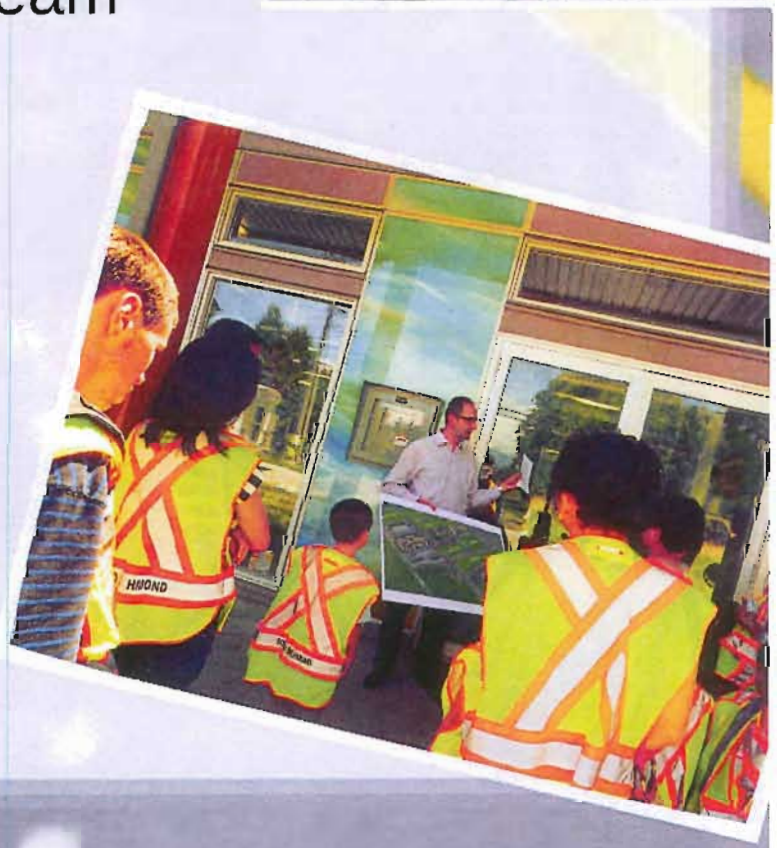
May 24th, 2014 & June 7th, 2014

- Harvest Power Plant

Duration: 2 hrs

Resources

- WOW Bus Tour Team
- Anthony Fu
- Shawn Dubnov
- Alen Postolka
- Mark Timmons
- Firefighter Pete
- Firefighter Star
- Farrell Spence



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Attendance

WOW Bus Tour

May 24th, 2014 - 11:15am
Full Bus!

May 24th, 2014 - 1:00pm
Bus **Overload**!

June 7th, 2014 - 11:15am
Bus **Overload**!

June 8th, 2014 - 11:15am
18/22 seats full.

Attendance

Harvest Power Tour

May 24th, 2014 - 11:45am
16/21 seats

June 7th, 2014 - 1:30pm
16/21 seats

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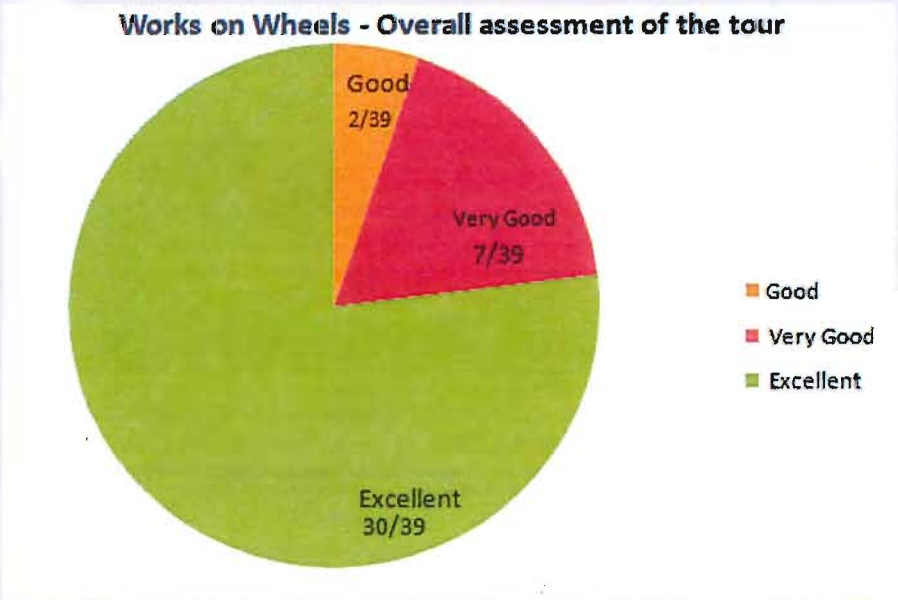
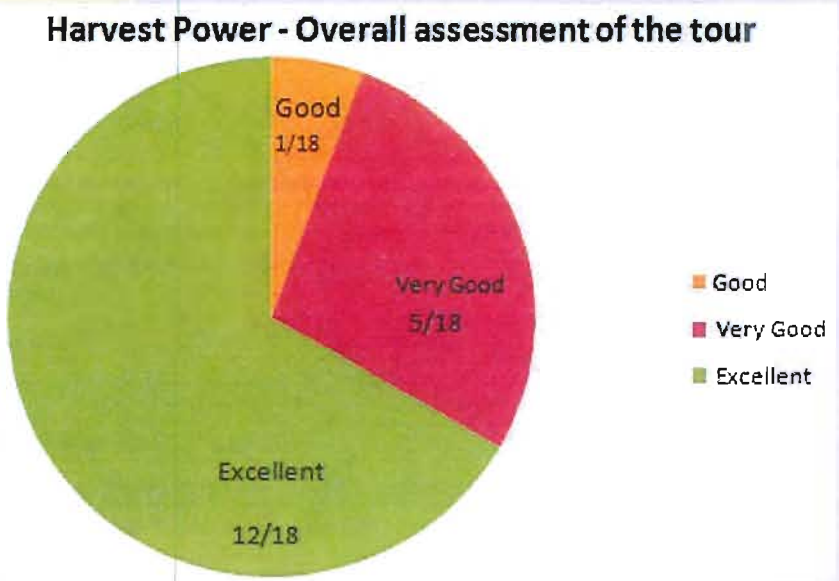
Budget

	Infrastructure Bus Tour (1.5 hr)	Infrastructure Bus Tour (2.5hrs)	Harvest Power Bus Tour (2 hrs)
Bus	$44.00	$44.00	$44.00
Bus Driver	$22.00	$38.50	$27.50
Water/Snacks	$13.54	$13.54	$13.54
Total	$79.54	$96.04	$85.04
Grand Total for All Tours	$525.00*		

*Does not include tour guide

Overall Assessment of the Tour





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Suggestions for Future Tours

Re-target audience

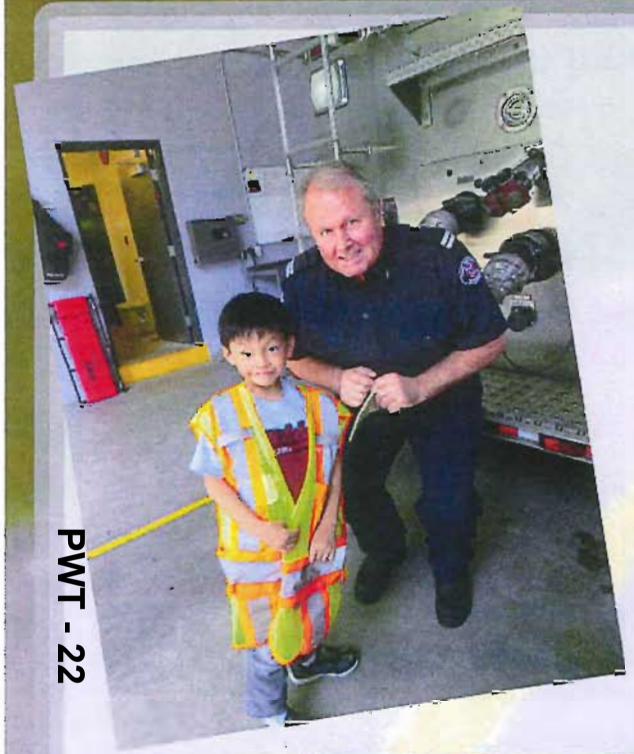
Add New Sites

Improve Internal Communication

Pamphlets for Harvest Power Tour

Register for Doors Open early

Increase No. of Tours



Conclusion

It was a SUCCESS!!

Cost of 6 tours: $525.00

Informative Tour Guides

Great Feedback

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City of Richmond

Report to Committee

To:	Public Works and Transportation Committee	**Date:**	June 23, 2014
From:	John Irving, P.Eng. MPA Director, Engineering	**File:**	10-6060-04-01/2014-Vol 01
Re:	**Flood Protection Update 2014**		

Staff Recommendation

That the staff report titled, "Flood Protection Update 2014," dated June 23, 2014, from the Director, Engineering, be received for information.

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

REPORT CONCURRENCE		
ROUTED TO:	**CONCURRENCE**	**CONCURRENCE OF GENERAL MANAGER**
Sewerage & Drainage	☑	
REVIEWED BY STAFF REPORT / AGENDA REVIEW SUBCOMMITTEE	**INITIALS:**	**APPROVED BY CAO**

Staff Report

Origin

The City of Richmond's topography is generally flat with a natural average elevation of 1m above mean sea level. Surrounded by the Fraser River and the Strait of Georgia, Richmond's flood protection system includes 49 km's of dikes, 622 km of drainage pipes, 178 km of ditches, and 41 drainage pumping stations. Many areas have been raised out of the flood plain through land development related land improvements.

Private and public land with improvements in Richmond are valued at approximately $63 billion. To protect this investment, the City is focused on implementing and improving policies, practices and infrastructure to maintain and improve flood protection service levels and mitigate the effects of climate change. The *2008 – 2031 Richmond Flood Protection Strategy* is the City's guiding framework for continuing upgrading and improvement of the City's flood protection system.

Accepted science indicates that climate change will increase winter precipitation, increase summer storm intensity and raise sea levels. The City can expect a 0.2 m rise in sea level over the next 50 years and a further 0.8 m over the subsequent 50 years totalling 1.0 m over the next 100 years.

The City's Flood Protection Program supports Council's Term Goals for Financial Management, Managing Growth and Development, Sustainability, Municipal Infrastructure Improvement and Waterfront Enhancement.

Flood protection is a regular point of discussion at the Public Works and Transportation Committee meetings. This report updates Council on flood protection system planning efforts and improvements.

Findings of Fact

Weather

Rainfall

Rainfall highlights for 2013 include the following:

- Approximately 960 mm of rain fell on the City in 2013, which is 23% less than the average annual rainfall of 1,239 mm.
- September was the wettest month in 2013 with 131 mm of recorded precipitation.
- The rainiest day in 2013 was November 2, with 45 mm of rainfall in a 24 hour period, which is well below the single day precipitation record for Richmond of 74 mm on December 16, 1979.
- The most significant storm of 2013 was on September 16, which recorded a rainfall intensity of 7.3 mm / hour over two hours and has a statistical return period of 10 years.

In general, 2013 was a below average rainfall year, but there were two 10 year return period storms. All events were within the design limits for Richmond's drainage system and identified flooding issues were local in nature and unrelated to drainage system capacity. Climate change experts are predicting that storms will become more intense in the future and the occurrence of two 10 year return period storms in 2013 supports this hypothesis. Staff will continue to monitor changes in rainfall patterns due to climate change and update drainage system plans as required.

Freshet

The 2014 Fraser River freshet reached 5 year return period flows briefly in early June and has been lower since then. Less than average snow pack and lower than average rainfall have resulted in a relatively low Fraser River freshet in 2014 and the river is not expected to experience high water levels again this year. The City's diking system performed well and there were no flooding concerns related to this year's freshet.

Flood Protection Policy and Planning

The *Provincial Flood Hazards Statues Amendments Act*, 2003, transferred responsibility for floodplain regulation from the Province to local municipalities. This has provided opportunities to strengthen Richmond's flood protection policies and create autonomous flood protection strategies. The *2008 – 2031 Richmond Flood Protection Strategy* is the overarching framework that guides Richmond in developing policy and strategy for overall improvement of the flood protection system. Highlights of the City's recent flood protection policy and planning achievements are provided in ***Table 1***.

Table 1 - Highlights of the City's recent flood protection policy and planning achievements

Year	Achievement
2002	A Drainage Utility established to provide a dedicated funding source for drainage improvements
2002	A multi year project begins to hydraulically model West Richmond's drainage system and prioritise system improvements
2002	A multi year project begins to create Richmond's first Flood Protection Management Strategy
2005	The Tsunami Hazard at the Fraser River Delta Study is completed. No tsunami was found to impact Richmond in the last 4000 years (since geological records began)
2006	The 2006 – 2031 Flood Protection Management Strategy is finalised
2006	A Dike Utility is implemented to provide a dedicated funding source for dike improvements
2006	The East Richmond Agricultural Water Supply Study is finalised to prioritise area wide drainage and irrigation system improvements
2008	The 2008 – 2031 Flood Protection Management Strategy replaces the 2006 strategy
2008	The Flood Plain Designation and Protection Bylaw No. 8204 is enacted
2009	The Mid Island Dike Study concludes that it is more cost effective to upgrade Lulu Island's perimeter dike than to build a mid island dike
2011	Drainage Modelling is updated to support Bylaw 9000, The 2041 Official Community Plan
2013	City Council adopt recommendations of the Dike Master Plan – Phase 1 Report that includes

	endorsement of Steveston Island as the preferred long term diking solution in Steveston
2013	Richmond's Ageing Infrastructure Planning Report to Council was updated to identify drainage funding requirements and infrastructure targets
2014	Richmond's Integrated Rainwater Resource Management Strategy is being finalised
2014	The East Richmond Agricultural Water Supply Study Update was completed

Drainage System Planning

The City's drainage system improvement plan includes a number of integrated facets that support and guide the City's five year capital plan. Hydraulic models are utilized to identify required capacity based improvements for existing and future conditions, condition assessment identifies elements that are deteriorating and require repair or replacement, ageing infrastructure assessments identify deteriorating infrastructure for replacement and long term financial requirements, and the Integrated Rainwater Resource Management Strategy will identify potential strategies for reducing the overall flows in the drainage system, while improving water quality.

Hydraulic Modeling

Drainage system capacity improvements are based on the results of computer based hydraulic modeling. Drainage system water level monitoring is utilized to calibrated and validate computer models to ensure they are an accurate representation of field conditions. The City is divided into two areas for modeling purposes based on basic land use, West Richmond and East Richmond.

West Richmond is primarily a highly developed urban environment. The West Richmond hydraulic model was updated based on the 2041 OCP and is utilized to identify and forecast drainage system elements that are or will be undersized as a result of ongoing development.

East Richmond is primarily agricultural and the drainage system is utilized for both drainage and irrigation purposes. The 2013 East Richmond Agricultural Water Supply Update study updated the East Richmond hydraulic model to include drainage systems improvements implemented since the original study in 2006. Hydraulic model results were combined with anecdotal information from the farm community to update planned drainage system improvements in East Richmond.

Both of the hydraulic models have considered the impacts of climate change on the drainage system and updates will be required as the science of climate change evolves.

Hydraulic modeling results from the 2041 OCP study and the 2013 East Richmond Agricultural Water Supply Update generated a catalogue of prioritized capacity based drainage system improvements that will be brought forward for Council's consideration as part of the City's five year Capital Program.

Condition Assessment

The City has approximately 56 km of box culverts that are critical to the drainage system. Some of these box culverts are deteriorating and causing sink holes adjacent to them. Staff has reviewed the issue and identified a plan for remediation. Box culvert lining projects will be brought forward for Council's consideration as part of the City's five year capital plan.

Ageing Infrastructure

The ageing infrastructure assessment predicts short, medium and long term requirements for infrastructure replacement due to deterioration. The ageing infrastructure assessment for drainage infrastructure considers age, material, criticality, soil condition, and condition assessment to determine the useful life of the City's pipes, box culverts and drainage pump stations. Short term requirements are brought forward for Council's consideration as part of the City's five year capital plan and longer term requirements are reported to Council for consideration as part of the City's longer term financial strategy.

Integrated Rainwater Resource Management Strategy

The Integrated Rainwater Resource Management Strategy (IRRMS) is undergoing final revisions and will be brought forward to Council for consideration in the fall. The City is required to complete the IRRMS in 2014 as a municipal commitment in Metro Vancouver's Integrated Liquid Waste and Resource Management Plan. The Strategy reviews a broad scope of rainwater issues, including rainwater re-use, detention, green roofs, storm water quality and strategies to reduce the impact of development on the drainage system. It also identifies monitoring and tracking initiatives that support Riparian Management Areas (RMA's), which supports the City's ecological network. After the IRRMS is implemented, staff will incorporate impacts of the IRRMS in the hydraulic models and update the catalogue of capacity based improvements and their timing.

Ecological Network

Richmond's Ecological Network (EN) is the inter-connected system of natural areas across Richmond, of which the City's drainage infrastructure forms an important component. As such, Richmond's Ecological Network Management Strategy is integrated with the other drainage planning tools listed above in the development of drainage maintenance and improvement plans.

Dike Planning

The City's dikes are critical infrastructure that protect the City from inundation from the Fraser River and the Straight of Georgia. Climate change is causing sea levels to rise that must be accommodated by the City's diking system. The City is developing a master plan to address this issue. The City continues to pursue dike improvements through development that meet the long term sea level rise requirements. Seismic design of the City's dikes is an emerging issue based on guidelines released by the Province in 2011.

Climate Change

Sea levels are predicted to rise approximately 1.2 m in Richmond over the next 100 years due to climate change. The best predictions indicate that the City can expect 0.3 m of sea level rise over the next 50 years with 0.9 m of sea level rise in the subsequent 50 years. Based on the current science, the City has significant time to plan and prepare for this eventuality.

To address sea level rise, the City is developing a Dike Master Plan. To date, Phase 1 of the plan associated with Steveston Harbour and the West Dike has been adopted by Council. Staff is currently requesting permission from the Province to perform a preliminary survey and geotechnical work on Shady Island in preparation for feasibility level work to utilize the island as the primary dike. Staff are also in discussions with Port Metro Vancouver (PMV) to mitigate the erosion of Sturgeon Bank and potentially build barrier islands to protect the West Dike from waves. Development of the Dike Master Plan – Phase 2 will begin later this year.

In 2011 the BC Ministry of Environment published the *Climate Change Adaptation Guidelines for Sea Dikes and Coastal Flood Hazard Land Use Sea Dike Guidelines*. These guidelines recommend criteria for calculating the recommended height for sea dikes for existing and future conditions. These guidelines appear to recommend dike heights that are much higher than those required by current provincial regulation. Staff continues to work with the Provincial Dike Inspector to interpret the guideline and develop appropriate future dike heights for the City.

Seismic Guidelines

In 2011, the BC Ministry of Forests, Lands and Natural Resource Operations published the *Seismic Design Guidelines for Dikes*. The guideline is based on performance criteria that limits displacement of dike during a seismic event. There are alternate methods of providing adequate seismic protection for the dikes that fall outside of the provincial guidelines that are considerably less expensive and deserve exploration. Staff continue to work with the Provincial Dike Inspector to rationalize the seismic requirements for the City's dikes and develop alternate strategies that provide an appropriate level of cost effective seismic protection.

Development

Developments adjacent to the City's dike want to take advantage of the waterfront as an amenity. To do so, it is often desirable to raise the dike and the adjacent development to long term elevations. Developments often fill the area between the dike and private property which has the effect of creating a much wider effective dike, which benefits the City and the development. Richmond has ongoing success with dike raising through development.

Infrastructure Improvement

Richmond's Drainage and diking infrastructure is continually improving. This is achieved through the City's 5 Year Capital Plan (funded by the Drainage and Diking Utilities) and private development. Accomplishment highlights include:

- The City implemented $45M of drainage and diking improvements since 2008, of which $9.6 million was contributed by senior government grant funding. A further $9.9M of drainage and diking improvements will be implemented in 2014.
- Ten drainage pump stations have been rebuilt to increase drainage system capacity, resiliency and meet long term drainage needs as well as locally improve dike elevation. Two additional stations have undergone significant mechanical refurbishment and 12 out of 31 major stations have backup generator power.
- 4.4 km of dike have been or are scheduled to be raised to a geodetic elevation of between 4.0 m and 4.7 m, which exceeds the Provincial requirement of 3.5 m to 3.9 m.
- Watercourse, drainage sewer and catch basin cleaning rates have been increased to a five year cycle.

The City's 2015 – 2019 Five Year Capital Plan is under development and will propose approximately $50 M of drainage and dike upgrades, examples of which will include:

- 5 drainage pump station rebuilds.
- 10 laneway drainage upgrades.
- $7 M of dike upgrades.

Staff continue to apply for senior government grants to fund these and other projects.

Financial Impact

None

Conclusion

Flood protection is the primary responsibility of the City of Richmond. The ongoing pressures of climate change, development and system aging require ongoing drainage and diking improvements to maintain the City's high flood protection standards. The City's drainage and diking utilities ensure there is dedicated funding available for improvements that are advanced through the City's capital planning process. Over $45M of drainage and diking works have been completed by the City since 2008, and a further $9.9M will be completed by the end of 2014.

Richmond's drainage infrastructure is well developed and complex. Computer based hydraulic models are used to identify existing capacity issues and forecast future capacity requirements. Capacity issues are merged with ageing infrastructure renewal needs in development of the City's Five Year Capital Plan. The Integrated Rainwater and Resource Management Strategy will be incorporated into this process, when it is finalized later this year.

Rising sea levels induced by climate change is a long term issue and staff are developing a long term master plan to that will address this issue. Phase 1 of the Dike Master Plan, which addresses Steveston and the West Dike, was completed and endorsed by Council in 2013. Staff is currently pursuing authorization from the province to access Shady Island to perform preliminary survey and geotechnical work required to develop Shady Island as a primary dike. Staff is also working

with PMV to stop the erosion of Sturgeon Bank and potentially build barrier islands identified in the Dike Master Plan – Phase 1.

Lloyd Bie, P.Eng.
Manager, Engineering Planning
(604-276-4075)

LB:lb

City of Richmond

Report to Committee

To:	Public Works and Transportation Committee	**Date:**	June 27, 2014
From:	John Irving, P.Eng. MPA Director, Engineering	**File:**	10-6060-04-01/2014-Vol 01
Re:	**East Richmond Agricultural Water Supply**		

Staff Recommendation

That the report titled "East Richmond Agricultural Water Supply Update 2013" as attached to the staff report titled "East Richmond Agricultural Water Supply", dated June 27, 2014, from the Director, Engineering, be used as input in the five year capital program process.

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

Att. 3

REPORT CONCURRENCE		
ROUTED TO:	**CONCURRENCE**	**CONCURRENCE OF GENERAL MANAGER**
Sewerage & Drainage	☑	
REVIEWED BY STAFF REPORT / AGENDA REVIEW SUBCOMMITTEE	**INITIALS:**	**APPROVED BY CAO**

Staff Report

Origin

In 2006, the City, in partnership with the Ministry of Agriculture and the Richmond Farmer's Institute (RFI), completed the original East Richmond Agricultural Water Supply Study (the Study) to address flood protection and irrigation needs for agricultural lands in East Richmond. Approximately $4.7M of drainage upgrades identified in the Study have been implemented or are included in Council approved capital projects that are scheduled for completion by the end of 2014.

The Study's update was started in 2013 to review progress and build upon the original study. This report presents the 2013 Study Update report (attachment 1) to Council for consideration and endorsement.

Findings of Fact

East Richmond land use is primarily agricultural. Approximately 2,788 Ha is available for agriculture and approximately 1,994 Ha are in agricultural production. This represents a 210 Ha (12%) increase in land in agricultural production since the 2006 study.

The drainage system in East Richmond serves both flood protection and irrigation purposes. Planning and operating the system to serve both of these purposes is a balancing act as drainage is fundamentally the opposite of irrigation. The complexity of the system requires hydraulic models and creative planning work for ongoing improvements that reduce flooding and improve irrigation which is ultimately required to improve the agricultural viability of the ALR.

The 2006 Study was a comprehensive review of the drainage system in the East Richmond ALR with a focus on improvements required to improve conditions for farming. The study identified a catalogue of proposed drainage and irrigation improvements based on hydraulic modeling and input from the farm community. From this catalogue, $4.7M of improvements have been implemented or are included in Council approved capital projects that are scheduled for completion by the end of 2014. They include:

- 7.3 km of new or re-profiled ditches on Granville, No. 7 Road, Westminster, Francis, and No. 8 Road (listed from longest to shortest improvements),
- Five control structures,
- Three pump station improvements,
- One new drainage pump station (currently under construction at No. 8 Road and Granville); and
- Remote salinity monitoring.

The goal of the 2013 Study Update was to review progress and build upon the original study. The 2013 Study Update report includes:

- A catalogue of infrastructure projects completed since the 2006 Study,
- Updated hydraulic model that includes infrastructure improvements completed since the 2006 Study,

- A stakeholder consultation process,
- An updated catalogue of proposed drainage and irrigation infrastructure improvements for East Richmond (Attachments 2 and 3); and
- A cost benefit analysis of proposed drainage and irrigation infrastructure improvements.

Stakeholder Consultation

The project team consulted with the Agricultural Advisory Committee (AAC), and hosted a public open house and hosted a workshop with City operations staff. The identified issues and concerns are documented in the 2013 Study Update report and were utilized in developing the recommended upgrade strategy.

On May 22, 2014, the completed 2013 Study Update report was presented to the Agricultural Advisory Committee. There was discussion regarding the hydraulic modeling work as well as some of the results. In particular, committee members were interested in the recommended Sidaway Road improvements and the impacts of a proposed development at No. 6 Road and Steveston Highway. The committee indicated general satisfaction with the update.

Improvement Strategy

The 2013 Study Update builds on the previous study and a number of the original recommendations are maintained in the update. The majority of the irrigation and flood protection problems identified by the farming community are south of Highway 91. As such, the majority of the recommended and completed improvements are south of Highway 91. Both the original 2006 study and the 2013 study update identify supplying water from the north arm of the Fraser River to the farm land south of Highway 91 as the preferred option. Primary reasons for this preference are:

- The water in the north arm of the Fraser River is of better quality for farming purposes than the water in the south arm,
- Topography and low ground elevations limit the distance water from the south arm of the Fraser can be pushed north; and
- It is the more cost effective option.

The update improves on the original study by:

- Adding detail to Sidaway and No. 6 Road ditch re-grading,
- Recommending additional ditch cleaning on No. 7 Road,
- Recommending new settings for No. 6 Road South Pump Station; and
- Recommending additional control structures in the south west quarter of the study area.

The additional control structures recommended at No. 7 Road and Westminster and No. 7 Road and Granville are key to accomplishing irrigation objectives in the south west area without flooding the south west area.

Recommended improvements for the next ten years are:

1. Ditch re-grading and culvert upgrades Sidaway Road south of Francis Road,
2. Ditch re-grading and culvert upgrades No. 6 Road south of Blundell Road,
3. New culvert on Blundell Road east of Sidaway Road,
4. New culvert on Burrows Road,
5. Clean ditches on No. 7 Road, No. 8 Road and Cambie Road,
6. Ditch re-grading and culvert upgrades on Westminster Highway west of No. 7 Road; and
7. Irrigation improvements including the addition of 2 flap gates, 5 gates with automated controls, re-grade ditch on Sidaway from north of Blundell Road to Westminster Highway, and new ditch on Granville Road from No. 6 Road to Sidaway.

Maps of recommended drainage and irrigation improvement projects are attached as Attachments 2 and 3 respectively. A benefit to cost ratio of 3 was calculated for the recommended improvements based on potential revenue for un-used agricultural land and the estimated cost of improvement projects.

With Council's endorsement, staff will include recommended projects for Council's consideration in the five year capital program.

Financial Impact

None at this time. Recommended projects will be submitted for Council's consideration as part of the City's Five Year Capital Program.

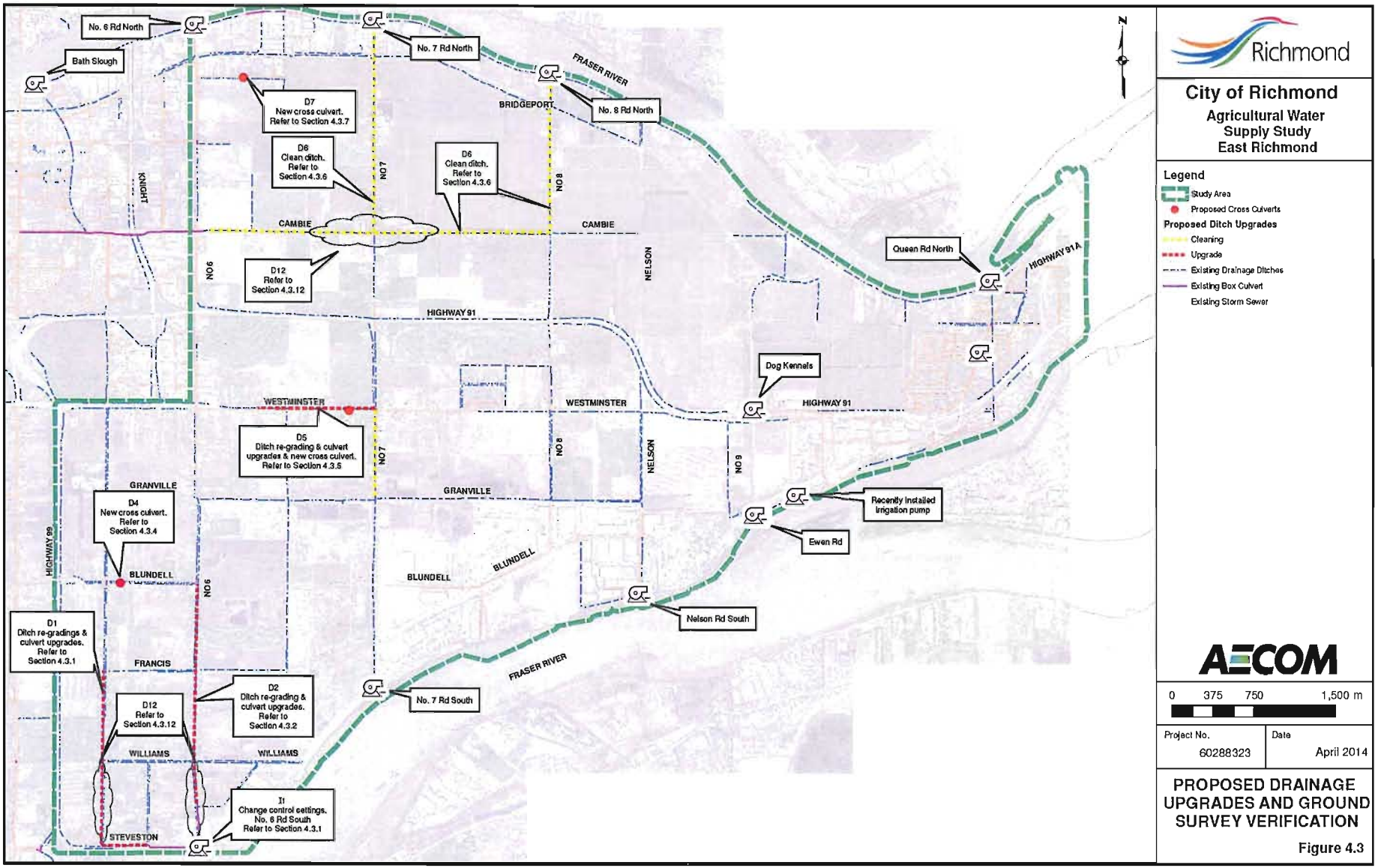
Conclusion

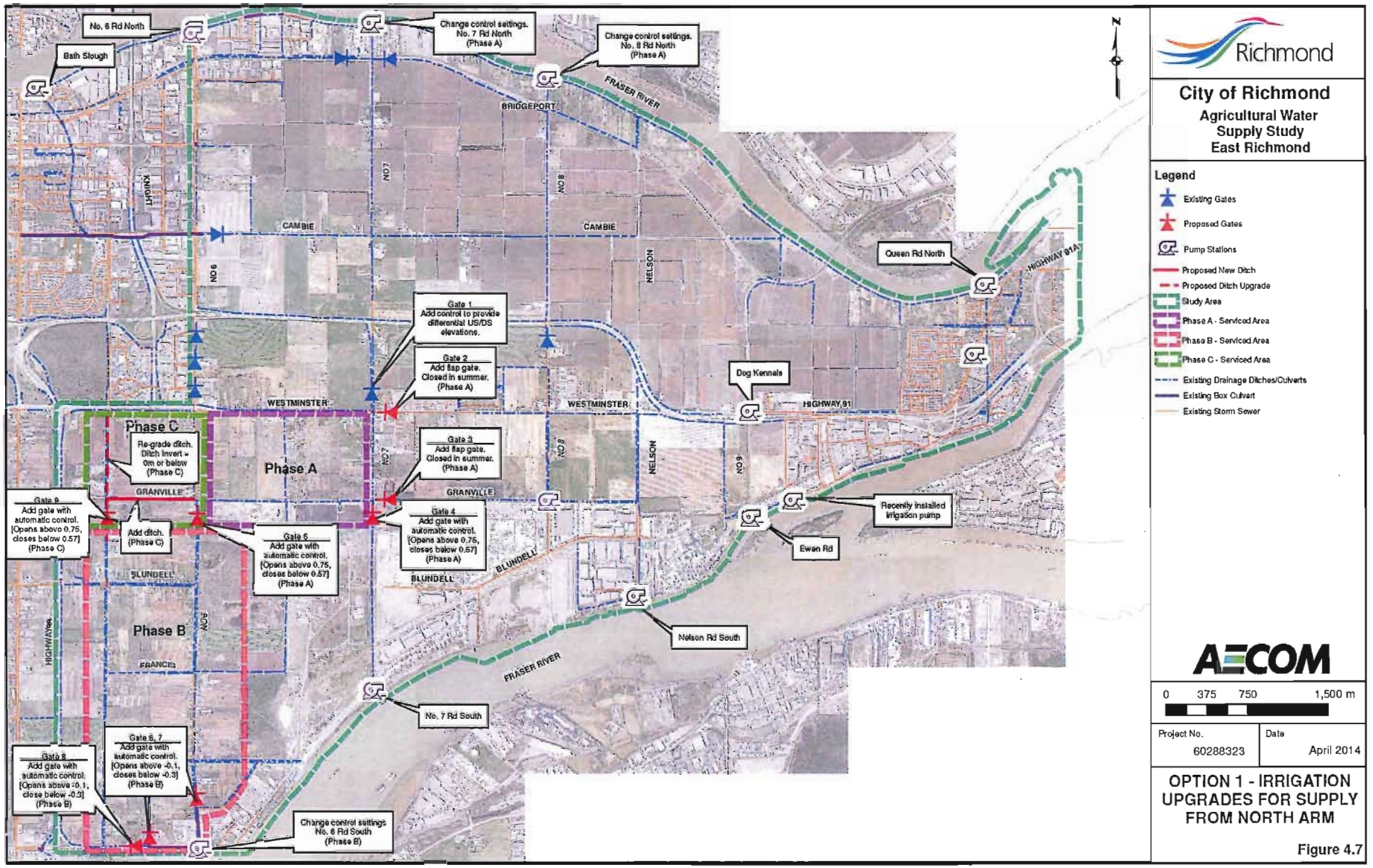
East Richmond land use is primarily agricultural and the drainage system provides both flood control and irrigation for local farms. The 2006 Study was a comprehensive review of demands on the system and recommended a number of improvements. Since 2006, approximately $3.7M of drainage improvements have been implemented in East Richmond. The 2013 Study Update incorporates these improvements, reviews current stakeholder input, confirms the overall irrigation and drainage strategy and identifies an updated catalogue of improvements for the East Richmond drainage system.

Lloyd Bie, P.Eng.
Manager, Engineering Planning
(604-276-4075)

LB:lb

Att. 1: Plan Showing Proposed Drainage Upgrades
Att. 2: Plan Showing Proposed Irrigation Upgrades
Att. 3: 2013 East Richmond Agricultural Water Supply Update (REDMS 4226898)


No. 6 Rd North
Bath Slough
No. 7 Rd North
FRASER RIVER
No. 8 Rd North
BRIDGEPORT
D7
New cross culvert.
Refer to Section 4.3.7
D6
Clean ditch.
Refer to Section 4.3.6
D6
Clean ditch.
Refer to Section 4.3.6
KNIGHT
NO7
NO8
CAMBIE
CAMBIE
NO6
D12
Refer to Section 4.3.12
NELSON
HIGHWAY 91
Queen Rd North
HIGHWAY 91A
Dog Kennels
WESTMINSTER
WESTMINSTER
HIGHWAY 91
D5
Ditch re-grading & culvert upgrades & new cross culvert.
Refer to Section 4.3.5
NO7
NO8
NELSON
NO9
GRANVILLE
GRANVILLE
D4
New cross culvert.
Refer to Section 4.3.4
Recently Installed Irrigation pump
Ewen Rd
HIGHWAY 99
BLUNDELL
BLUNDELL
BLUNDELL
NO6
Nelson Rd South
D1
Ditch re-gradings & culvert upgrades.
Refer to Section 4.3.1
FRANCIS
FRASER RIVER
D12
Refer to Section 4.3.12
D2
Ditch re-grading & culvert upgrades.
Refer to Section 4.3.2
No. 7 Rd South
WILLIAMS
WILLIAMS
I1
Change control settings.
No. 6 Rd South
Refer to Section 4.3.1
STEVESTON
N
Richmond
City of Richmond
Agricultural Water Supply Study
East Richmond
Legend
Study Area
Proposed Cross Culverts
Proposed Ditch Upgrades
Cleaning
Upgrade
Existing Drainage Ditches
Existing Box Culvert
Existing Storm Sewer
AECOM
0 375 750 1,500 m
Project No.
60288323
Date
April 2014
PROPOSED DRAINAGE UPGRADES AND GROUND SURVEY VERIFICATION
Figure 4.3


No. 6 Rd North
Bath Slough
Change control settings. No. 7 Rd North (Phase A)
Change control settings. No. 8 Rd North (Phase A)
FRASER RIVER
BRIDGEPORT
KNIGHT
NO 7
NO 8
CAMBIE
NO 6
NELSON
Queen Rd North
HIGHWAY 91A
Gate 1 Add control to provide differential US/DS elevations.
Gate 2 Add flap gate. Closed in summer. (Phase A)
Dog Kennels
HIGHWAY 91
WESTMINSTER
Phase C
Re-grade ditch. Ditch Invert = 0m or below (Phase C)
Phase A
Gate 3 Add flap gate. Closed in summer. (Phase A)
NO 9
GRANVILLE
Gate 8 Add gate with automatic control. [Opens above 0.75, closes below 0.57] (Phase C)
Add ditch. (Phase C)
Gate 5 Add gate with automatic control. [Opens above 0.75, closes below 0.57] (Phase A)
Gate 4 Add gate with automatic control. [Opens above 0.75, closes below 0.57] (Phase A)
Recently installed irrigation pump
Ewen Rd
BLUNDELL
Phase B
HIGHWAY 99
NO 5
FRANCIS
Nelson Rd South
No. 7 Rd South
Gate 6, 7 Add gate with automatic control. [Opens above -0.1, closes below -0.3] (Phase B)
Gate 9 Add gate with automatic control. [Opens above -0.1, close below -0.3] (Phase B)
Change control settings No. 6 Rd South (Phase B)
N
Richmond
City of Richmond
Agricultural Water Supply Study
East Richmond
Legend
Existing Gates
Proposed Gates
Pump Stations
Proposed New Ditch
Proposed Ditch Upgrade
Study Area
Phase A - Serviced Area
Phase B - Serviced Area
Phase C - Serviced Area
Existing Drainage Ditches/Culverts
Existing Box Culvert
Existing Storm Sewer
AECOM
0 375 750 1,500 m
Project No. 60288323
Date April 2014
OPTION 1 - IRRIGATION UPGRADES FOR SUPPLY FROM NORTH ARM
Figure 4.7

PWT - 36

Water AECOM

City of Richmond

FINAL REPORT
East Richmond Agricultural Water Supply Update 2013

Prepared by:

AECOM
3292 Production Way, Floor 4 604 444 6400 tel
Burnaby, BC, Canada V5A 4R4 604 294 8597 fax
www.aecom.com

Project Number:
60288323

Date:
April 2014

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- represents Consultant's professional judgement in light of the Limitations and industry standards for the preparation of similar reports;
- may be based on information provided to Consultant which has not been independently verified;
- has not been updated since the date of issuance of the Report and its accuracy is limited to the time period and circumstances in which it was collected, processed, made or issued;
- must be read as a whole and sections thereof should not be read out of such context;
- was prepared for the specific purposes described in the Report and the Agreement; and
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AECOM
3292 Production Way, Floor 4
Burnaby, BC, Canada V5A 4R4
www.aecom.com

604 444 6400 tel
604 294 8597 fax

April 28, 2014

Mr. Andy Bell, M.Eng., P.Eng.
Engineering Planning
City of Richmond
6911 No. 3 Road
Richmond, BC
V6Y 2C1

Dear Andy:

Project No: **60288323**

Regarding: **FINAL REPORT**
East Richmond Agricultural Water Supply Update 2013

Please find attached three copies of the Final Report for the East Richmond Agricultural Water Supply Update 2013. This report includes an assessment of the current and future drainage conveyance and irrigation water supply, as well as proposed recommendations for both the drainage and irrigation systems.

We have enjoyed working with City Staff on this project and we look forward to providing our continued services to the City of Richmond. If there are any questions or concerns please don't hesitate to contact me at 604.444.6400

Sincerely,
AECOM Canada Ltd.

Sumandeep Singh

Suman Shergill, P.Eng.
Project Engineer

Encl.
cc:
SB:ss

Distribution List

# of Hard Copies	PDF Required	Association / Company Name
1	Yes	City of Richmond
1	Yes	City of Richmond
3	Yes	City of Richmond

Revision Log

Revision #	Revised By	Date	Issue / Revision Description
0	SB	Sept 9, 2013	Draft Report – Drainage Only
1	SB/SS	Oct 2, 2013	Draft Final Report
2	SB/SS	Dec 18 2013	Final Report –Version1
3	SS	Jan 4,2014	Updated Final Report
4	SS	April 28, 2014	Final Report

AECOM Signatures

Report Prepared By:

Sumandeep Singh

Suman Shergill, P. Eng.
Project Engineer

Executive Summary

In the 2041 OCP the City of Richmond identified that it shall maintain and improve Agricultural Land Reserve (ALR) drainage and irrigation systems to support agriculture. To meet this objective, the City requested an update of its East Richmond Agriculture Water Supply Study that includes a hydraulic assessment for the drainage and irrigation system under existing agricultural land use conditions and future land use conditions (OCP 2041), and provides a prioritized list of recommended upgrades for Capital Planning purposes.

The City's objectives for drainage and irrigation in East Richmond are to:

- Continue to protect agricultural land in the Agricultural Land Reserve (ALR).
- Enhance the long term viability, opportunities for innovation, infrastructure and environmental impacts of the agricultural sector.
- Ensure prioritized drainage improvements are implemented according to Agricultural and Rural Development Subsidiary Agreement Criteria (ARDSA) performance standards and in consultation with the agricultural community and relevant City departments.
- Encourage sufficient notification to the agricultural sector of ditch cleaning plans to achieve beneficial, effective, timely drainage.
- Facilitate the improvement of irrigation and drainage infrastructure to provide secure and affordable water supplies that support the agricultural sector.

The study area is approximately 3,918 Hectares (Ha) and the portion of land for agricultural use is approximately 2,788 Ha (based on 2010 Land Use Inventory data) of which approximately 1,994 Ha is used for farming. Agricultural land uses include cranberries, blueberries, strawberries, raspberries, vegetables, fruit and nut trees and forage crops for livestock. Cranberries take up the majority of the land area and dominate the area north of Highway 91. A functional drainage and irrigation system is critical to successful crop production and the diverse crops have varying requirements and are sensitive to drainage patterns.

Project stakeholders include the City of Richmond, Agricultural Advisory Committee, Richmond Farmers' Institute, Ministry of Agriculture and Lands, and Fisheries and Oceans Canada. Feedback from individual farmers and AAC members was obtained at the AAC meeting and Open House and has been incorporated in this report. A workshop with City Operations Staff was also held where valuable information was obtained pertaining to known problem areas and previous works completed.

Design criteria for the Study area include the ARDSA criteria and irrigation growth, harvest and frost protection conditions. ARDSA criteria include removing runoff from the 10-Year 5-day winter storm event within 5 days in the dormant period (November 1 to February 28) and removing runoff from the 10-Year 2 day storm event within 2 days in the growing period (March 1 to October 31). Between storm events and in periods when drainage is required, the ARDSA criteria require that base flow in channels is maintained between 0.9m to 1.2m below field elevation where possible. Irrigation criteria that were applied include use of a uniform growth irrigation rate (determined to be 5.33mm/day as per the 2006 Study) across the study area as well as addition of known estimates for water discharged during cranberry harvest periods. Model analysis for the frost protection period has not been completed as no concerns were expressed for this scenario. Tidal information from stations at Nelson Road PS, No. 6 Road South PS and Queens Pump Station are also applied in the model to represent the boundary conditions at the Fraser River.

Once the design criteria were re-established and areas of concern identified, the hydraulic model was updated to DHI's Mike Urban software and infrastructure upgrades completed since 2006 were added. The next step was to review the drainage and irrigation pump operational parameters. This is particularly pertinent for No 7 Rd North and

No 8 Rd North pump stations as the operational settings for pumps and gravity intakes at these locations are changed from season to season to allow for irrigation water supply.

The existing system assessment included a review of conveyance and pump station capacities. The existing system peak HGLs for the dormant winter period (10-Year 5 day storm event with 7 day high tide) was determined using the model. Areas with hydraulic constraints were then determined and improvements were proposed. The pump station analysis indicates that five of nine pump stations have a peak inflow (10-Year 5 day) greater than the theoretical pump station capacity at high tide. With exception of No. 7 Road South PS, all of the flood box outlets have capacity to covey 10-Year 5 day peak flow during low tide. At No. 7 Road South the combined capacity of flood box and pump station is adequate to convey 10-Year 5 day peak inflow.

Two irrigation improvement options were considered to irrigate the southwest lands. Option1 – Supply water from the Fraser River's North Arm using the existing river intakes and Option 2- Build a new irrigation pump station at the foot of No 6 Rd. Option 2 was rejected primarily because of high cost of construction. In addition, there are limitations on how far north irrigation water can be supplied based on the topography and low ground elevations, particularly along Sidaway Rd north of Blundell Rd.

Prioritized drainage and irrigation improvement projects for the ten year Capital Plan are provided in ***Table E.1.*** Additional information for each drainage and irrigation project is provided in ***Section 4.3 and 4.4*** respectively, which includes a discussion on the system improvements, before and after water level profiles, and detailed cost breakdowns. The projects generally include a combination of ditch cleaning and re-grading, culvert upgrades, and installation of new cross culverts to connect roadside ditches. A key component of upgrades in the Southwest (Sidaway Rd, Steveston Hwy and No 6 Rd areas) is the lowering of No 6 Rd South PS pump ON OFF levels.

Table E.1 Prioritized List of Upgrades

Priority	Project ID	Project Description	Cost Estimate	Time Horizon
1	D1	Sidaway Road South of Francis Alignment (Section 4.3.1)	$1,176,000	1-2 years
2	D2	No 6 Road South of Blundell Road (Section 4.3.2)	$693,000	3-5 years
3	D4	Blundell Road East of Sidaway (Section 4.3.4)	$46,000	3-5 years
4	D7	Burrows Road (Section 4.3.7)	$50,000	3-5 years
5	D6	Cambie Road East to No 8 Rd, No 7 Rd & No 8 Rd from Cambie to PS (Section 4.3.6)	$1,595,000	5-10 years
6	D5	Westminster Highway West of No 7 Road (Section 4.3.5)	$981,000	5-10 years
7	(I-1). Irrigation-Option 1 Upgrades for Supply	Phase A	$647,000	5-10 years (or sooner if funds are available)
		Phase B	$812,000	
		Phase C	$722,000	
		Total Cost	**$6,722,000**	

Note: "D" represents drainage projects and "I" represent irrigation projects.

A cost benefit analysis was completed to assess the economic, social and environmental impacts of the proposed drainage and irrigation improvements. The methodology applied is similar to the 2006 Study where the average potential revenue for un-used agricultural land was compared with the cost of infrastructure upgrades. Essentially, the net result is a benefit to cost ratio of approximately 3. Other factors that were explored include the potential savings to farmers for City supplied potable water, additional costs of drainage pump station maintenance and power, and potential reduced risk of economic impacts from flooding or loss of crops.

Further recommendations and improvements that were discussed at the Staff workshop and require additional investigation prior to inclusion in the current Capital Plan include the following items:

- Survey ground elevation (field elevations) along existing ditch on Cambie Rd (east and west of No 7 Rd). The ground elevation survey should also be completed for low lying areas along Sidaway and No 6 Rd south of Williams Road.
- Review capacity of the No. 7 Road South PS and flood box as it was identified as under capacity in ***Table 4.1***
- Consider implementing the following projects identified in the 2006 Study as low priority works:
    - Construct 600m of ditch along Sidaway-East to connect the Blundell and Francis ditch systems
    - Upgrade ditch on east side of No 6 Rd between Granville Rd and Blundell Rd. This will further increase conveyance along No 6 Rd and facilitate supply of irrigation water from North Arm.

- Repair or replacement of the failing headwall at the south ditch box culvert inlet on Cambie Rd just east of No 6 Road
- Ditch cleaning and re-profiling along CN Rail corridor between No 7 Rd and No 8 Rd (City needs permission from the railway for access)
- Ditch cleaning and re-profiling for south side of River Rd from the CN box (Cambie Rd alignment) east to Queens PS
- Box culvert flushing and cleaning for No 6 Rd north drainage corridor and further investigation of the jet fuel pipeline elevations
- Review the need and methods to remove invasive species such as Japanese Knotweed and Parrot Feather.
- Review possibility of lowering the No 7 Rd North PS culvert and impact this would have on the downstream ditch systems
- Create a culvert inspection program for entire study area and in particular a review of who is responsible for maintenance of culverts crossing Hwy 91
- Consider implementing a procedure that requires farmers to identify when and where new outfalls from fields to municipal ditches are constructed
- Coordinate operation of the CN box gravity intake (River Rd and Cambie Rd alignment) between farmers and Operations staff
- Facilitate farmers to coordinate water use from No 7 Rd North PS during harvest

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Appendices

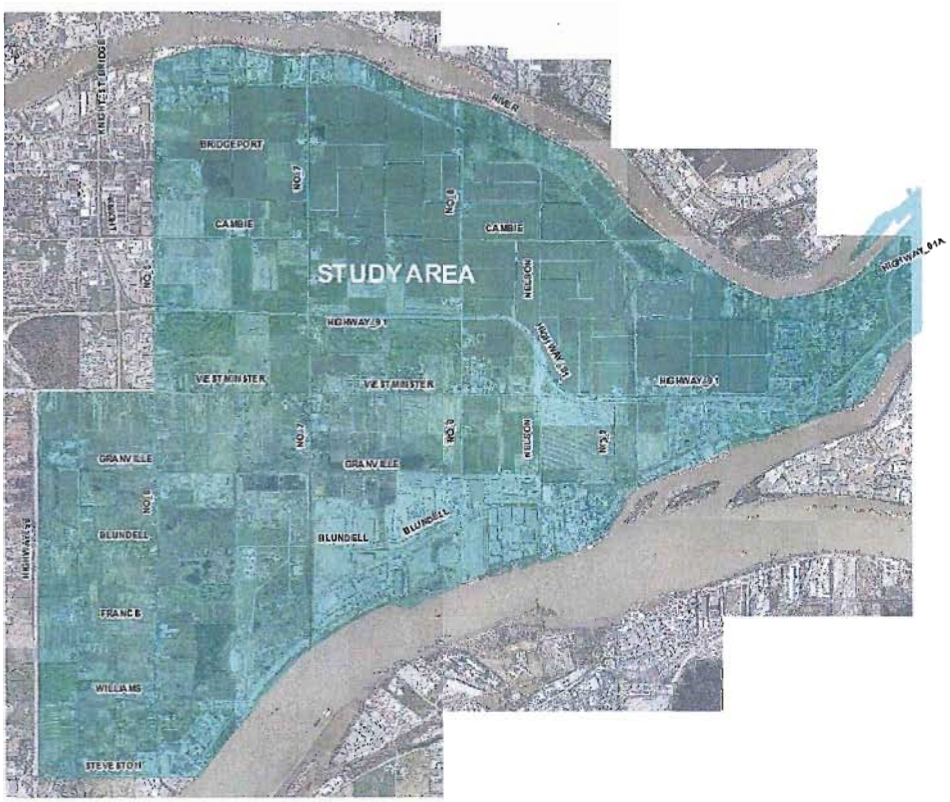
1. Introduction

The City of Richmond requested an update of its East Richmond Agriculture Water Supply Study that provides a prioritized list of recommended upgrades for Capital Planning purposes. To achieve this objective, a hydraulic assessment for the East Richmond drainage and irrigation system under existing agricultural land use conditions and future land use conditions (OCP 2041) was completed.

1.1 Background

The study area as shown in ***Figure 1.1*** is approximately 3,918 Hectares (Ha) and the portion of land for agricultural use is approximately 2,788 Ha (based on 2010 Land Use Inventory data) of which approximately 1,994 Ha is used for farming. Agricultural land uses include cranberries, blueberries, strawberries, raspberries, vegetables, fruit and nut trees and forage crops for livestock. Cranberries take up the majority of the land area and dominate the area north of Highway 91. A functional drainage and irrigation system is critical to successful crop production. The diverse crops have varying requirements and are sensitive to drainage patterns.

Figure 1.1 Study Area



In 2006, the previous East Richmond Agricultural Water Supply Study was completed by UMA/AECOM (referred as "2006 study" in this report) and included a list of proposed irrigation and drainage projects within the Agricultural Land Reserve (ALR) east of Highway 99. Since the 2006 study was completed, approximately $3.5M in capital projects have been implemented and were added to the hydraulic model as part of this study. Projects recommended in the 2006 Study and their completion status is provided in ***Tables 1.1*** and ***1.2***. ***Tables 1.1*** also include projects identified and completed subsequent to the 2006 study. Projects are shown in the same priority order as in the 2006 study.

Table 1.1 Drainage & Irrigation Upgrade Projects Completed Since 2006

YEAR	LOCATION	SCOPE OF WORK
2007	Granville Avenue Alignment (No. 6 Road to Kartner Road)	1600m of ditch constructed and/or upgraded
	No. 7 Rd (Granville to No. 7 Rd Pump Station South)	1700m of ditch re-profiled
2008	Westminster Hwy (No. 8 Rd to Nelson Road)	800m of ditch re-profiled (scope revised from No. 7 Rd to No. 8 Rd due to environmental restrictions)
	No. 6 Rd	Flap gates installed at 3 locations: • Commerce Parkway • Wireless Way • International Place
	No. 7 Rd	Temporary flap gate installed at No. 7 Rd and Westminster Hwy to prevent cranberry water from discharging to the south
	No. 8 Rd	Temporary flap gate installed at No. 8 Rd south of HWY 91 to prevent cranberry water from discharging to the south
	No. 8 Rd (south of Westminster Hwy)	Culvert installed in No. 8 Rd's east ditch (south of Westminster Hwy) to increase ditch connectivity
	No. 8 Road Pump Station North	New Programmable Logic Controller (PLC) & sonar installed
2009	Granville Alignment (Kartner Road to Nelson Road)	1600m of ditch constructed and re-profiled (scope modified slightly due to Terason gas main conflict between No. 8 Rd and Nelson Rd causing the City to construct on either side of the conflict)
	No. 8 Rd (Westminster Hwy to Granville Avenue Alignment)	800m of ditch re-profiled (original project scope revised from Highway 91 to Westminster Hwy due to most of the area between Highway 91 and Westminster Hwy being culverted)
	No. 6 Rd Pump Station South	New Programmable Logic Controller (PLC), sonar, salinity meter, and automated irrigation system installed
2010	Francis Rd Alignment (Sidaway Rd to No. 6 Rd)	800m of ditch constructed
	Sidaway (west side from Francis Rd to Steveston HWY)	1600m of major ditch maintenance (original project scope revised from upgrading ditch to major ditch maintenance due to existing culverts)
2011	No. 7 Rd Pump Station South	1 pump replaced to improve reliability and reduce low level water elevations & new Programmable Logic Controller (PLC) and control cell installed
2012	Sidaway Road (at Francis Road Alignment)	New culvert installed to connect Sidaway Road's east and west drainage ditches
	Ewen Road Irrigation Pump Station	New irrigation pump station and piping to supply irrigation water to a local farm in the vicinity of pump station.
2013	No. 8 Road and Granville Avenue Alignment	New 25 HP drainage pump station (planned for summer 2013)
	No. 6 Rd Pump Station North	1 pump replaced to improve reliability and reduce low level water elevations (Summer 2013)

Note:

Drainage Projects
Irrigation Projects

Table 1.2 Drainage & Irrigation Upgrade Projects Under Review

LOCATION	SCOPE OF WORK
Sidaway (Blundell to Francis)	Construct 600m of ditch along Sidaway-east to connect the Blundell and Francis ditch systems
No. 6 Rd (Highway 91 to No. 6 Rd Pump Station North)	Re-profile and smooth inverts through 2650m of ditches and storm sewers (delayed due to Kinder Morgan jet fuel pipeline conflicts and scope issues)
Cambie Rd	Re-profile 4000m of ditches
Blundell Rd (No. 6 Rd to No. 7 Rd)	Construct 1600m of ditch
West Boundary	Install an additional 6 flap gates with manual override along Highway 99 and No. 6 Rd. (1 of the initial 7 proposed was installed in 2008)
No. 7 Rd (south of Granville)	Install 1 drop leaf gate to prevent potential irrigation water discharging at the No. 7 Rd South Pump Station
No. 8 Rd (east side between Highway 91 and Westminster Highway)	Upgrade 400m of storm sewers
Westminster Highway (No. 6 Rd to ditch near Kartner)	Upgrade / realign 2400m of storm sewers
No. 6 Rd (Westminster to Granville)	Upgrade / realign 800m of storm sewers
No. 6 Rd (Granville to No. 6 Rd Pump Station South)	Upgrade 3200m of ditches and storm sewers
Williams, Blundell, & Francis	Upgrade ditches (scope undetermined)
Granville Avenue Alignment (Sidaway to No. 6 Road)	Construct 800m of ditch to connect Sidaway to No. 6 Rd.
Granville & No. 6 Rd	Install screw pump and 2 drop leaf gates (to irrigate Sidaway Rd)
No. 7 Road North	Install irrigation pump
Blundell Rd (east of No. 6 Rd)	Install 1 drop leaf gate
General Study Wide Upgrades	These upgrades had a low priority in the 2006 Study: • Culvert connecting Nelson to Ewen • Culvert connecting ditches on the west side of No. 6 Rd to Granville Avenue Alignment • Flap gates with manual override at No. 8 Rd and Westminster Hwy • Manually operated gate at Nelson-east and Westminster Hwy • Drop-leaf gate at No. 6 Rd, north of Bridgeport Rd • Drop-leaf gates at No. 7 Rd and Cambie (both sides of No. 7 Rd) • Drop-leaf gate at No. 8 Rd and Cambie (on west side of No. 8 Rd) • Deepen ditch along Westminster Hwy between Nelson Rd and Ewen Rd

Note

Drainage Projects
Irrigation Projects

In addition to individual farm owners and their specific requirements, there are a number of stakeholders including the City of Richmond, Agricultural Advisory Committee, Richmond Farmers' Institute, Ministry of Agriculture and Lands, and Fisheries and Oceans Canada. Feedback from individual farmers and AAC members was obtained at the AAC meeting and open house and is incorporated in the study. A workshop with City operations staff was also held and resulted in additional valuable information for input into the overall development of a prioritized list of recommendations.

1.2 Goals and Objectives

In Section 7.1 of its 2041 OCP, the City recognizes the importance of agriculture as a food source, environmental resource, a heritage asset and important contributor to the local economy. Most of the ALR in Richmond is outside of Greater Vancouver Regional District's (GVRD) servicing boundary.

It is the City's objective to maintain and improve ALR drainage and irrigation systems to support agriculture (Section 12.6, 2041 OCP). Goals and objectives identified in Section 7 of the 2041 OCP that relate to drainage and irrigation have been incorporated into this study and include the following statements:

Drainage:

- Continue to protect agricultural land in the ALR
- Enhance all aspects of the agricultural sector including long term viability, opportunities for innovation, infrastructure and environmental impacts
- Ensure drainage improvements to the ALR occur in a prioritized order and according to Agricultural and Rural Development Subsidiary Agreement Criteria (ARDSA) performance standards
- Ensure drainage improvements are considered in a comprehensive manner in consultation with the agricultural community and relevant City departments
- Encourage sufficient notification to the agricultural sector of ditch cleaning plans to achieve beneficial, effective, timely drainage

Irrigation:

- Facilitate the improvement of irrigation and drainage infrastructure to provide secure and affordable water supplies that support the agricultural sector

The scope for the 2013 East Richmond Water Supply Update are as follows:

- Review all current information available from the City and Ministry of Agriculture pertaining to water supply and land use changes in the study area;
- Complete a field reconnaissance to verify current irrigation and drainage infrastructure and locations for proposed upgrades;
- Gather first-hand information from farming community stakeholders through an open house and attendance at an AAC meeting;
- Update the current East Richmond hydraulic model with drainage and irrigation infrastructure constructed since 2006 and identify ways to optimize the model performance;
- Complete a comprehensive assessment with the updated model and develop a prioritized list of drainage and irrigation system improvements;
- Review feasibility of irrigation water supply transfer from the north to the south; and
- Develop cost estimates for the proposed upgrades based on current market conditions.

1.3 Land Use

1.3.1 Agricultural Land Use

A comprehensive review of current agricultural land uses was completed by the Ministry of Agriculture in 2010 and is provided in the Ministry's Draft Land Use Inventory (LUI) Report (January 2013). Information presented in the LUI report was collected by completing drive-by surveys for all properties in the Agricultural Land Reserve.

During the LUI survey, data was collected on general land use and land cover including agricultural practices, irrigation, crop production methods, livestock, agricultural support (e.g. storage, compost and waste), and activities which add value to raw agricultural products. General land cover information collected in the LUI is presented in ***Table 1.3*** and ***Figure 1.2***. Agricultural land uses include berry cultivation (including cranberries, blueberries, strawberries, and raspberries), vegetables (including greenhouses), fruit and nut trees, and forage crops for livestock. ***Figure 1.3*** shows the location of various cultivated crops in the area.

Cultivation of cranberries is the major land use for the area north of Highway 91. Cranberry production involves significant investment by farmers in infrastructure such as ditches, reservoirs, control structures, and pumping irrigation equipment. Most of the cranberry crops in the north are supplied to Ocean Spray for the juice and canned cranberry market, and farming tends to be cooperative and organized with farmer's coordinating their schedules and sharing water resources.

South of Hwy 91 the most significant crops are blueberry, vegetable and forage along with nurseries and greenhouses. In the southwest portion of the study area, west of No 6 Road, there are numerous small urban lot developments and the area has a high amount of un-used farmland and land used for non-agricultural uses.

Table 1.3 Crop Coverage & Irrigation Area

Cultivated Field Crops	Area* (Ha)	% of Cultivated Land	% of Crop Area Irrigated
Berries	1,433	54	71
(cranberries)	(873)	(61)	(98)
(blueberries)	(492)	(34)	(31)
(strawberries)	(62)	(4)	(30)
(raspberries)	(7)	(<1)	(na)
Vegetables	647	24	54
Forage & Pasture	402	15	24
Nursery & Tree Plantations	64	2	84
Grains, Cereals, Oilseeds	37	1	na
Other**	73	19	na
Total	**2656 Ha* (Includes land outside the study area)**		

Notes:
- Area based on the Ministry of Agriculture 2010 survey data that includes ALR in west Richmond. 1994 ha are located in east Richmond

** Other includes tree fruits, turf, vines, floriculture, nut trees, bare cultivated land, fallow land, land in crop transition
Source: 2010 Land Use Inventory

In addition, the LUI report includes data on irrigation water use recorded by crop type and irrigation system type (e.g. sprinkler, trickle, giant gun or sub-surface). The report notes that sprinkler systems are the most common type of irrigation system and are used on a broad range of crops, while trickle systems are the next most common and used

exclusively on berry, vegetable, nursery and vine crops. Subsurface systems were third and used on several types of crops. The coverage for each irrigation type as per the data collected for the LUI report is presented in ***Figure 1.4*** and ***Table 1.1***. As shown in the table, 71% of all berry crops and 54% of all vegetable field crops are irrigated.

1.3.2 Other Land Uses

Other land uses in the study area include golf courses, large rural residential lots, industrial properties and the Hamilton residential area. At present there are five golf courses and driving ranges in East Richmond that use surface water for irrigation supplemented with City supplied water. Several of the large residential lots have hobby farms on the property that also draw water for irrigation and require drainage.

Industrial areas are located along the North and South Arm's of the Fraser River in East Richmond and are generally not included in the hydraulic model as they have their own drainage systems and do not draw water for irrigation purposes. Larger industrial properties located along the South Arm of the Fraser are occupied by Lafarge (concrete production) and Port Metro Vancouver. Each of these areas drain surface water directly into the Fraser River.

The Hamilton area is serviced by a local drainage system and only the major ditches and trunk sewers are included in the East Richmond hydraulic model. The area is serviced by the gravity outlets to the Fraser River during low tide and the Queen Road North Pump Station during high water levels, as well as a smaller pump station inland at 22740 Westminster Hwy.

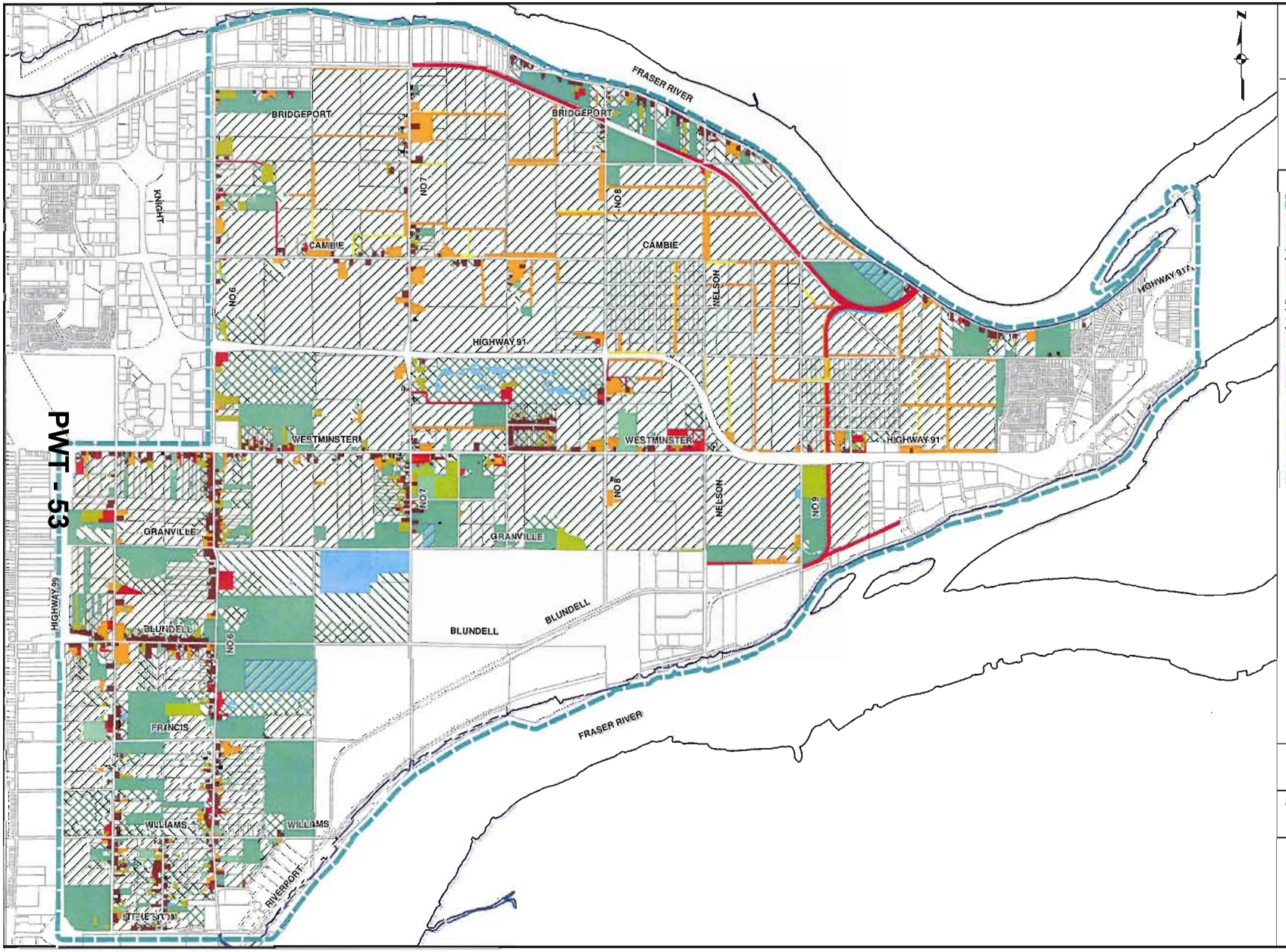
1.3.3 OCP Future Land Use

The 2041 OCP future land use information was obtained from the City and is shown in ***Figure 1.5***. There are no major changes from the current land use in the study area and the primary land use remains agricultural meaning that land imperviousness is unlikely to significantly change.

An additional land use plan is currently being developed for the Hamilton area; however, its findings are not expected to significantly impact the outcome of this study.

1.3.4 Integrated Rainfall Resource Management Strategy (IRRMS)

The City's IRRMS is being completed in parallel to this study, and it makes recommendations to protect and enhance Riparian Management Areas (RMA's) to protect and improve water quality. Many of the East Richmond's watercourses have designated RMA's. The detailed design of drainage and irrigation capacity upgrades recommended through the East Richmond Agricultural Water Supply Update should aim to incorporate relevant IRRMS recommendations, such as protecting RMA setbacks and enhancing RMA's.



PWT - 53

Richmond

City of Richmond

Agricultural Water Supply Study East Richmond

Legend

- Study Area
- Built up - Other
- Crop barn
- Cultivated field crops
- Farm Infrastructure
- Greenhouses
- Managed vegetation
- Non Built or Bare
- Residential footprint
- Settlement
- Transportation
- Unmaintained field crops
- Unmaintained greenhouses
- Utilities
- Vegetated
- Waterbodies
- Wetlands

Source:
2010 Land Use Inventory

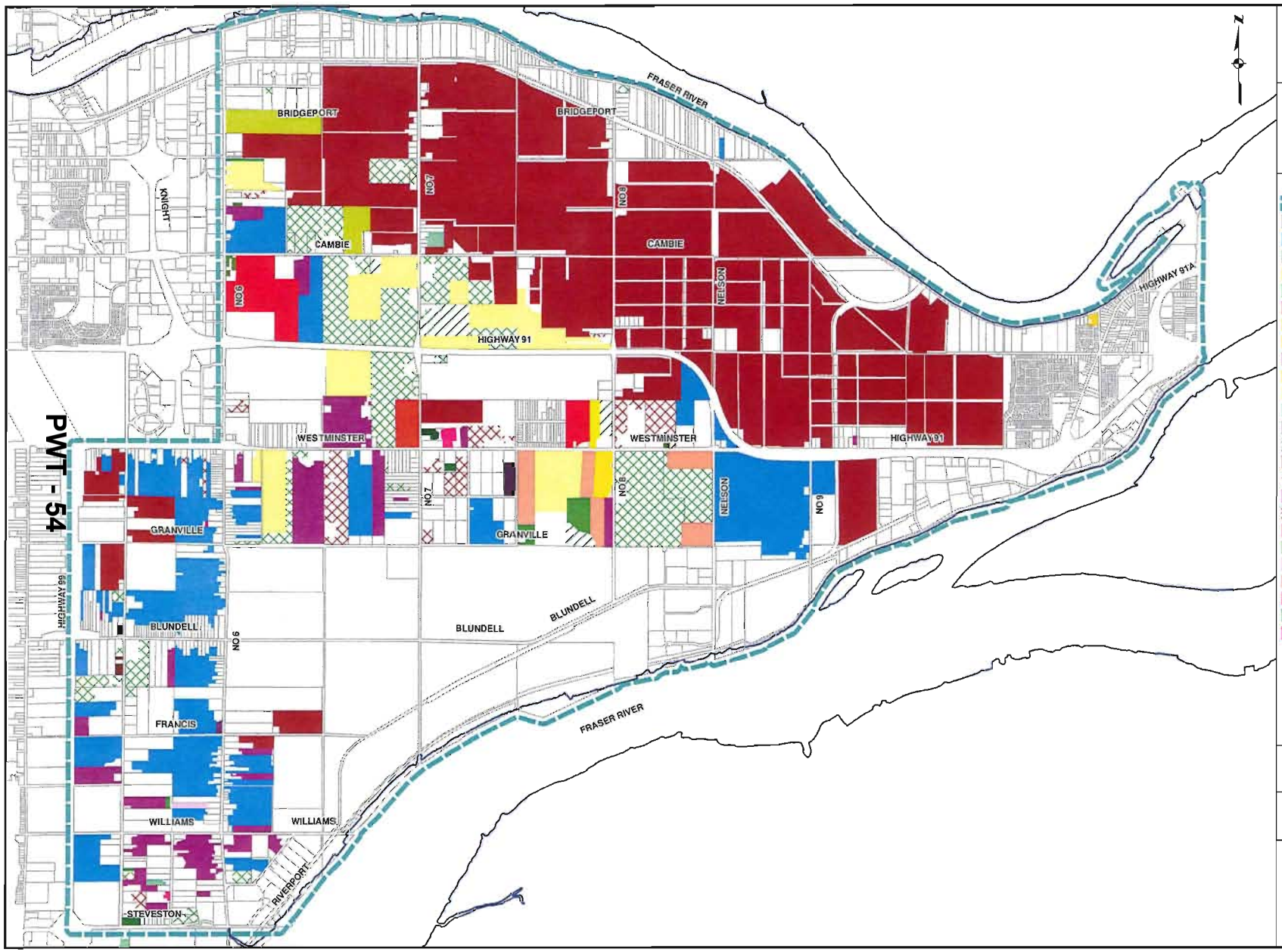
AECOM

0 375 750 1,500 m

Project No.	Date
60288323	April 2014

GENERAL LAND-USE COVER

Figure 1.2



PWT - 54

Richmond

City of Richmond

Agricultural Water Supply Study East Richmond

Legend

- Extended Study Area2
- Not Cultivated
- Blueberries
- Cedar hedging
- Cole crop
- Cover grass
- Cranberries
- Crop transition
- Cucurbits
- Cut flowers
- Floriculture
- Forage corn
- Forage, pasture
- Grapes
- Grass
- Hazelnut / filbert
- Mixed grass / legume
- Mixed vegetables
- Nursery
- Oats
- Ornamentals and shrubs
- Other
- Potatoes
- Strawberries
- Trees (plantation)
- Vegetables

Source:
2010 Land Use Inventory

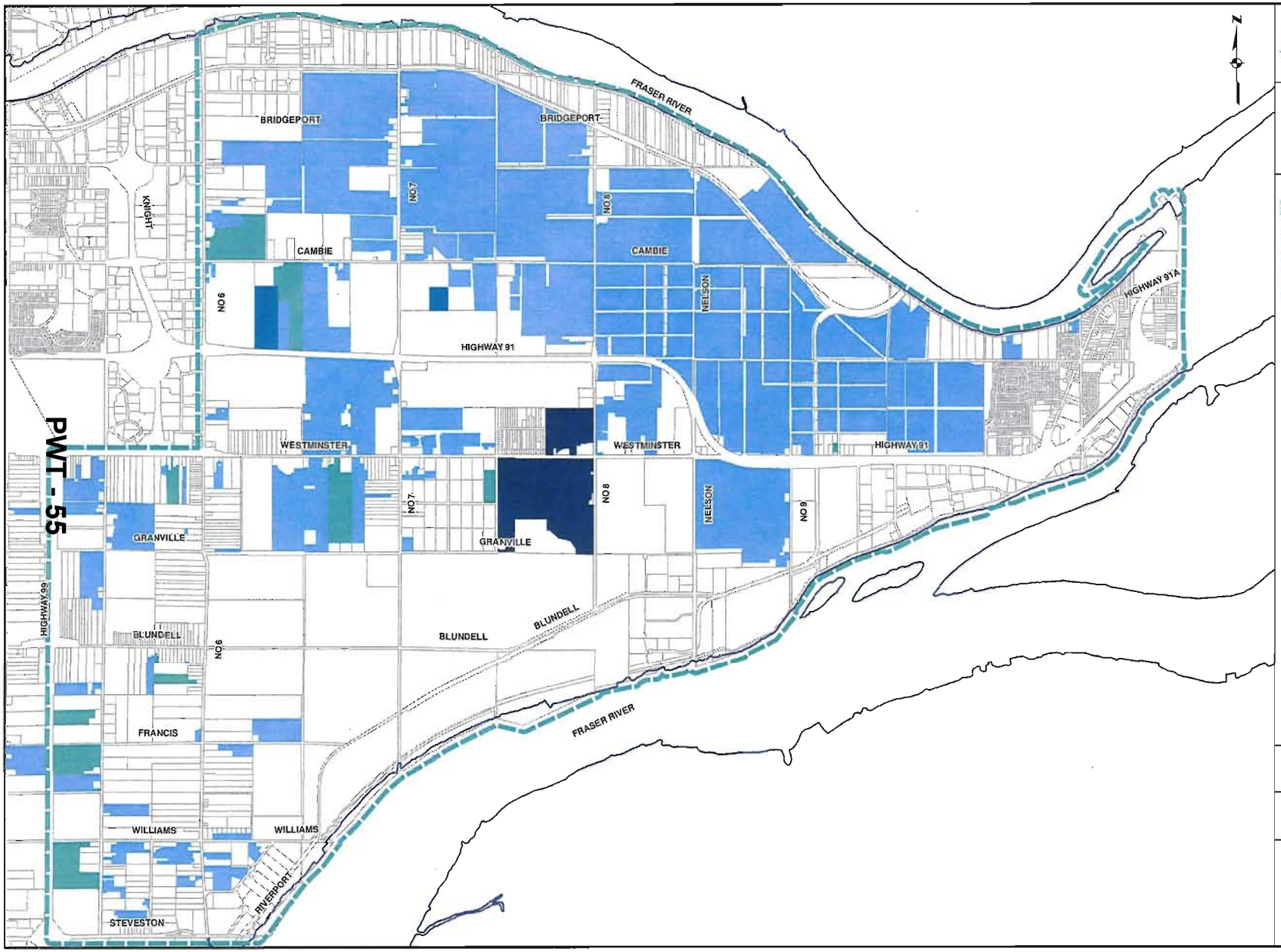
AECOM

0 375 750 1,500 m

Project No.	Date
60288323	April 2014

CULTIVATED CROPS

Figure 1.3



PWT - 55

Richmond

City of Richmond

Agricultural Water Supply Study East Richmond

Legend

- Study Area
- Not Irrigated
- Giant Gun
- Sprinkler
- Sub-surface
- Trickle

Source:
2010 Land Use Inventory

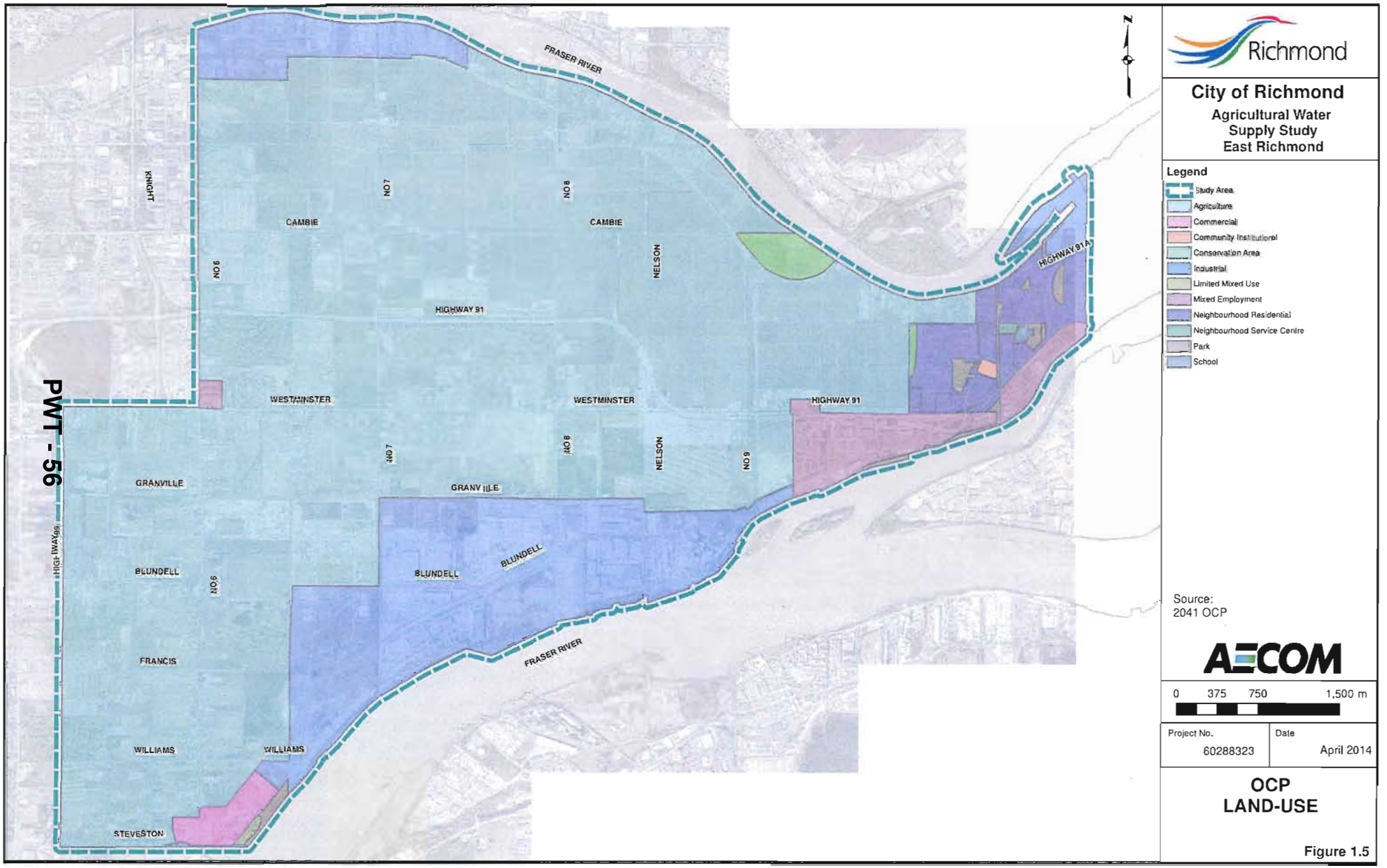
AECOM

0 375 750 1,500 m

Project No.	Date
60288323	April 2014

IRRIGATION TYPE/SYSTEM

Figure 1.4


FRASER RIVER
KNIGHT
NO 7
NO 8
CAMBIE
CAMBIE
NELSON
NO 6
HIGHWAY 91A
HIGHWAY 91
WESTMINSTER
WESTMINSTER
HIGHWAY 91
NO 7
NO 8
NELSON
NO 9
GRANVILLE
GRANVILLE
BLUNDELL
BLUNDELL
BLUNDELL
NO 6
HIGHWAY 99
FRANCIS
FRASER RIVER
WILLIAMS
WILLIAMS
STEVESTON
N
Richmond
City of Richmond
Agricultural Water Supply Study
East Richmond
Legend
Study Area
Agriculture
Commercial
Community Institutional
Conservation Area
Industrial
Limited Mixed Use
Mixed Employment
Neighbourhood Residential
Neighbourhood Service Centre
Park
School
Source:
2041 OCP
AECOM
0 375 750 1,500 m
Project No.
60288323
Date
April 2014
OCP
LAND-USE
Figure 1.5

PWT - 56

1.4 Irrigation and Drainage Infrastructure Overview

1.4.1 Current Drainage and Irrigation Infrastructure

Figure 1.6 shows the current drainage and irrigation infrastructure in East Richmond. Major pump station catchments are also shown in the above figure. These are approximate boundaries as the ditches may be interconnected at some locations. The majority of the water supply for the area north of Highway 91 is provided through three gravity intakes at No 7 Road North PS and No 8 Road North PS and the CN Box on the North Arm of the Fraser River. During low tide periods water is also pumped into the drainage canals at No 8 Road Pump Station. Inland, there is a network of canals/ditches and control gates that convey drainage and irrigation water and are generally well maintained. In addition, there are two other drainage pump stations on the North Arm of the Fraser River, No 6 Rd North PS and Queens North PS, that do not provide irrigation water supply.

Irrigation and drainage infrastructure in the north is primarily geared towards cranberry production and water supply for frost protection and harvesting. The majority of the infrastructure was constructed in the 1990s as a result of an ARDSA funding program.

Water supply in the south is more challenging, particularly for the western region where there are known issues with a lack of fresh water supply and water quality. The primary source of irrigation water is from the No 6 Road South PS gravity intake and is limited due to the presence of salt water. Salt water is a particular concern in late summer and early fall when river flows are at their lowest level. There is a conductivity meter in place at the pump station that automatically closes the intake when salinity levels reach 700 micro Siemens. In addition, during summer months there is less rainfall and river water available to flush the system which can lead to water stagnation. Also there are a series of hold back structures that keep the water in the system during summer. Farmers have reported elevated iron levels in this area. As a result, many of the farmers in the southwestern portion of the study area use City supplied potable water.

There are three other drainage pump stations on the South Arm of the Fraser, No 7 Road South PS, Nelson Road South PS, and Ewen PS. None of these pump stations are able to supply irrigation water. In 2012 a low capacity irrigation pump and piping system was built near Ewen PS to service farms local to that area. There are two existing drainage pump stations inland: Dog Kennels at Dhillon Way and Westminster Highway that serves a small low lying area, and one at 22740 Westminster Highway. Both these station do not provide irrigation water supply. The City is also constructing a new drainage pump station at No 8 Road and the Granville Avenue alignment that will discharge into the Port Metro Vancouver drainage system to the south. A summary of the major drainage infrastructure is provided in ***Table 1.4***.

It should be noted that farmers typically have private pumps and canals within their properties that have not been included in this study. This is particularly prevalent for cranberry farmers that have extensive private ditches and reservoirs to balance water requirements.

In addition to the pump stations and gravity/irrigation intakes listed above there are several flap gates and slide gates that are used to retain water in the ditch system. These exist at the following locations:

- Manual slide gates at the intersection of No 6 Rd and Triangle Rd as well as Westminster Hwy and Palmberg Rd;
- Flap gates along No. 6 Rd at Commerce Parkway, Wireless Way and International Place to stop water from flowing west;
- A flap gate at No. 7 Rd and Westminster Hwy to prevent cranberry water from discharging to the south; and
- A flap gate at No. 8 Rd south of HWY 91 to prevent cranberry water from discharging to the south.

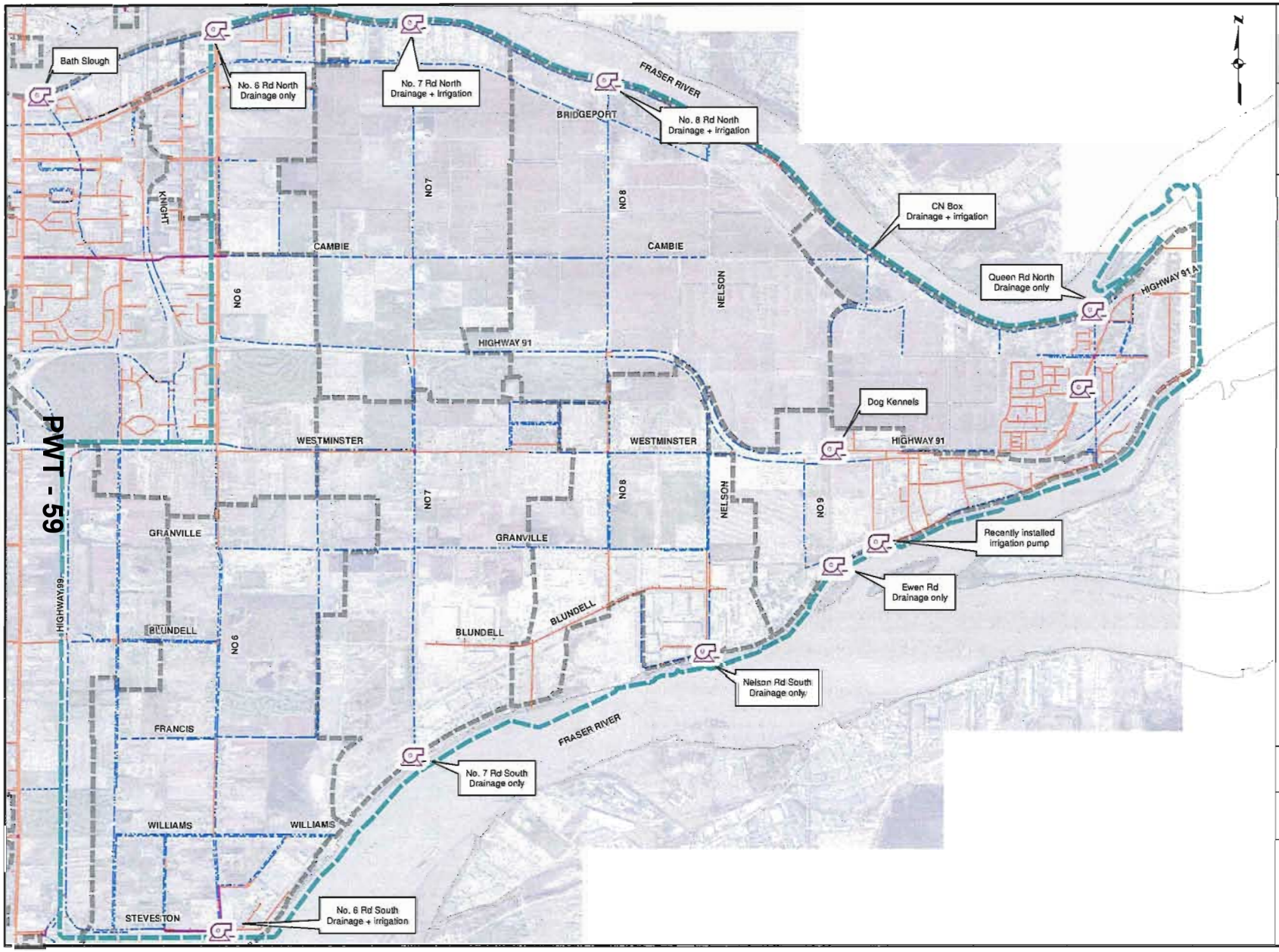
Table 1.4 Summary of Major Drainage Infrastructure

Structure & Name	Theoretical PS Capacity (see note below)	Intake/ Flood Box Dimensions	Description
No. 6 Road North PS	1.14 m^3/s	Flood Box 2.8m X 1.5m	No change to pump start/stop levels between seasons, flap gates on river side for gravity outflows during low tides
No. 7 Road North PS & Irrigation Intake at No. 7 Rd North	2.09 m^3/s	Flood Box 3.4m X 2.0m Intake dia. 1200mm	Fully automated with controls for low tide outflow slide gate & drainage PS for high tide, plus inflow slide gate for irrigation water during high tide events. Gravity inflow pipe reported to be installed too high but cannot be lowered due to ditch elevation.
No. 8 Road North PS & Irrigation Intake at No. 8 Rd North	2.41 m^3/s	Flood Box 3.7m X 2.3m Intake dia. 1200mm	Drainage PS with integrated drainage flood box and separate irrigation PS
Queens PS (North)	3.07 m^3/s	Flood Box 2.7m X 2.0m	No change to pump start/stop levels between seasons, flap gates on river side for gravity outflows during low tides
CN Drainage Flood Box (No. 9 North)		3.7m X 2.3m	Provides irrigation water and drainage for No 9 Rd ditch system and is manually controlled
Ewen PS (South) & Drainage Flood Box at Ewen	2.35 m^3/s -	Flood Box dia. 900mm	No change to pump start/stop levels between seasons, separate flood box structure with flap gates on river side for gravity outflows during low tides 50m away
Nelson Road South PS	1.62 m^3/s	Flood Box dia. 1600mm	No change to pump start/stop levels between seasons, flap gates on river side for gravity outflows during low tides
No. 7 Road South PS	2.90 m^3/s	Flood Box 1.37m X 1.0m (Twin Box)	No change to pump start/stop levels between seasons, flap gates on river side for gravity outflows during low tides
No. 6 Road South PS	2.16 m^3/s	Flood Box 3.4m X 1.5m	Drainage by gravity outflow during low tide and pumped flows for high tide events. Irrigation water supplied by 200mm valve structure.
Dog Kennels PS (Westminster Hwy)	0.17 m^3/s	NA	Drainage for a small low lying area

Note: Theoretical pump rates as provided by the City based on previous studies

1.4.2 Connectivity with West Richmond

There are three locations where the model is hydraulically connected to West Richmond; however, it is assumed that there is no flow entering the East model. The connections are modelled as a set boundary condition that was determined during the model development phase in 2006 and based on the 10-year 2 day event peak HGL.



PWT - 59

Richmond

City of Richmond

Agricultural Water Supply Study East Richmond

Legend

- Study Area
- Existing Drainage Ditches/Culverts
- Existing Box Culvert
- Existing Storm Sewer
- Pump Station Catchment Areas

AECOM

0 375 750 1,500 m

Project No.	Date
60288323	April 2014

EXISTING DRAINAGE/IRRIGATION NETWORK

Figure 1.6

1.5 Design Criteria

1.5.1 Drainage Design Criteria

The City's Engineering Design Criteria includes design storms that are geared towards urban areas and not suitable for agricultural areas. Drainage Criteria defined by the Ministry of Agriculture was used for the model assessment in the 2006 Study and has also been used in this update.

All ALR lands follow the Agricultural and Rural Development Subsidiary Agreement Criteria (ARDSA). The BC Agricultural Drainage Manual provides information on the design of farmland drainage systems. This manual looks at crop types to be planted, soil types, water table depth, and local climate conditions. For farmers, an important issue for managing agricultural stormwater is the duration it takes for land to drain. The length of time in which crops are saturated in water is much more critical to farmers than flooding. Different crops are sensitive to different flood periods; therefore, it is important that any changes implemented to upland areas also take into consideration the impacts to downstream farm areas.

The ARDSA criteria are as follows:

- Remove runoff from the 10-year, 5-day storm, within 5 days in the dormant period (November 1 to February 28);
- Remove runoff from the 10-year, 2 day storm, within 2 days in the growing period (March 1 to October 31);
- Between storm events and in periods when drainage is required, the base flow in channels must be maintained at 1.2m below field elevation; and,
- The conveyance system must be sized appropriately for both base flow and design storm flow.

It is also important to note that the freeboard, which is the elevation difference between the base flow water level in the channel and the field elevation, should be 1.2m as noted above; however, a freeboard of 0.9m may be acceptable in some areas depending on the crop usage because drainage of the plant/ crop root zone may still be viable.

ARDSA design hyetographs for the 10-Year Winter (Harvest) and 10-Year growing season storm events were developed in the 2006 study and have been used for this study update. The hyetograph plots are shown in ***Appendix B***.

In the hydraulic model the roughness coefficient (Manning's n value) used for all ditches cleaned since 2006 was 0.04, while for all others a value of 0.06 was used.

1.5.2 Irrigation Design Criteria

Due to the diversity of crops grown, irrigation requirements vary within the study area. ***Figure 1.3*** (previously referred to) shows various cultivated crops and was used to verify the locations of irrigation demands in the hydraulic model. As a part of the LUI, information about type of irrigation used in the area was also collected and is discussed in ***Section 1.3.1***. ***Figure 1.4*** (previously referred to) shows various irrigation systems used in the area.

Irrigation demands can be separated into three different categories as follows-

I. *Growth Irrigation:* Irrigation water is mainly required for crop growth. The 2006 study assumed growth irrigation rate of 5.33mm/day throughout the area. This study adopted the same rate for growth irrigation.

II. *Frost Irrigation:* Cranberry growers, mainly north of Hwy 91, require irrigation for frost protection. Majority of cranberry farmers in this area rely on sprinkler irrigation system as shown in ***Figure 1.4***. Freezing

temperature in the early spring or late fall can result in considerable damage to cranberries. The guidelines for frost protection of cranberries (BC Frost Protection guide published by B.C. Ministry of Agriculture and Fisheries-1988) are summarized in the following paragraph:

Low growing plants such as cranberries generally require approximately 1.5mm/hr to 2.0mm/hr of water to be applied by overhead irrigation system. Dew point temperatures, wind velocity and sprinkler rotation speed have an effect on the level of protection achieved. To effectively protect against frost with an irrigation system, the system must be operated continuously from onset of frost until the ice encasement has sufficiently begun to melt. A large amount of water is required to provide this protection. Assuming an application rate of 2.0mm/hr, the flow rate required is 90gpm/hectare (or 5.7 L/s/ha). That means a 10hectare farm will require a flow rate of 900gpm (or 57 L/s/ha). It is difficult to achieve these high flowrates.

Most farmers in this area have built private storage ponds to supply water for frost irrigation. Ideally, the storage reservoir should be large enough to allow for 3 nights of frost protection at 10hours per night. Based on the information provided in 2006 study, no shortage of water for frost irrigation was reported by farmers. Farmers use the same pumps for growth irrigation and frost irrigation to withdraw water from ditches. So even though more intense rate is required for frost protection, for modelling purposes it is the same. Farmers extract water over extended period to fill local reservoirs. The stored water is then used for frost protection when required.

III. *Harvest Irrigation:* The most widely-known use of flooding in cranberry cultivation is for harvest. Approximately 90 percent of the crop is harvested this way. Flood harvesting occurs after the berries are well colored and the flood waters have lost their summer heat. The bogs are flooded with up to one foot of water. In order to conserve water, harvest is managed so water is reused to harvest as many sections of bog as possible before the water is released from the system. Flood water is recycled in the cranberry bog system, passed from bog to bog through canals and flume holding ponds and reused, often shared by several growers.

As a part of 2006 study, UMA completed an *ad hoc* survey of farmers. This survey gathered information about farmers schedule for flooding the fields. Please refer to Section 4.0 of 2006 Study for details about harvest water demands. Similar to frost irrigation, it is assumed that farmers fill local reservoirs over extended period and use stored water to flood the fields.

1.5.3 Tides

As a part of 2006 Study tidal information was acquired from three recording stations located at Nelson Road Pump Station, No. 6 Road South Pump Station and Queens Pump Station. Representative tides were developed for each station. For stations where no tidal data is available, representative tide from the nearest station is used for the following modelling scenarios:

- *Scenario 1* - To model winter drainage conditions during dormant period, a 7 day high tide cycle was developed and used with 10-year 5 day winter storm
- *Scenario 2* - To model summer drainage during growing period, *a* 4 day high tide cycle was developed and used with 10-year 2 day summer storm.
- *Scenario 3* - To model irrigation during growing period, a 3 day low tide cycle was developed to represent worst case scenario.

Please refer to section 4.2.1 of 2006 study for detailed tide information.

2. Data Collection & Review

2.1 Background Information Review

In the 2006 study, a number of issues were identified:

- Poor drainage and ditch maintenance south of Highway 91
- Concerns over competition for irrigation water and high cost of City supplied water
- Stagnant water and poor water quality, particularly the Sidaway / No. 6 Road area
- Limited options for increasing ditch capacity due to topography, high ground water levels, private property limitations, and traffic safety considerations
- Balance between ditches providing both irrigation and positive drainage
- High cost for system upgrades

To alleviate some of these concerns the City has implemented several infrastructure improvements, some of which were recommended based on the previous analysis of the system under winter and summer conditions. The model scenarios corresponded with the water intensive cranberry growing and harvesting seasons as this is a primary land use in the study area. Infrastructure improvements that were implemented include installation of flow control structures, ditch re-grading, construction of new ditches and new pump station upgrades. A summary of the works completed since 2007 is provided in Section 3 ***Table 3.1***.

In order to evaluate whether these same issues are still valid or if there are new concerns with the drainage and irrigation water supply the project team initiated meetings with the AAC and Operations Staff as well as an Open House to garner input from the general public.

2.2 Agricultural Advisory Committee Meeting, Open House and Staff Workshop

2.2.1 AAC Meeting

AECOM and City staff attended the Richmond AAC meeting on March 14, 2013. The AAC is appointed by City Council and there are ten voting members on the Committee, five of whom are nominated by the Richmond Farmer's Institute.

Background information on the project was presented along with the City's primary objective of identifying a prioritized list of drainage and irrigation upgrades within the ALR east of Highway 99. The goal for meeting with the AAC was to seek assistance from committee members and ultimately the farming community to identify drainage and irrigation issues, crop catalogue changes and any other pertinent information.

During the March 14, 2013 meeting, a Ministry of Agriculture representative gave a presentation on the latest Richmond Land Use Inventory (LUI) report (issued in 2013 and based on 2010 roadside survey). A brief description of the LUI report is provided in ***Section 1.3.1***.

During the AAC meeting, several members provided comments on known drainage and irrigation issues. A summary of the comments recorded include the following items:

- Review ditch profile and survey for Sidaway Rd between Williams and Steveston as conveyance is not good
- Water quantity and quality in vicinity of Westminster Hwy and No 6 Rd needs to be improved
- Review proposed upgrades from 2006 that have not yet been completed
- Review ditch capacity improvements on No 6 Rd north of Cambie as it is already wide with steep side slopes
- Confirm plans for re-profiling Cambie Rd ditch between No 6 Rd and No 7 Rd

2.2.2 Open House

An Open House was held on April 18, 2013 at City Hall to educate residents and farmers and encourage the community to voice their drainage and irrigation concerns. Poster boards including maps of the study area showing the Agricultural Land Use Inventory findings and East Richmond drainage and irrigation system upgrades, as well as descriptions for upgrade projects completed since 2006, were presented at the Open House. Attendees were asked to complete feedback forms or go to LetsTalkRichmond.ca to provide comments online.

A few drainage and irrigation concerns were raised at the Open House and are summarized below. The completed questionnaire forms that were received are included in ***Appendix A.***

- Drainage ditches located on north and south sides of Westminster Hwy east of No 6 Rd are not effective in winter and spring and the ditches have been observed to flow in both directions. In summer there is no water for irrigation and City water is used by local area farmers. One vegetable farmer stated that City water is too cold and chlorinated such that vegetable quality is reduced and adds operational cost to buy water.
- Concern over increased impervious areas due to development of large houses on Blundell Rd between Sidaway Rd and No 6 Rd. The increased runoff may cause drainage problems in the area.

2.2.3 Workshop with Operations Staff

A workshop was held with City Operations Staff on May 1, 2013 to discuss known drainage and irrigation issues in the study area. The workshop was followed by a field trip with Operations Staff to visit several of the problem areas as well gain a further understanding of the system operation.

During the workshop it was noted that several of the cranberry farmers are increasing the size of their fields by amalgamating smaller plots into larger plots putting increased pressure on the drainage and irrigation systems. This is occurring at a number of locations north of Hwy 91 and one location in particular is west of No 6 Road between Bridgeport Rd and Cambie Rd.

The following locations were discussed as areas where maintenance works are required:

- Ditch cleaning and re-profiling on the south side of the Cambie Rd ditch between No 6 Rd and No 8 Rd. It was noted that east of No 8 Rd the ditch is on private land
- Repair or replacement of the failing headwall at the south ditch box culvert inlet on Cambie Rd just east of No 6 Road
- Ditch cleaning and re-profiling along CN Rail corridor between No 7 Rd and No 8 Rd (City needs permission from the railway for access)
- Ditch cleaning and re-profiling for south side of River Rd from the CN box (Cambie Rd alignment) east to Queens PS
- Box culvert flushing and cleaning for No 6 Rd north drainage corridor
- Removal of invasive species (Japanese Knotweed) and training for staff to do this (areas to be determined based on further field inspection)

In addition to the areas identified above, other known problem areas and concerns include:

- Sidaway Rd from Steveston Hwy to Granville Ave is prone to flooding due to low topography. Solutions discussed include removal (or lowering) of culverts, additional ditch re-profiling and combination of automated gate structures and level sensors.
- The area between Nelson Rd at Hwy 91 to Westminster Hwy is prone to flooding due to fields from the north draining south.
- A lack of irrigation water in the south west area between Steveston Hwy and Highway 99. Concerns include:
    - Water quality and quantity-Farmers are currently supplementing ditch flows with City water which has chlorine, temperature and cost implications; and
    - Salinity at the No 6 Rd irrigation intake during periods when the salt wedge is present in the Fraser River South Arm.
- Limited ditch and box culvert capacity in No 6 Rd between Cambie Rd and No 6 Road North PS, including the known obstruction of the Kinder Morgan jet fuel pipeline crossing on No 6 Road between Cambie Rd and Bridgeport Rd.
- Sloughing in ditch along No 8 Road north of CN railway tracks to River Road.

Other items discussed that are to be reviewed and may be potential study recommendations include:

- Lowering the No 7 Rd North PS culvert and the impact this would have on the downstream ditch systems
- A culvert inspection program of the entire study area and in particular a review of who is responsible for maintenance of culverts crossing Hwy 91
- Procedures that requires farmers to identify when and where new outfalls from fields to municipal ditches are constructed
- Coordination of operation for CN box gravity intake (River Rd and Cambie Rd alignment) with farmers and Operations staff
- Coordinated water use by farmers from No 7 Rd North gravity intake and No 8 Rd North PS during harvest

2.3 Field Reconnaissance

At the onset of the project AECOM staff completed a site reconnaissance of the study area on March 12, 2013. A second site visit was completed on May 1, 2013 with City Staff. During the site visits further anecdotal information about the system's operation was recorded and has been incorporated into this report.

3. Model Update

3.1 Conversion from DHI's Mouse to Mike Urban

The 2005 version of DHI's (Danish Hydraulic Institute's) MOUSE software was used for modelling in the 2006 study. This software is no longer available nor is it supported by DHI. The existing scenario model files from the 2006 study were converted from MOUSE into MIKE URBAN 2012.

3.2 Infrastructure Updates Completed after 2006

The model network was then updated based on the upgrades completed since 2006 as shown in ***Table 1.1*** (previously referred to in ***Section 1.1***). Record drawings and survey information for the infrastructure improvements listed in the table were provided by the City and incorporated into the updated model. ***Figure 3.1*** shows the location of completed upgrades. Many were recommended in the 2006 East Richmond Agricultural Water Supply Study as high priority upgrades while other additional projects have also been completed based on input from Operations Staff. The upgrades were entered into the hydraulic model for both the drainage and irrigation scenarios.

3.3 Pump Station Operations

Details for the pump models and seasonal settings at each pump station are provided in ***Table 3.1*** below. The information summarized in the table was provided by the City and also extracted from the 2006 Study.

To assist with meeting water requirements for different seasons, City Operations Staff alter the drainage pump start/ stop levels at two northern pump stations: No 7 Rd North and No 8 Rd North. In addition, operational settings of the irrigation gate at No 7 Rd North and No 8 Rd North irrigation pump station are also changed from season to season. These two pump stations are the only stations where settings are altered from season to season to allow for irrigation water supply. Settings at all other pump stations are not changed over the course of the year unless Operations Staff are conducting routine maintenance or ditch cleaning works.

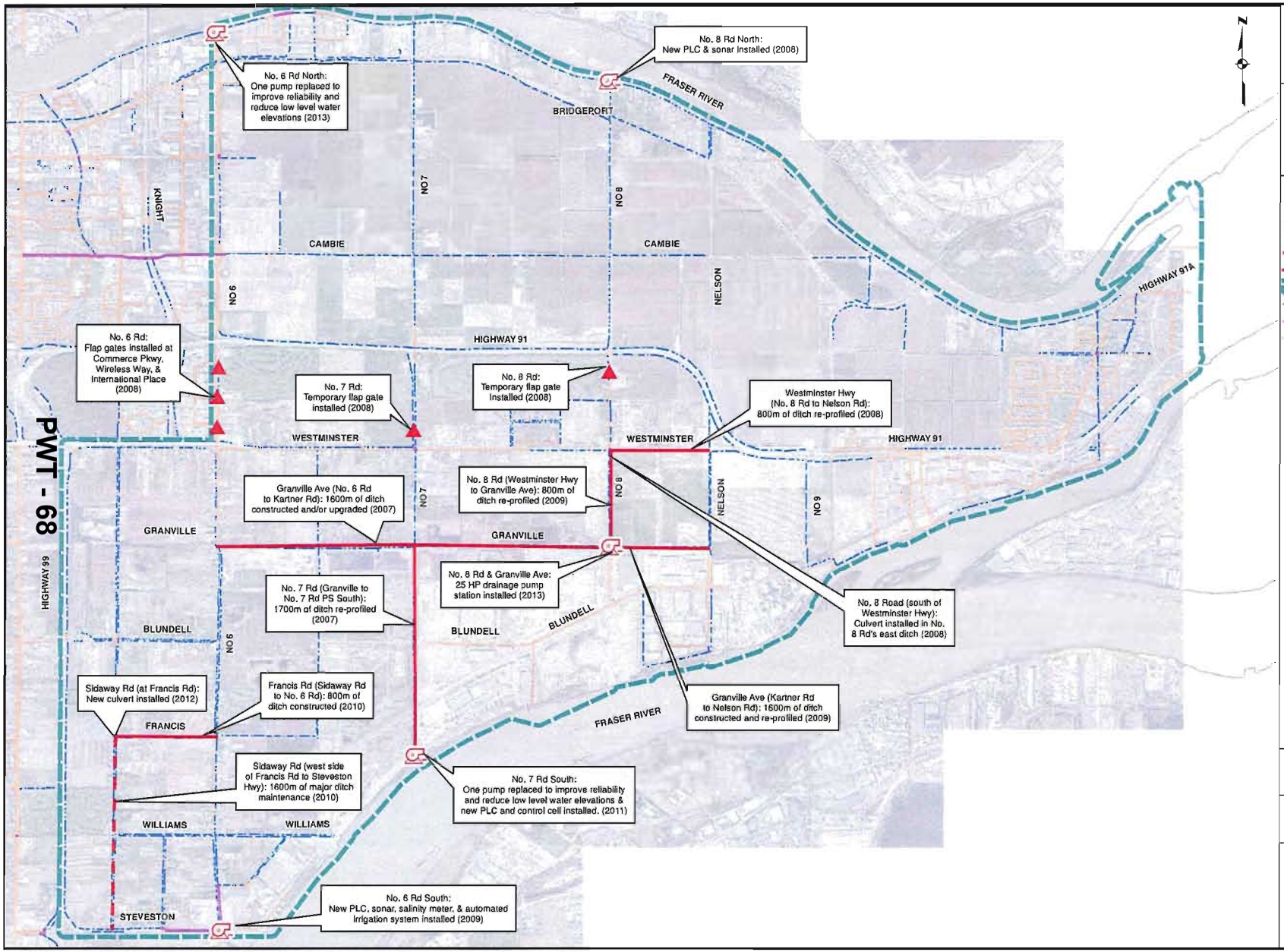
The alternate irrigation season pump start and stop settings for No 7 Rd North and No 8 Rd North pump stations are in place so that target water level elevations in the irrigation ditches can be achieved. The target levels for No 7 Rd North and No 8 Rd North Pump Stations are currently 0.217m and 0.575m geodetic elevations respectively (as shown in ***Figure 3.2 and Figure 3.3)***.

Control logic for the No 8 Rd North irrigation pump station is as follows:

- Under normal irrigation mode when the ditch water level drops 0.25m below the target water level (elevation 0.575m) the gravity inlet gate will open, but only if the tide is high enough to provide water. However, if at this time the tide is too low to deliver water then the irrigation pump will start.
- If the gravity inlet is delivering water and the tide drops then the gate will close. After the gate has closed the pump will not start unless the ditch water level reaches an elevation of 0.25m or more below the target level.
- Typically gravity inflows are sufficient to maintain water levels above the start level (0.25 m below target) and the pump rarely turns on through the summer. However, the gravity inflow typically cannot maintain the upper water level (0.5m above target) required during cranberry harvest and frost protection periods when farmers are drawing heavily on the ditch water.
- To maintain a consistent water level of 0.5m above the target both the gravity gate and pump controls are overridden. The pump start and stop levels are increased by 0.5m (pump start 0.825 and stop at 1.575).

At No 8 Rd North the irrigation pump has been noted to pump continuously for a week such that the upper water level is not attained or only attained intermittently. At this time the gravity inlet gate elevations are also set higher so that the pump operates before the gate has an opportunity to open. This could possibly be caused by short circuiting of flow back to the river at No 7 Rd North PS as existing drainage pumps at No 7 Rd North start at 0.4m elevation which is lower than No 8 Rd North target level (0.575m).

There is no dedicated irrigation pump at No 7 Rd North so inflows via the 1200mm diameter gravity irrigation intake pipe are controlled by the tides and the gate structure on the intake pipe. During the irrigation season the gate is set to be open between elevation 0.14m and 0.37m geodetic.



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Agricultural Water Supply Study East Richmond

Legend

- Flap Gates installed since 2006
- Completed Pump Station Upgrades
- Ditch Maintenance Only
- Completed Ditch Upgrades
- Study Area
- Existing Drainage Ditches
- Existing Box Culvert
- Existing Storm Sewer

AECOM

0 375 750 1,500 m

Project No.	Date
60288323	April 2014

PROJECTS COMPLETED SINCE 2006

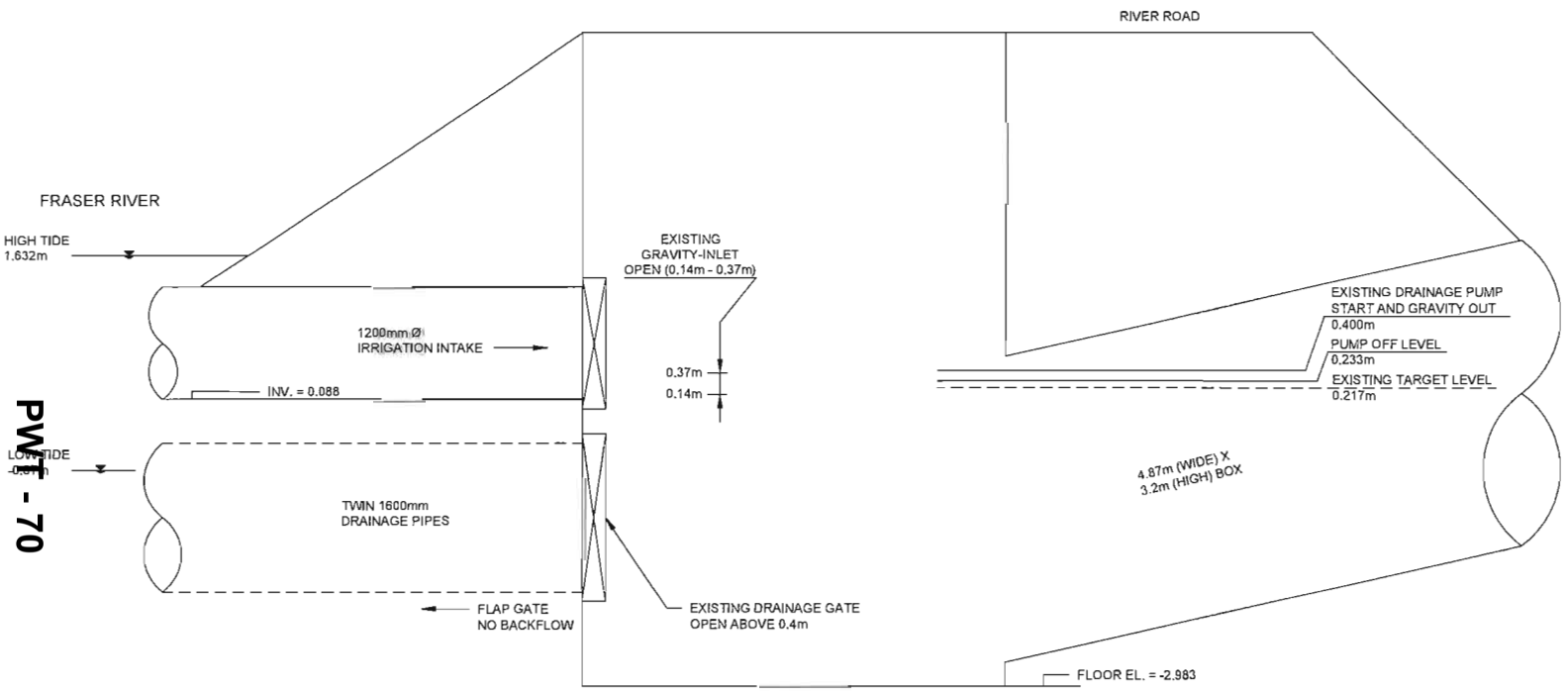
Figure 3.1

Table 3.1 Pump Station Information

Station	Pump Model	Impeller #	Pump Unit	Power (Hp)	Pumping Levels (m – geodetic)			
					Drainage		Irrigation	
					On	Off	On	Off
No. 6 Road North PS	Flygt 7050-680	15	P1	60	-0.04	-0.26	No Change	
	Flygt 7050-680	15	P2	60	0.13	-0.26		
	Flygt CP3152-120	614	P3 (jockey)	20	-0.22	-0.47		
No. 7 Road North PS	Flygt 7060-770	16	P1	84	-0.10	-0.41	0.42	0.23
	Flygt 7060-770	16	P2	84	-0.07	-0.41	0.45	0.23
	Flygt CP3300-180	814	P3 (jockey)	77	-0.10	-0.41	0.40	0.23
No. 8 Road North PS	Flygt 7060-760	16	P1	60	0.08	-0.52	1.11	0.65
	Flygt 7060-760	16	P2	60	0.24	-0.52	1.14	0.65
	Flygt 7060-760	16	P3	60	0.38	-0.52	1.17	0.65
	Flygt CP3300-180	814	P4 (jockey)	32	-0.32	-0.61	1.19	0.65
Queens PS (North)	Flygt 7080-820	16	P1	70	-0.53	-0.72	No Change	
	Flygt 7080-820	814	P2	70	-0.26	-0.72		
	Flygt 7080-820	16	P3	70	0.01	-0.72		
	Flygt CS3300-180	814	P4 (jockey)	35	-0.56	-0.87		
Ewen PS	Gen Elec	N/A	P1	60	0.15	-0.16	No Change	
	Gen Elec	N/A	P2	60	0.21	-0.09		
	Gen Elec	N/A	P3	60	0.30	0.00		
	Flygt 3300	N/A	P4 (jockey)	20	0.07	-0.16		
Nelson Road South PS	Flygt 7060-760	16	P1	60	0.04	-0.54	No Change	
	Flygt 7060-760	16	P2	60	0.21	-0.54		
	Flygt CP3201-120	614	P3 (jockey)	35	-0.17	-0.47		
No. 7 Road South PS	KSB	N/A	P1	130	-0.08	-0.38	No Change	
	Westinghouse	N/A	P2	125	0.22	-0.38		
	Flygt CP3300	N/A	P3 (jockey)	60	-0.39	-0.69		
No. 6 Road South PS	Flygt 7060	20	P1	84	-0.46	-0.80	No Change	
	Flygt 7060	20	P2	84	-0.28	-0.80		
	Flygt CP3300	804	P3 (jockey)	32	-0.64	-1.00		

No. 7 ROAD NORTH SCHEMATIC FOR IRRIGATION SETTINGS

NOT TO SCALE



WET-WELL SECTION

PWT - 70

NOTES:

1. ALL ELEVATIONS ARE GEODETIC
2. LOW TIDE AND HIGH TIDE BASED ON DESIGN TIDE USED IN MODEL
3. ABOVE SKETCH IS SCHEMATIC TO SHOW ELEVATIONS ONLY

EXISTING SETTINGS:

1. TARGET LEVEL IS 0.217m
2. IRRIGATION INTAKE OPENS AT 0.14m AND CLOSES AT 0.37m
3. DRAINAGE PUMPS START AND GRAVITY-OUT FALLS OPEN AT 0.4m OR ABOVE (TO PREVENT FLOODING DURING SUMMER STORMS)

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East Richmond

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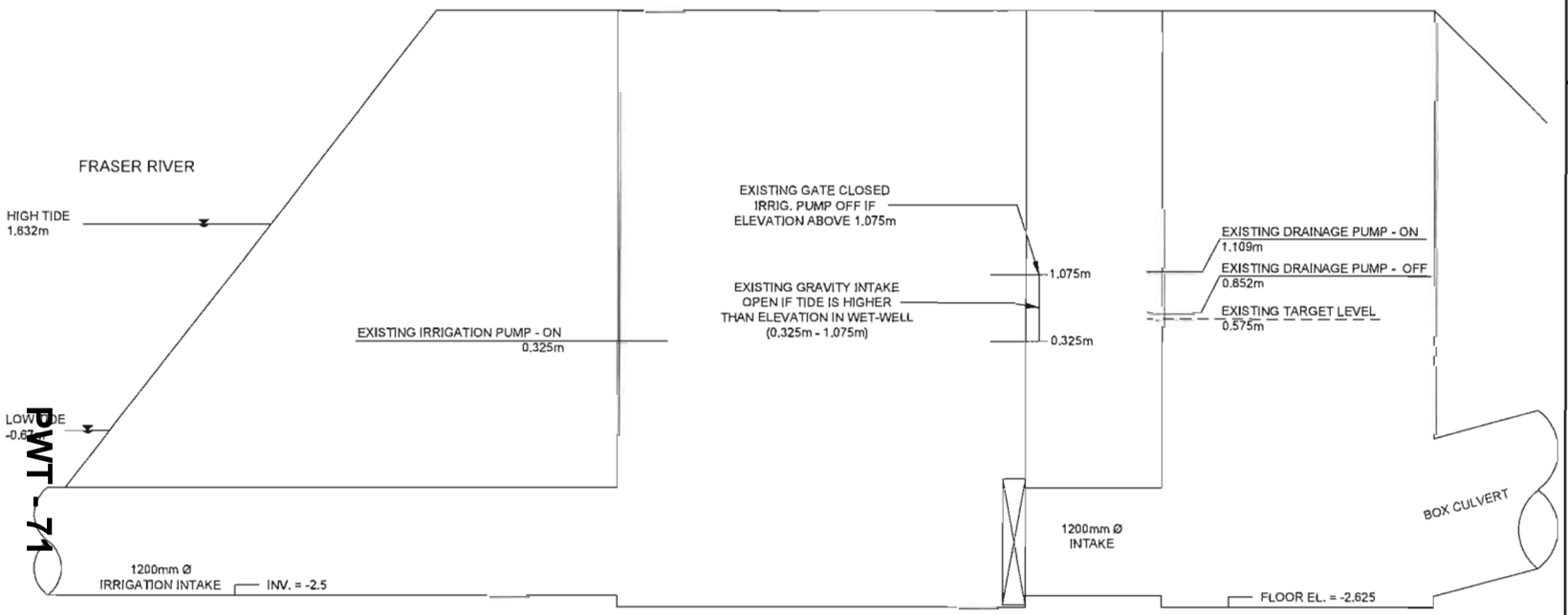
No. 7 Rd. North Schematic for Existing Irrigation Settings

Figure 3.2

No. 8 ROAD NORTH SCHEMATIC FOR IRRIGATION SETTINGS

NOT TO SCALE



IRRIGATION PUMP STATION CHAMBER

No. 8 ROAD DRAINAGE PUMP STATION WET-WELL

NOTES:

1. ALL ELEVATIONS ARE GEODETIC
2. ONLY ONE IRRIGATION-INFLOW TAKES PLACE (PUMP OR GRAVITY) AT ONE TIME
3. LOW TIDE AND HIGH TIDE BASED ON DESIGN TIDE USED IN MODEL
4. ABOVE SKETCH IS SCHEMATIC TO SHOW ELEVATIONS ONLY

EXISTING SETTINGS:

1. TARGET LEVEL IS 0.575m
2. IRRIGATION PUMP TURNS ON ONLY IF LEVEL DROPS BELOW 0.325m. ONCE IT TURNS ON THEN IT TURNS OFF AT 1.075m
3. PUMP/GATE CONTROLS ARE MANUALLY OVERRIDDEN WITH A TEMPORARY SETTING TO MAINTAIN A HIGHER WATER LEVEL (START 0.825, STOP 1.575) DURING CRANBERRY HARVEST & SPRING FROST PROTECTION
4. GRAVITY INTAKE GATE OPENS AT 0.325m AND CLOSES AT 1.075m

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Agricultural Water Supply Study
East Richmond

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No. 8 Rd. North Schematic for Existing Irrigation Settings

Figure 3.3

4. Existing System Assessment

4.1 Drainage System Assessment Scenarios

Assessment of existing drainage system was completed for the following two worst case scenarios:

4.1.1 *Scenario 1- Dormant Winter Period*

For this scenario 10-Year 5-day design storm (as shown in Appendix B) and 7-day winter high tide (boundary condition) was used to evaluate the performance of drainage network.

In addition to storm runoff, cranberry harvest discharges were added as constant inflow into the model. Cranberry discharges vary from year to year depending upon the schedule developed between Ocean Spray and farmers. For modelling purposes, the volume and schedule of discharges was assumed to be same as per the 2006 Study. The model was set to run for 7 days with start date of November 1. A total cranberry harvest discharge volume of 308,447 m^3 was added at two separate locations in the model for this scenario. This is equivalent to discharge from a 68.5 hectare farm with 0.45m of standing water. Since all the cranberry farmers do not discharge water on the same day and tend to coordinate water supply for reuse during harvest periods, this is a conservative assumption.

4.1.2 Scenario 2- Summer Growth Period

For this scenario 10-Year 2-day design storm (as shown in Appendix B) and 4-day summer high tide (boundary condition) was used to evaluate the performance of drainage network. The two day storm has higher peak rainfall intensity but lower total rain (volume) than the five day storm.

Since the cranberry harvest is at the cusp of the growing and dormant period, harvest discharges were added as constant inflow into the model. Based on the schedule assumed in the 2006 study, a total discharge of 252,678 m^3 was added at two separate locations. For this scenario, the model was run for a period of 5-days to evaluate system performance after the storm is over.

4.2 Drainage Model Results

Analysis of the existing system indicates that there are several different factors that affect the maximum HGL at any location. The East Richmond drainage network is similar to the West Richmond drainage system as there are a lot of interconnected ditches but differs in that it serves the dual purposes of irrigation water supply and drainage conveyance.

4.2.1 System Conveyance

Several factors that contribute to conveyance problems and lack of irrigation water supply include capacity constraints, reliance on tide elevations, back water effects from pump stations and gravity outlets, and localized low ground elevations. For instance, at several locations the ground elevations in the hydraulic model were found to be very low when compared to neighbouring ground elevations (or attributes of adjacent ditch/culvert conduits), resulting in localized flooding. Locations where localized flooding was reported due to major discrepancies in ground elevations were often resolved by reviewing the digital elevation model (DEM) data for the study area as shown in ***Figure 4.1*** and information available on Google Street View. The DEM raster image was generated using data supplied by the City for the 2006 Study. It should also be noted that the elevation data does not take into account infill areas since the topographic data was recorded.

To better understand if flooding in a certain area is caused by capacity constraints or back water from a pump station, the model was simulated with no boundary conditions (i.e. no tide at outfalls) to allow the system to drain

freely. Subsequently all ditch improvements discussed in the following section were first analysed with no boundary conditions prior to running the model with high tides. This also assisted in gaining a better understanding of pump station operation, capacities and on-off levels.

The existing model results for the dormant winter period (10-Year 5 day storm event) with tides are shown in ***Figure 4.2a***. Flooding is predicted at several locations and is color coded based on the height of the maximum HGL above and below existing ground elevation. ***Figure 4.2b*** shows existing systems HGL after the 10-Year 5 day storm event has passed (on day 5).

All model nodes were set to allow ponding in Mike Urban, which means even though the maximum HGL goes above the existing ground elevation, no water is lost in the model. This helps in keeping the total volume within the system to review the downstream capacity. The HGL results are conservative as no flood cells were modelled (in the 2006 study as well as this study) due to lack of detailed survey of adjoining fields. Flooding at each location was analysed in further detail to identify the cause of flooding and determine if ditch upgrades are required. In ***Section 4.3***, various problem areas are identified and improvement options are recommended.

4.2.2 Drainage Pump Station Capacity Review

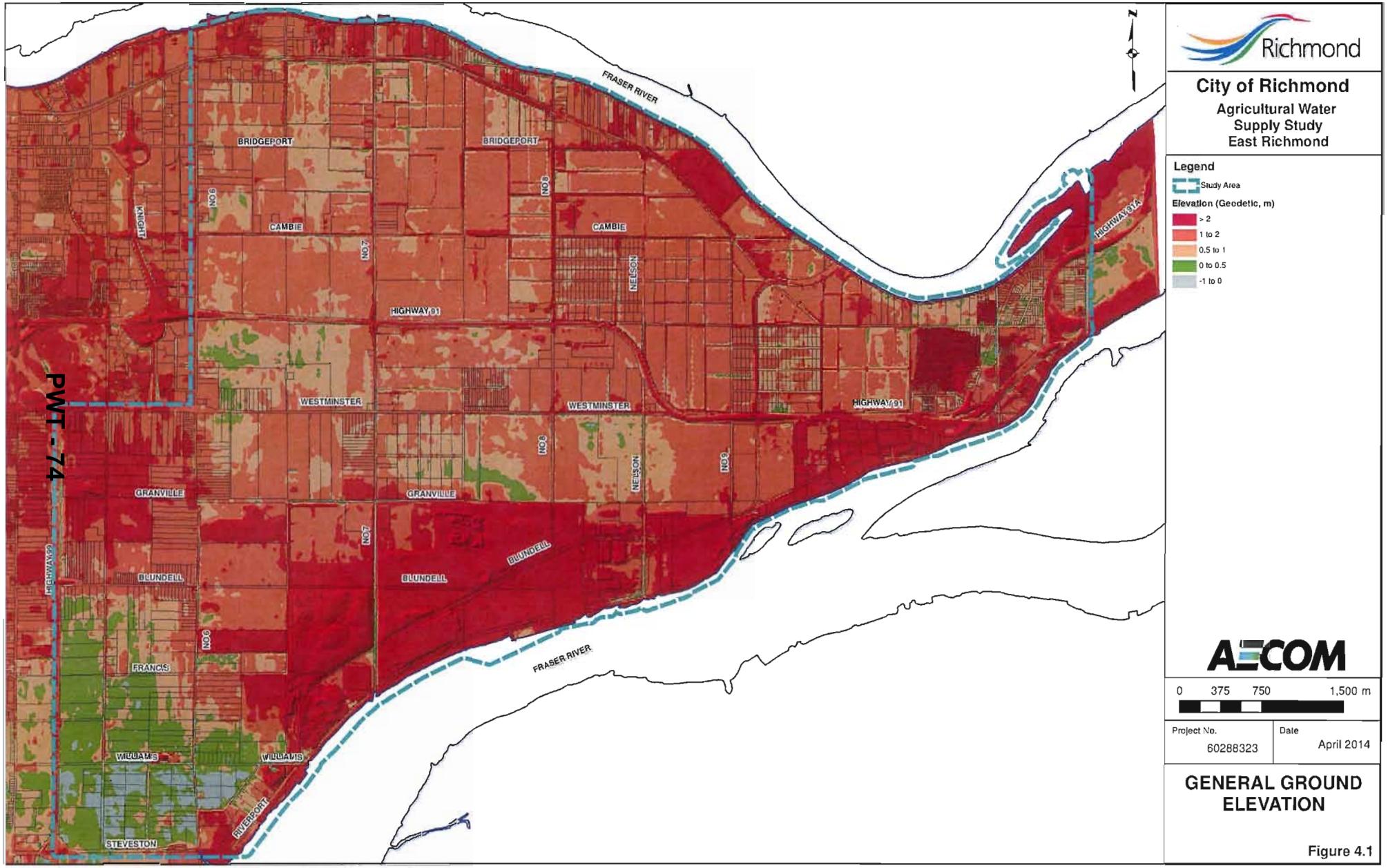
Drainage pump station capacities under Scenario 1 for the dormant winter period (10-Year 5-day design storm and 7-day winter high tide) were reviewed and the results are summarized in ***Table 4.1***. For all locations where there is a flood box outlet, the capacity will vary as the tide level changes such that ultimately no flow occurs when the tide is higher than the wet well or upstream ditch water level.

Table 4.1 Summary of Pump Station Capacities

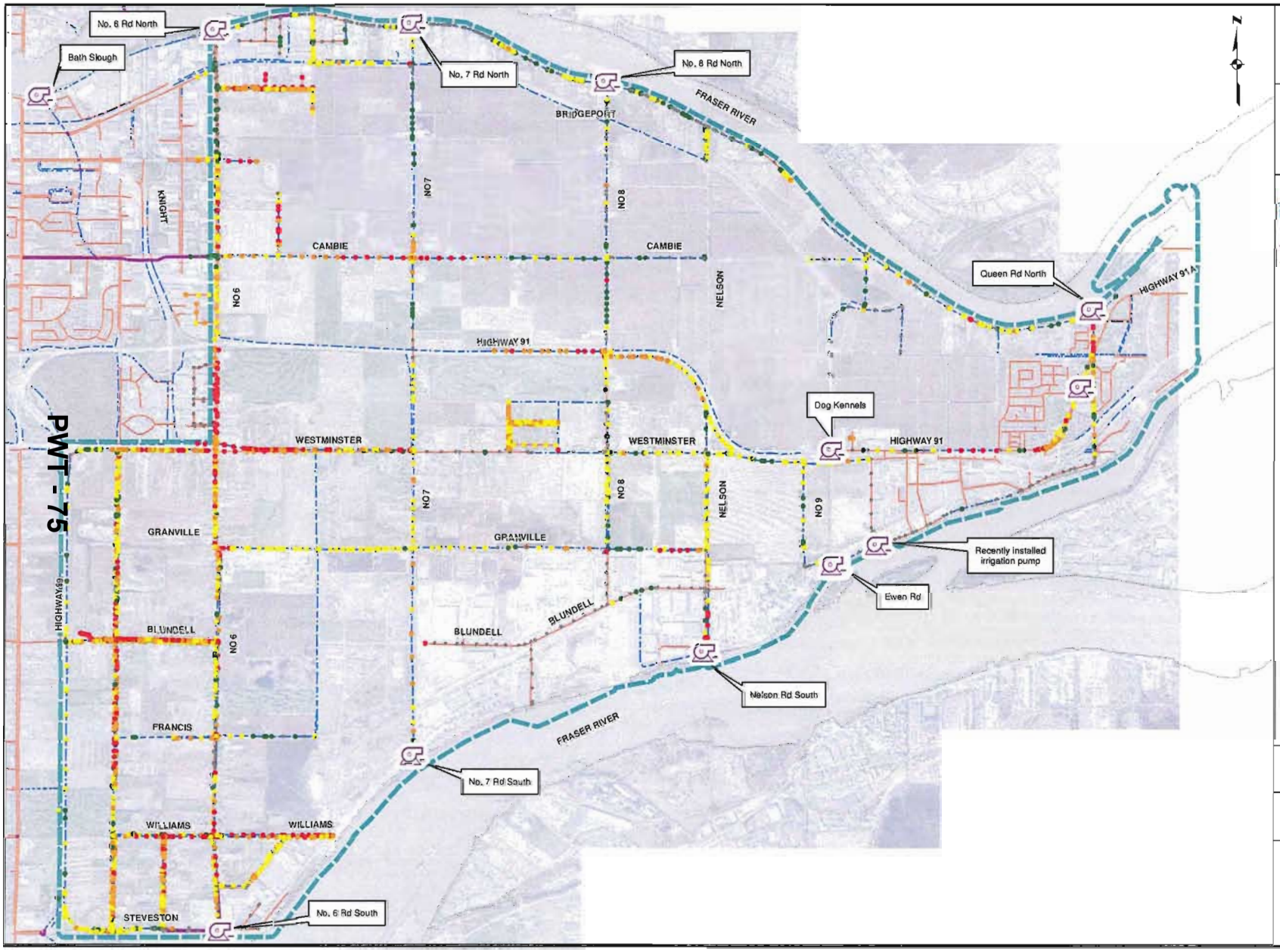
Structure & Name	Theoretical PS Capacity	Flood Box Size	Flood Box Capacity*	10-Year 5 day Peak Inflow	Comments
	m^3/s		m^3/s	m^3/s	
No. 6 Road North PS	1.14	2.8m X 1.5m	6.4	2.35	PS under capacity during high tide periods
No. 7 Road North PS	2.09	3.4m X 2.0m	12.0	3.35	Pump station under capacity during high tide periods
No. 8 Road North PS	2.41	3.7m X 2.3m	16.0	2.0	PS capacity is adequate
Queens PS	3.07	2.7m X 2.0m	9.0	3.05	PS capacity is adequate
Ewen PS	2.35	NA	NA	1.80	PS capacity is adequate
Nelson Road South PS	1.62	1600mm dia.	2.6	2.55	Pump station under capacity during high tide periods
No. 7 Road South PS	2.90	1.37m X 1.0m (Twin Box)	3.3	4.10	PS and flood box individually under capacity. Combined capacity is adequate.
No. 6 Road South PS	2.16	3.4m X 1.5m	8.0	3.65	Pump station under capacity during high tide periods
Dog Kennels PS (Westminster Hwy)	0.17	NA	NA	0.10	PS capacity is adequate

*Note: * Flood box capacity stated is calculated assuming HGL slope of 0.1%*

As shown in ***Table 4.1***, there are several pump stations where the capacity is less than the model predicted 10-Year 5 day inflow. With exception of No. 7 Road South PS, all of the flood box outlets have capacity to covey 10-Year 5 day peak flow during low tide. At No. 7 Road South the combined capacity of flood box and pump station is adequate to convey 10-Year 5 day peak flow.


FRASER RIVER
BRIDGEPORT
CAMBIE
WESTMINSTER
GRANVILLE
BLUNDELL
FRANCIS
WILLIAMS
RIVERPORT
STEVESTON
HIGHWAY 91
HIGHWAY 99
KNIGHT
NO 6
NO 7
NO 8
NELSON
N
Richmond
City of Richmond
Agricultural Water Supply Study
East Richmond
Legend
Study Area
Elevation (Geodetic, m)
> 2
1 to 2
0.5 to 1
0 to 0.5
-1 to 0
AECOM
0 375 750 1,500 m
Project No. 60288323
Date April 2014
GENERAL GROUND ELEVATION
Figure 4.1

PWT - 74



PWT - 75

N

Richmond

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Agricultural Water Supply Study East Richmond

Legend

- Study Area
- Existing Drainage Ditches/Culverts
- Existing Box Culvert
- Existing Storm Sewer

HGL Depth Below Ground

- Lower than 1.2m
- 1.2m to 0.9m
- 0.9m to 0.3m
- 0.3m to 0.0m
- Above 0.0m / Flooded

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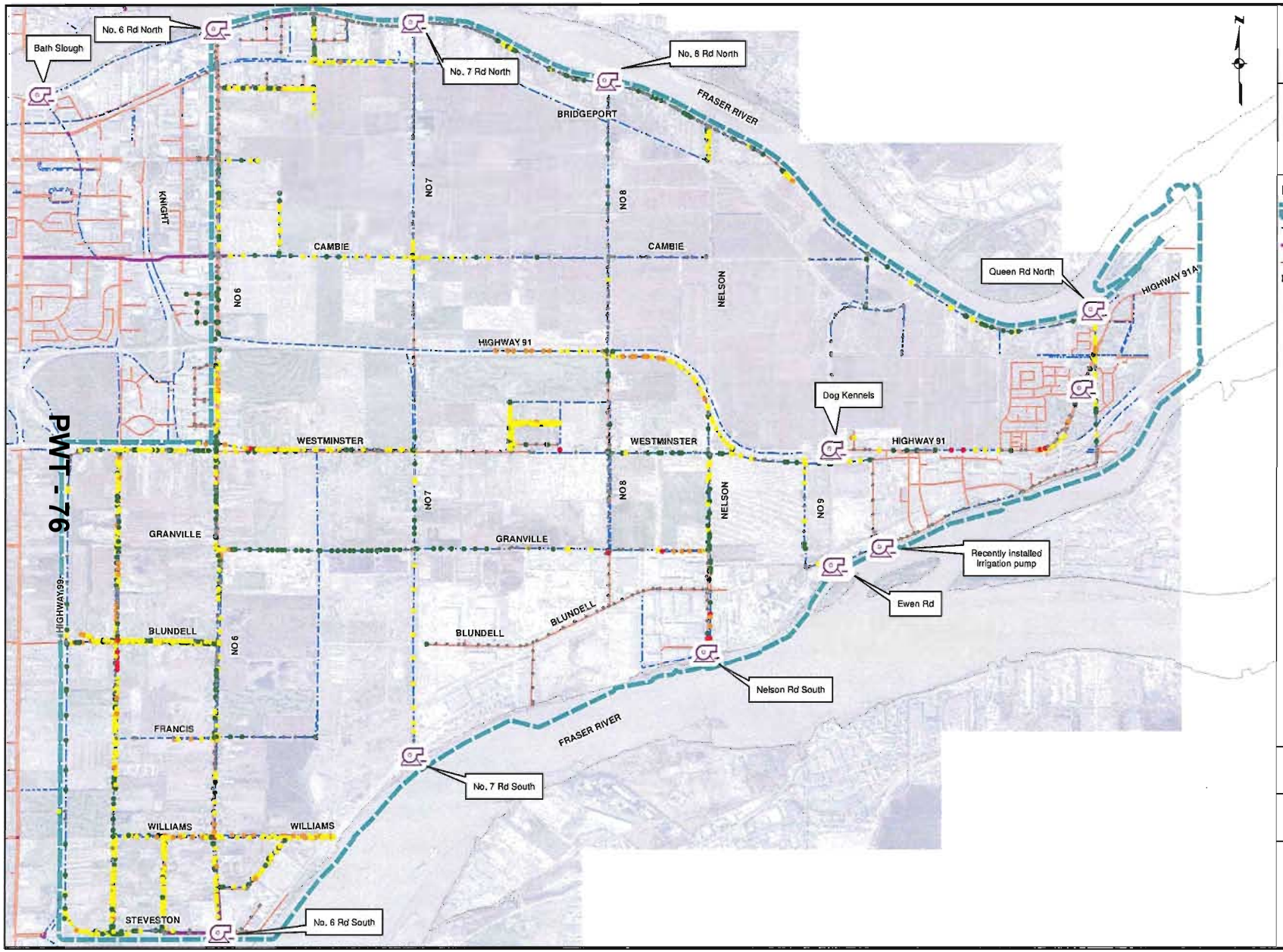
EXISTING SYSTEM PEAK HGL DORMANT WINTER PERIOD 10-YR 5-DAY STORM EVENT WITH TIDE

Figure 4.2a



PWT - 76

Richmond

City of Richmond

Agricultural Water Supply Study East Richmond

Legend

- Study Area
- Existing Drainage Ditches/Culverts
- Existing Box Culvert
- Existing Storm Sewer

HGL Depth

- Lower than 1.2m
- 1.2m to 0.9m
- 0.9m to 0.3m
- 0.3m to 0.0m
- Above 0.0m / Flooded

AECOM

0 375 750 1,500 m

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EXISTING SYSTEM HGL ON DORMANT WINTER PERIOD 10-YR 5-DAY STORM EVENT WITH TIDE [ON DAY 5]

Figure 4.2b

4.3 Proposed Drainage Improvements

The following sections highlight the problems areas identified using the existing model and proposed upgrades for each area. In each case the hydraulic model was simulated for the winter (10-Year 5 day storm) and summer (10-Year 2 day storm with maximum summer tide) events to confirm the proposed upgrades have the desired effects. An overview of the proposed drainage upgrades is shown in ***Figure 4.3***.

Please note that the ditch inverts as shown in the profiles in this section are conceptual elevations for modelling purposes. Elevations should be surveyed and verified during the detail design stage prior to construction. Additionally the areas identified on Figure 4.3 should be surveyed and data verified against current model elevations to confirm potential flood issues.

ARDSA criteria (discussed in ***Section 1.5.1***) requires that in periods when drainage is required, the base flows should generally be maintained at 1.2 m below field elevation, although a freeboard of 0.9 m may also be acceptable. The criteria further requires that drainage ditches remove runoff from the 10-Year 5-day storm within 5 days in the dormant period and remove runoff from 10-Year 2 day storm within 2 days in the growing period. The purpose of these criteria is to allow for the free-drainage of outlets of local field drainage systems.

As discussed in the 2006 Study (Section 5.3) there are several issues to consider when reviewing these criteria. The first is that the areas dominated by cranberries are well established and successful under current drainage and irrigation conditions. In such case, minimal changes are proposed for these areas regardless of the ditch water levels being able to meet the ARDSA criteria. Only ditch cleaning is proposed as part of the drainage infrastructure upgrades.

Ditches in the study area serve the dual purpose of supplying irrigation water and removing drainage water. Meeting the 1.2 m freeboard requirement (or even 0.9m) is a challenge as the ditches are generally full supplying irrigation water throughout most of the area or conveying stormwater runoff that is backed up in the system due to high tide conditions. Model results for the drainage system with improvements following the 10-Year 5 day storm event are shown in ***Figure 4.6***. The model predicted ditch HGLs are shown using 0.3m increments from ground level to represent the freeboard from the top of ditch level, which is assumed to correspond closely with the surrounding field elevations in most cases.

There are several locations where the 1.2m (or 0.9m) ARDSA freeboard criteria are not met. These include the Sidaway Rd west side ditches from Steveston Hwy to Westminster Hwy, Williams Rd east of No 6 Rd, Kartner Rd and Fedoruk Rd (which is a residential area), along Hwy 91 near No 8 Rd, and Granville Ave East of Neslon Rd, Nelson Rd South to the pump station, as well other isolated locations. Rationale for why these areas are not able to meet the freeboard criteria five days after the storm event is primarily due to the fact that the existing ditches are shallow and have a maximum depth of 1.2 m in many areas (even after improvement measures are implemented).

One option would be to construct deeper ditches; however, in the 2006 Study farmers reported the groundwater table to be approximately 300 mm to 900 mm (average of 700 mm) below ground level, so deeper ditches would potentially result in more pumping requirements and in areas with high iron content, possibly iron-affected water quality. The structural integrity of soils in East Richmond, which are predominantly silt and clay with silty and sandy loams, is also limiting factor such that steepening side slopes of the existing ditches is not possible is most areas. Furthermore, most of the area is already developed up to existing property lines, roadways, and ditches such that deeper ditches could require property acquisition, which is an expensive proposition.

4.3.1 Sidaway Road South of Francis Road Alignment (D1)

Figure 4.3.1 shows the existing ditch profile along the west side of Sidaway Rd from the Francis alignment to its entry point into the box culvert at Steveston Hwy. This ditch has large variation in bottom invert and shallow culverts

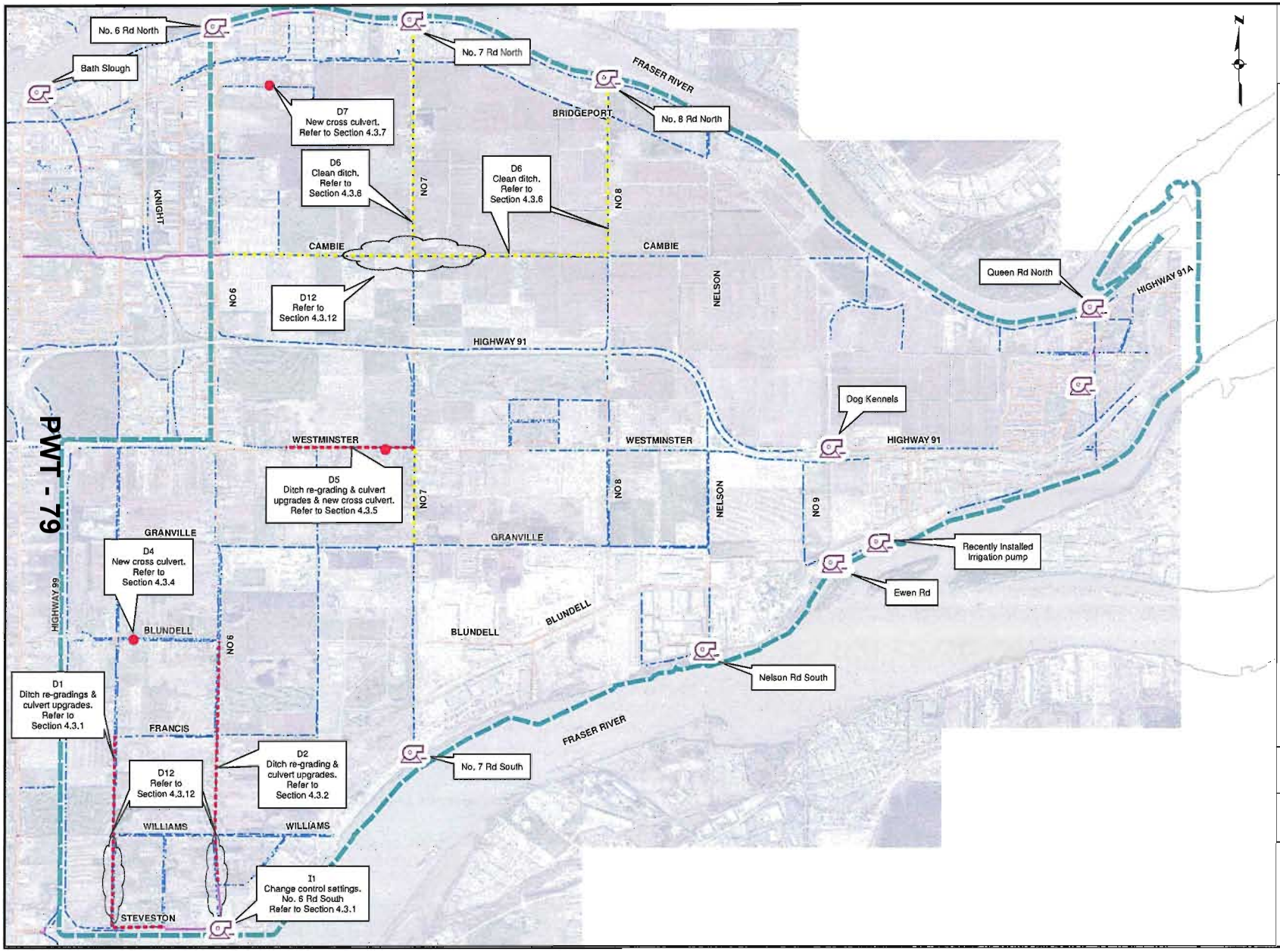
at several locations. As shown in the figure, the area south of Williams Rd is generally lower in elevation as compared to surrounding areas which is reflected in the ditch profile.

In order to reduce flooding in this area the following improvements are recommended:

- Re-grade the existing ditch along Steveston Hwy and Sidaway Rd with uniform slope starting from its entry point into box culvert at Steveston Hwy to Francis Rd alignment. This includes clearing and re-grading of 350m of existing ditch along North side of Steveston Hwy from Palmberg Rd to Sideway Rd and 1,450m along West Side of Sideway Rd from Steveston Hwy to Francis Rd alignment.
- Upgrade five existing 900mm diameter culverts along the North side of Steveston Hwy from Palmberg Rd to Sideway Rd to 1050mm diameter (for a total length of 55m of pipe) and match proposed ditch inverts
- Upgrade 15 existing culverts (ranging in diameter from 600mm to 750mm) along the West Side of Sideway Rd from Steveston Hwy to Francis Rd alignment to 900mm diameter (for a total length of 120m of pipe) and match proposed ditch inverts

It was noted that lowering the No.6 Rd South PS ON/OFF elevation had a significant impact on the maximum HGL upstream. Given that the wet well floor is -2.9m geodetic elevation (based on information from the City), it was assumed that the jockey pump ON elevation could be adjusted to -0.9m (from -0.64m currently) and OFF elevation to -1.3m (from -1.0m currently). Similarly the ON/OFF elevations of lead and lag pump was lowered by 0.3m.

Figure 4.3.2 shows the maximum HGL after the system improvements were incorporated. Under the 10-Year 2 day storm with maximum summer tide the maximum HGL with improvements was found to be slightly lower than the winter 5 day storm.



Richmond

City of Richmond

Agricultural Water Supply Study East Richmond

Legend

- Study Area
- Proposed Cross Culverts

Proposed Ditch Upgrades

- Cleaning
- Upgrade
- Existing Drainage Ditches
- Existing Box Culvert
- Existing Storm Sewer

AECOM

0 375 750 1,500 m

Project No.	Date
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PROPOSED DRAINAGE UPGRADES AND GROUND SURVEY VERIFICATION

Figure 4.3

Figure 4.3.1 Existing Ditch HGL: Sidaway Rd West Side from Francis Alignment to Box Culvert at Steveston Hwy (10-Year 5 day storm with winter tide)

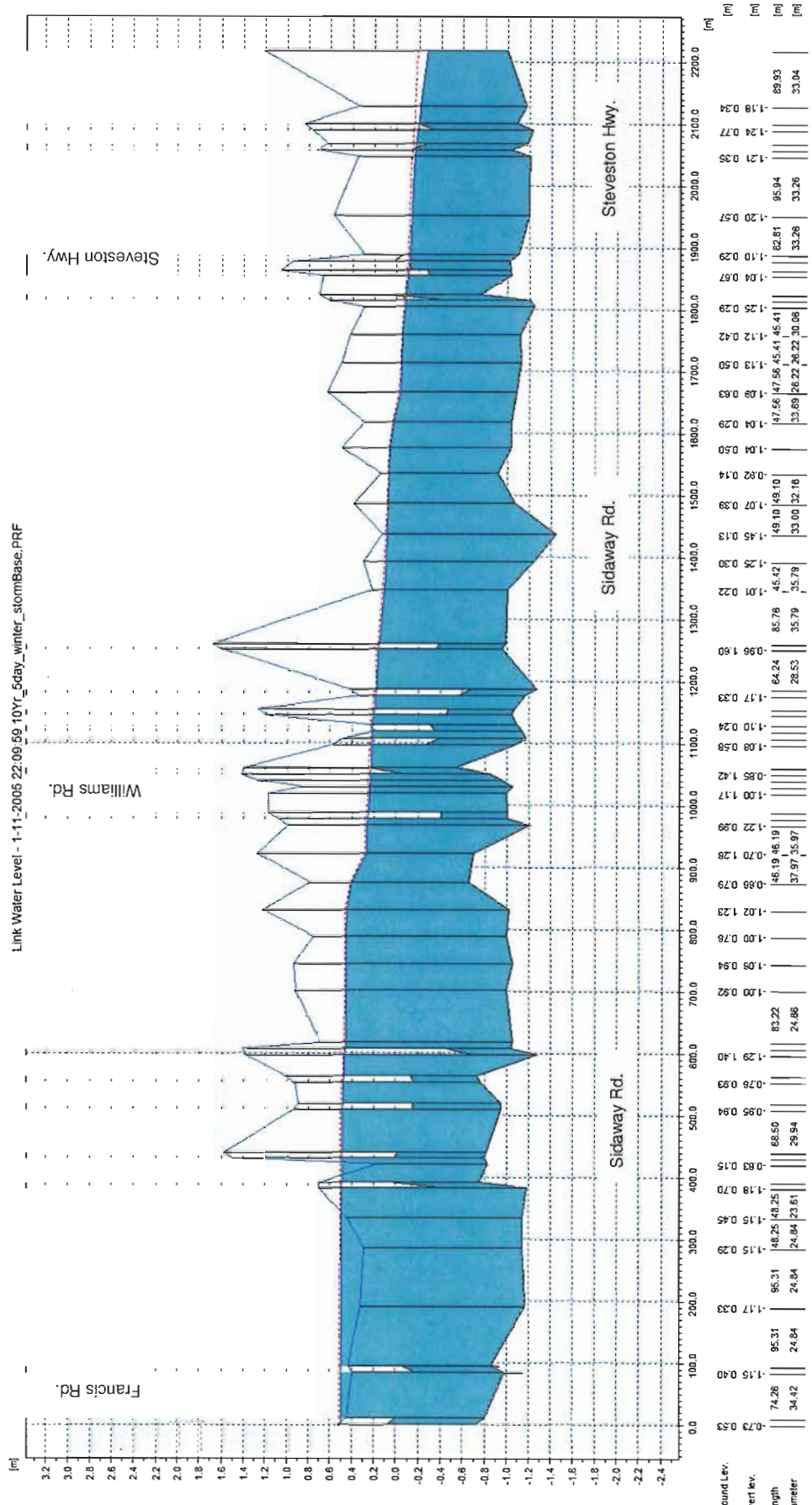
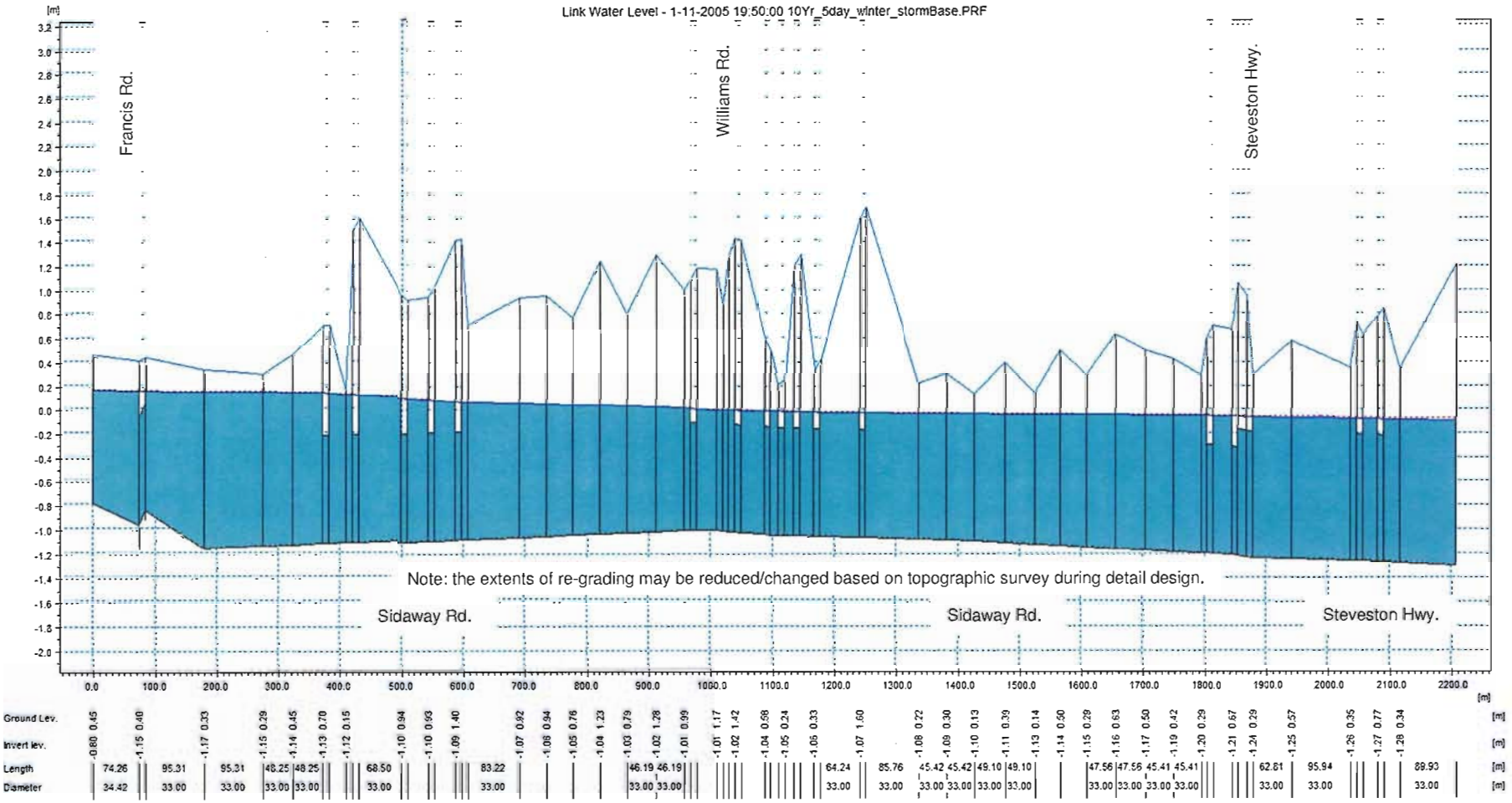


Figure 4.3.2 HGL After Improvements: Sidaway Rd West Side from Francis Alignment to Box Culvert at Steveston Hwy (10-Year 5 day storm with winter tide)



4.3.2 No. 6 Road South of Blundell Road (D2)

Figure 4.3.3 shows the existing ditch profile along the East side of No.6 Rd from Blundell Rd to its entry point into the box culvert near Triangle Rd. Similar to the Sidaway Rd ditch, this ditch has a large variation in bottom invert and has shallow culverts at few locations.

In order to reduce flooding in this area the following improvements are recommended:

- Re-grade the existing ditch assuming a uniform slope starting from its entry point into the box culvert near Triangle Rd to Blundell Rd. This includes a total of 2,000m of clearing and re-grading of the existing ditch along East side of No.6 Rd
- Upgrade two existing 600mm diameter culverts along the above alignment to 1050mm diameter (total length of 25m of pipe) and match proposed ditch inverts.
- Modifying the No.6 Rd South PS ON/OFF levels as described in ***Section 4.3.1*** above.

Figure 4.3.4 shows the maximum HGL after the system improvements were incorporated.

4.3.3 Williams Road Right of Way East and West of No 6 Road (D3)

Upgrades of existing ditches along Sidaway Rd and No 6 Rd as described in the above two sections will lower the maximum HGL in connected ditches including ditches along Williams Rd. The model shows significant improvement in flooding along Williams Rd after the above improvements were incorporated. So, no further ditch upgrades may be required along Williams Rd alignment.

4.3.4 Blundell Road East of Sidaway (D4)

Flows from the existing ditch on the East side of Sidaway Rd (north of Blundell) are currently diverted east along Blundell Rd. The model results show flooding along this ditch on the north side of Blundell Rd, East of Sidaway Rd. This ditch crosses a lot of driveways with varying culvert diameters.

The existing network does not show any cross connection between North side and South side ditch along Blundell Road. To reduce flooding in this area the following improvements are recommended:

- Install a new 15m long 600mm diameter cross culvert on Blundell Road, 100m east of Sidaway

After this upgrade was incorporated into the improvements model, the results show significant reduction in flooding along this ditch.

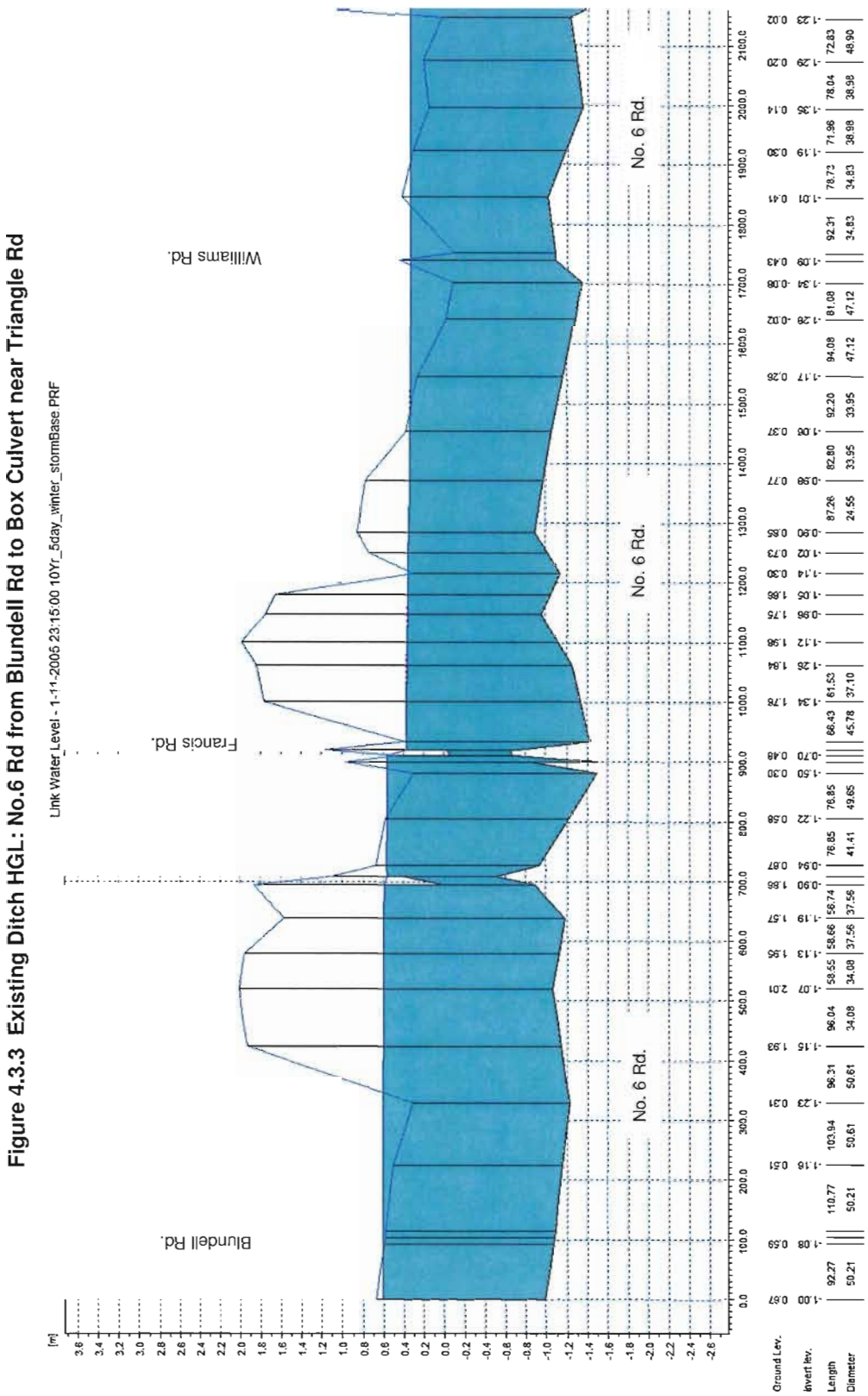
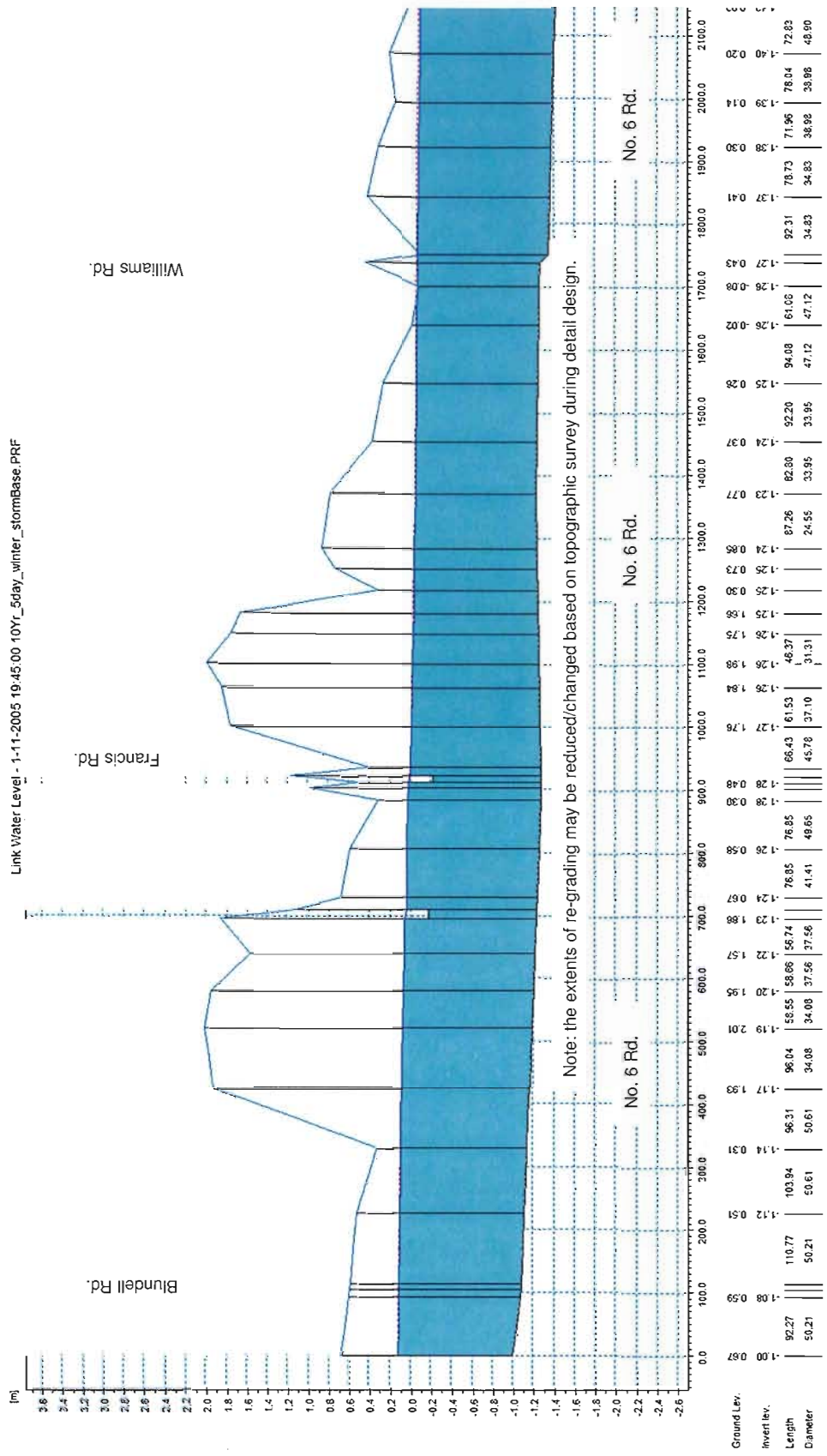


Figure 4.3.3 Existing Ditch HGL: No.6 Rd from Blundell Rd to Box Culvert near Triangle Rd
Link Water Level - 1-11-2005 23:15:00 10Yr_5day_winter_stormBase.PRF
Blundell Rd.
Francis Rd.
Williams Rd.
No. 6 Rd.
No. 6 Rd.
No. 6 Rd.
(10-year 5 day storm with winter tide)

Figure 4.3.4 HGL After Improvements: No.6 Rd from Blundell Rd to Box Culvert near Triangle Rd (10-year 5 day storm with winter tide)



4.3.5 Westminster Highway West of No. 7 Road (D5)

Figure 4.3.5 shows the existing ditch profile along the North side of Westminster Hwy from No 6 Rd to No 7 Rd. The model shows flooding in the low lying areas East of No. 6 Rd. Two homeowners in this area have reported drainage problems during the open house (please refer to ***Appendix A*** for property locations and issues).

To reduce flooding in this area the following improvements are recommended:

- Re-grade the existing ditch for 1400m
- Upgrade all existing culverts (ranging from 600 to 900mm) to a minimum 900mm diameter (total length of 153m of pipe)
- Install a new 16m long 900mm diameter cross culvert connecting the North side ditch with the existing 900mm storm sewer in street.

Once these improvements were incorporated into the model the peak HGL was lowered by 0.6m. ***Figure 4.3.6*** shows the maximum HGL after the system improvements were incorporated.

4.3.6 Cambie Road East and West of No 7(D6)

Under existing conditions, there is significant flooding along the Cambie Rd ditch. When the roughness coefficient is reduced in the model to simulate ditch cleaning the flooding in this area is greatly reduced. Cleaning works are recommended for following ditches:

- Cambie Road from the box culvert east of No 6 Road to No 8 Road for a length of 3200m
- No 7 Road from Cambie Road to No 7 Road North Pump Station for a length of 1965m
- No 8 Road from Cambie Road to No 8 Road North Pump Station for a length of 1461m

Once these maintenance works were incorporated into the model the HGL was lowered by 0.6m to 0.9m five days after the 10-Year 5 day storm event as shown in ***Figure 4.6***. There is still flooding predicted during the peak of the storm due to localized low elevations in the vicinity of Cambie Rd and No 7 Rd.

4.3.7 Burrows Road (D7)

The existing storm sewer along Burrows Rd East of No. 6 Rd shows flooding during a 10-Year 5 day event. The HGL in this section can be reduced by implementing the following upgrade:

- Installing a 15m long 600mm cross culvert connecting the storm manhole located East of Victory Street with existing ditch on South side of Burrows Street

4.3.8 CN Rail corridor between No 7 Rd and No 8 Rd (D8)

In addition to the above drainage upgrades, the City's operations staff has indicated the need for ditch cleaning and re-profiling along CN Rail corridor between No 7 Rd and No 8 Rd. Since this ditch is located in CN ROW, the City will need permission from the railway for access.

4.3.9 South Side of River Rd from the CN box (Cambie Rd alignment) east to Queens PS (D9)

The City's operations staff has also indicated the need for ditch cleaning and re-profiling for south side of River Rd from the CN box (Cambie Rd alignment) east to Queens PS.

4.3.10 Sidaway-East from Francis to Blundell (D10)

The 2006 study recommended construction of 600m of ditch along Sidaway-East to connect the Blundell and Francis ditch systems. This is a low priority project that should be completed after the proposed downstream ditch upgrades along Sidaway are completed (downstream of Francis Alignment –see section 4.3.1 above)

4.3.11 Storm sewers on No 6 Rd between Granville Rd to Blundell Rd (D11)

This project was also recommended as a part of 2006 study. This is a low priority project that should be completed after the proposed downstream ditch upgrades along No 6 Rd are completed (downstream of Blundell Alignment – see section 4.3.2 above)

4.3.12 Areas with Localized Low Ground Elevations in Model (D12)

Figures 4.4 and ***4.5*** show the model results for peak HGLs with all of the improvements incorporated with no tide or high tide, respectively. ***Figure 4.6*** shows the model results with improvements after the 10-Year 5 day storm event. Minor flooding is shown to occur at a few locations and is attributed due to localized low ground elevations. These elevations should be verified in the field. To prevent local flooding it may be necessary to build soil berms at these locations.

Further recommendations and improvements that are low priority and require additional investigation prior to inclusion in the current Capital Plan include the following items:

- Review the pump station and flood box capacity at No 7 Rd South as well as Nelson Rd as it may be impacting the water level elevations in upstream ditches
- Install a manually operated flap gate at Nelson-east and Westminster Hwy (as identified in the 2006 Study)
- Box culvert flushing and cleaning for No 6 Rd north drainage corridor and further investigation of the jet fuel pipeline elevations

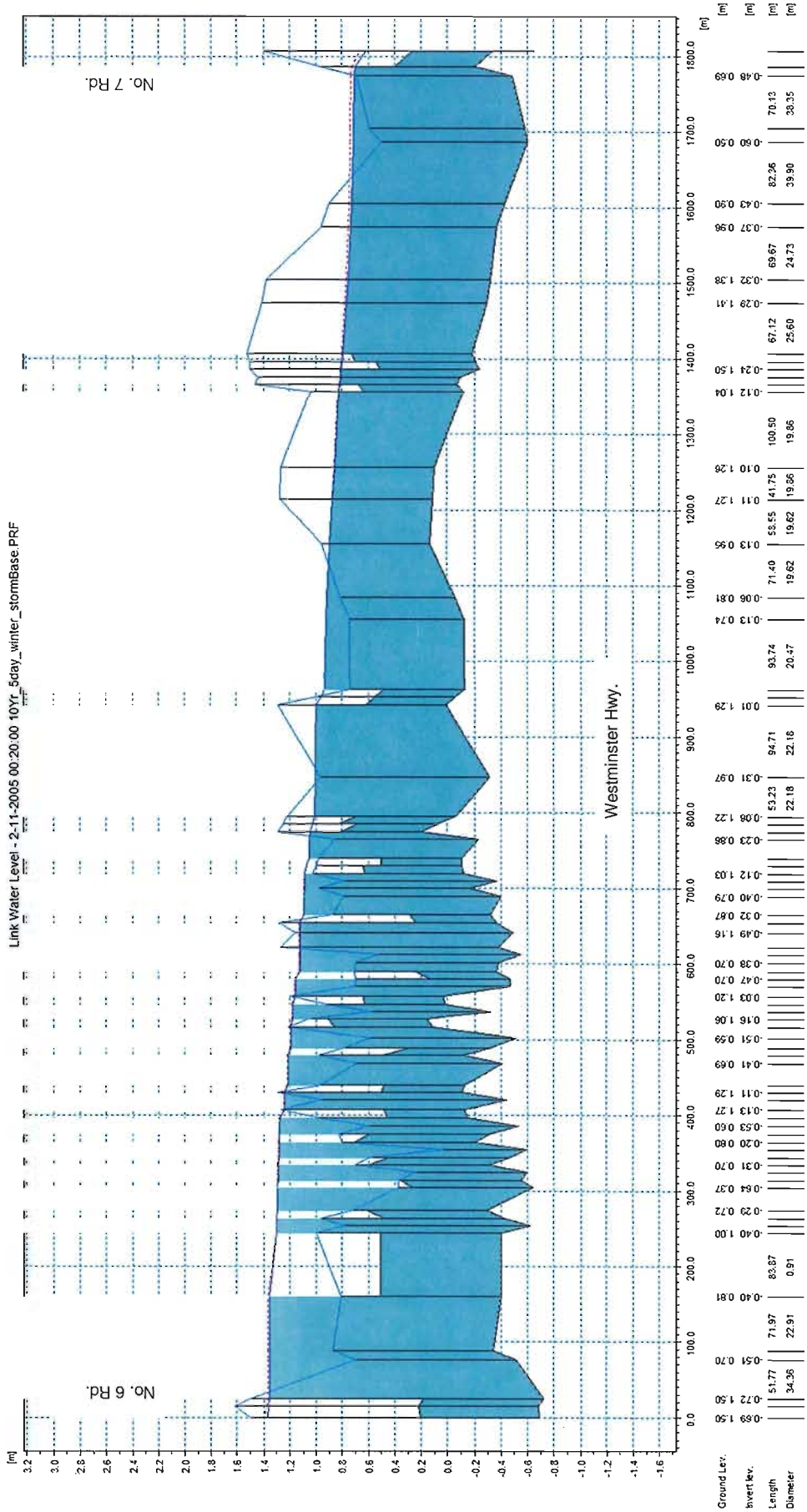
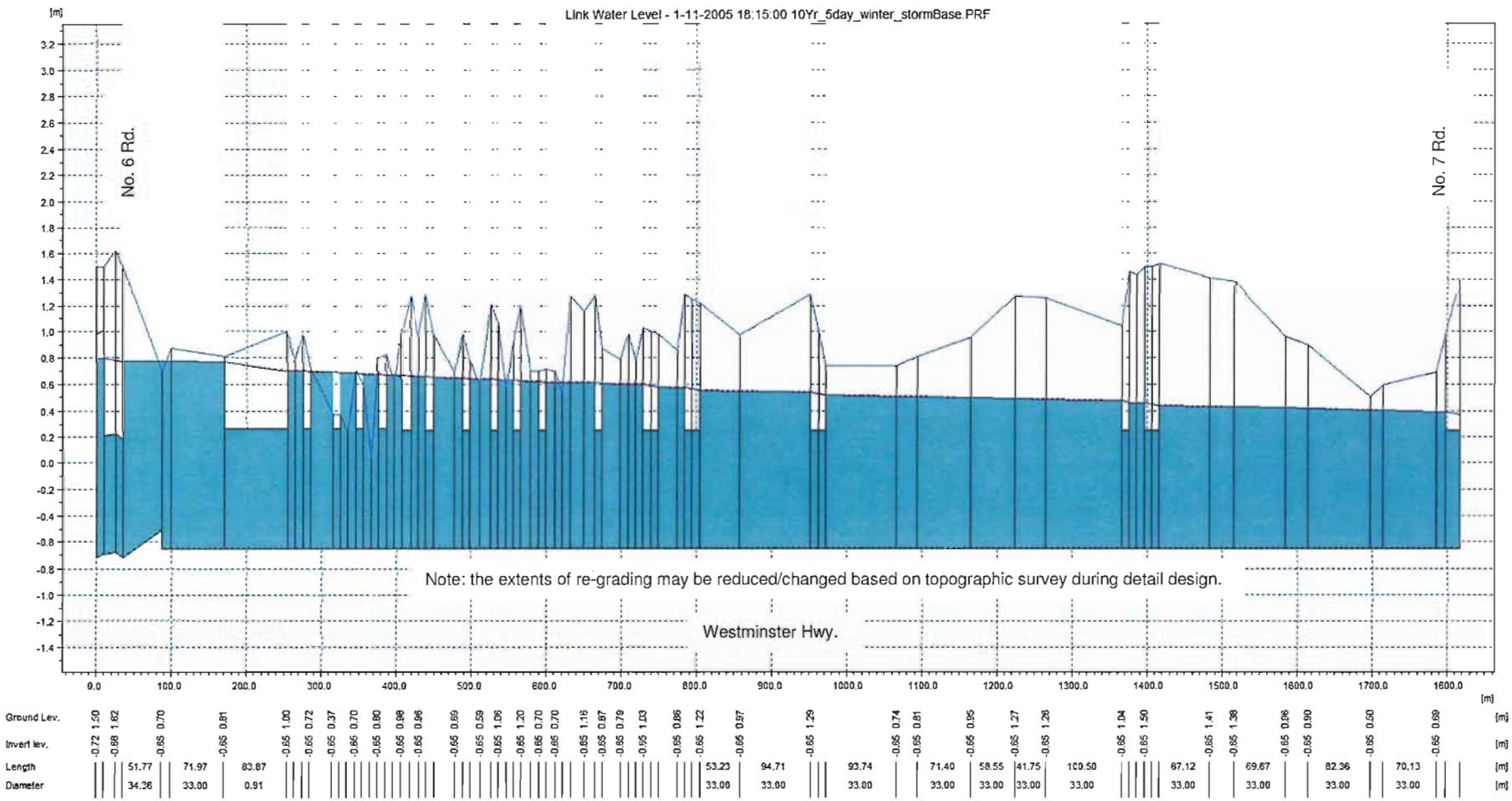
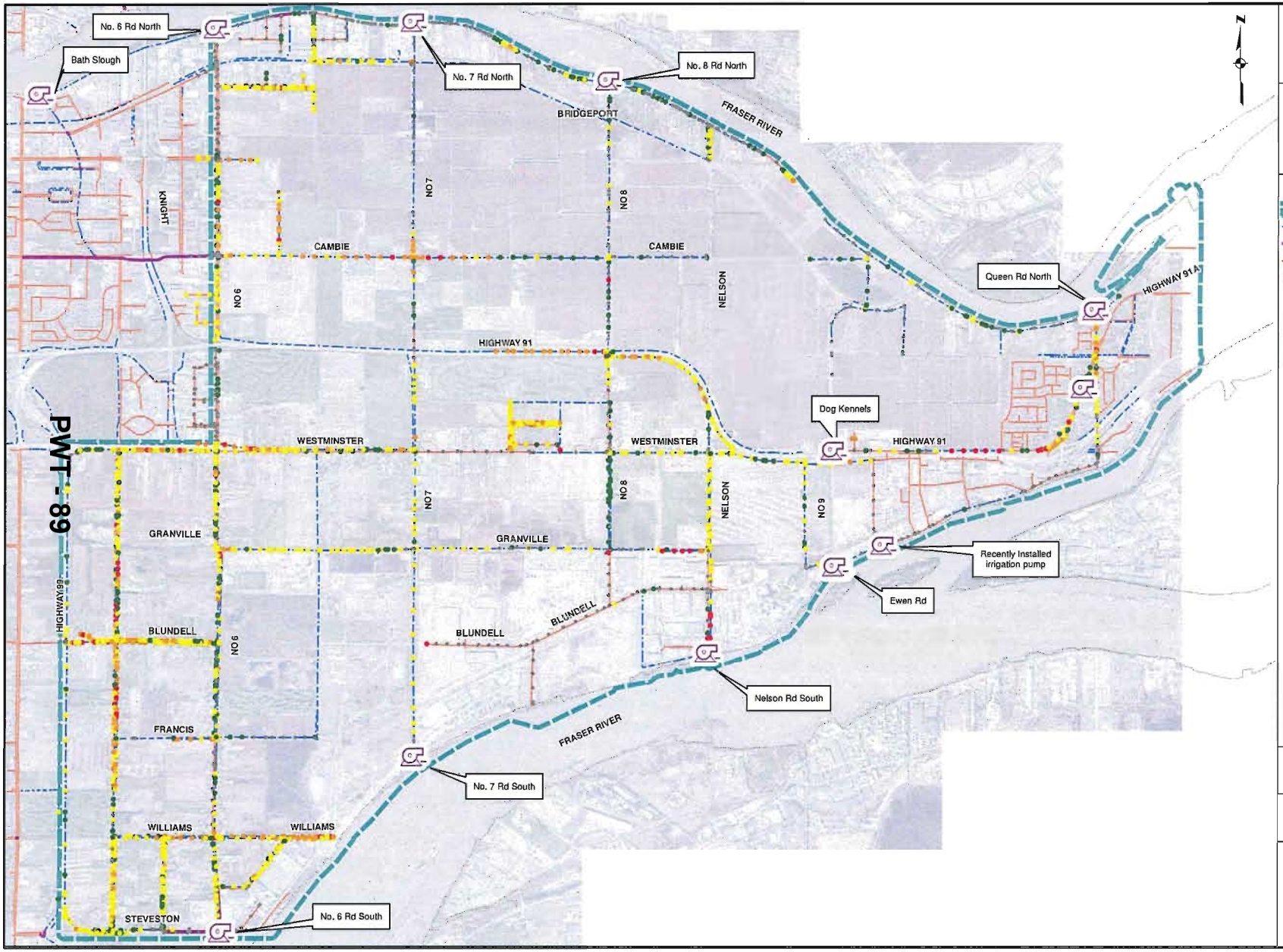


Figure 4.3.5 Existing Ditch HGL: Westminster Hwy from No. 6 Rd to No.7 Rd
(10-year 5 day storm with winter tide)

Figure 4.3.6 HGL After Improvements: Westminster Hwy from No. 6 Rd to No.7 Rd
(10-year 5 day storm with winter tide)





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Legend

- Study Area
- Existing Drainage Ditches/Culverts
- Existing Box Culvert
- Existing Storm Sewer

HGL Depth Below Ground

- Lower than 1.2m
- 1.2m to 0.9m
- 0.9m to 0.3m
- 0.3m to 0.0m
- Above 0.0m / Flooded

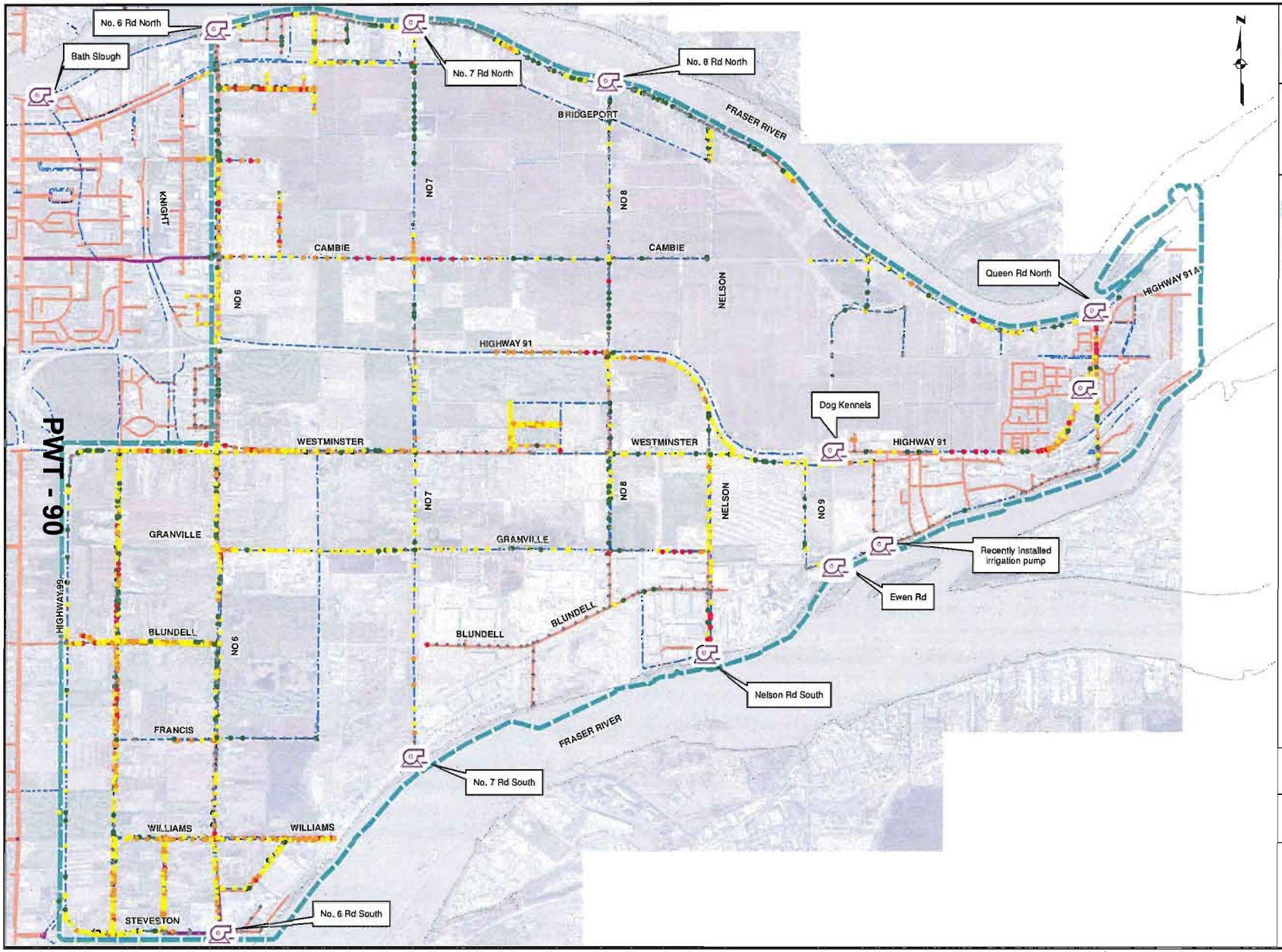
AECOM

0 375 750 1,500 m

Project No.	Date
60288323	April 2014

DRAINAGE SYSTEM PEAK HGL WITH IMPROVEMENTS 10-YR 5-DAY STORM EVENT NO TIDE

Figure 4.4



PWT - 90

Richmond

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Agricultural Water Supply Study East Richmond

Legend

- Study Area
- Existing Drainage Ditches/Culverts
- Existing Box Culvert
- Existing Storm Sewer

HGL Depth Below Ground

- Lower than 1.2m
- 1.2m to 0.9m
- 0.9m to 0.3m
- 0.3m to 0.0m
- Above 0.0m / Flooded

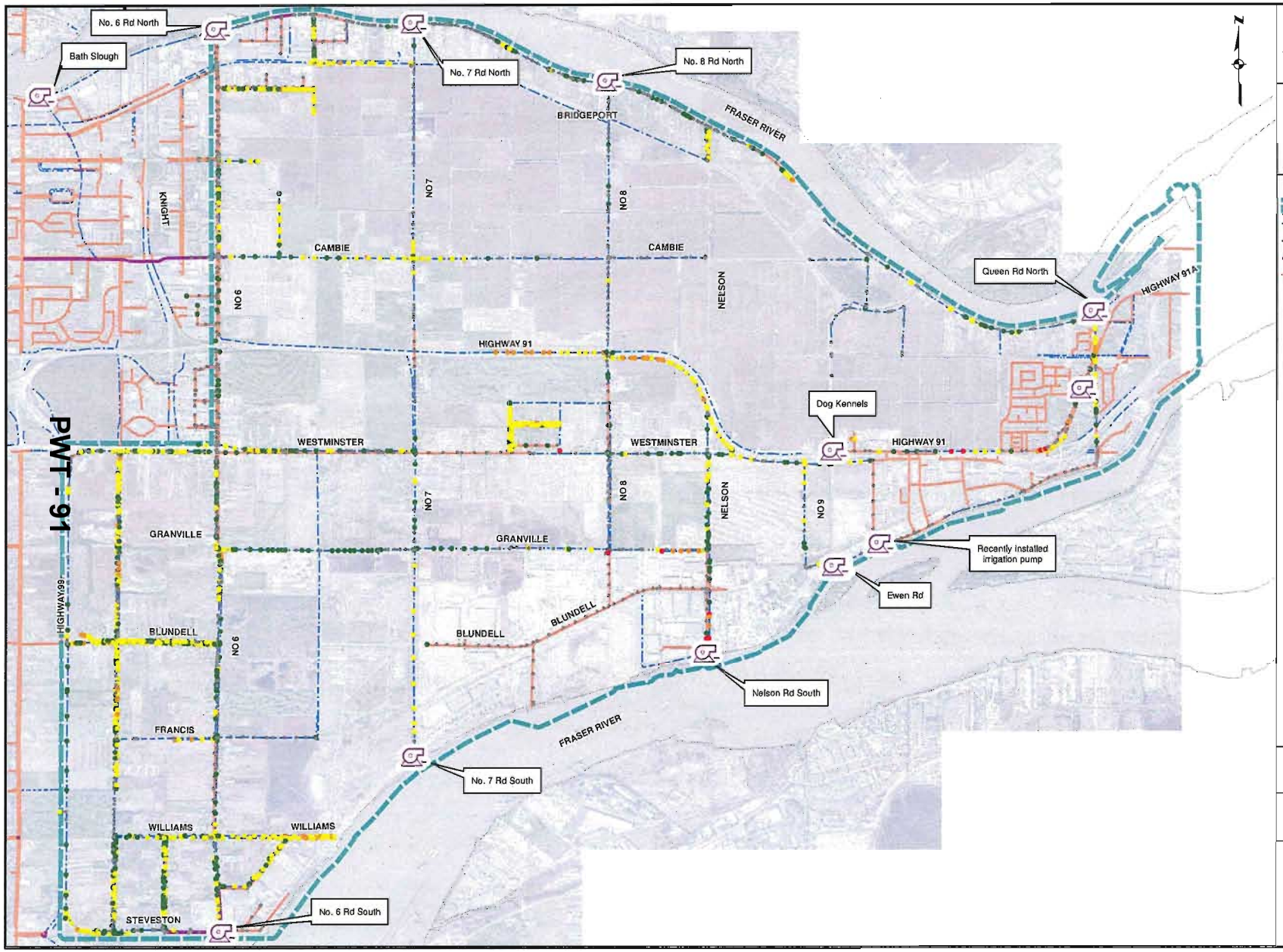
AECOM

0 375 750 1,500 m

Project No.	Date
60288323	April 2014

DRAINAGE SYSTEM PEAK HGL WITH IMPROVEMENTS 10-YR 5-DAY STORM EVENT WITH TIDE

Figure 4.5



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Agricultural Water Supply Study East Richmond

Legend

- Study Area
- Existing Drainage Ditches
- Existing Circular Culvert
- Existing Box Culvert
- Existing Storm Sewer

HGL Depth

- >0.9m below ground
- 0.9m to 0.6m below ground
- 0.6m to 0.3m below ground
- 0.3m to 0.0m below ground
- Flooded

AECOM

0 375 750 1,500 m

Project No.	Date
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DRAINAGE SYSTEM HGL WITH IMPROVEMENTS AFTER 10-YR 5-DAY STORM EVENT WITH TIDE (ON DAY 5)

Figure 4.6

4.3.13 Cost Estimates for High Priority Drainage Improvements

Cost estimates for the high priority drainage improvements discussed above are provided in ***Table 4.2***. All estimates are in 2013 CAD dollars. Cost estimate for low priority projects in not included in the above table.

All culvert upgrade project costs include an allowance for driveway restoration, headwalls and bypass pumping. Utility conflicts have not been investigated in this study. For ditch cleaning and re-grading projects, it is assume that the existing ditch cross sections will be reinstated. An allowance for engineering design and construction contingency of 25% is also added for each project area.

Table 4.2 Cost Estimates for Drainage Upgrades

ITEM NO.	Name (Ref Section)	DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	AMOUNT
D1	Sidaway Road South of Francis Alignment (Section 4.3.1)	Upgrade 5 culverts to 1050mm dia. along North side of Steveston Highway from Palmberg to Sideway	lin m	55	$2,625	$144,375
		Clean and re-grade existing ditch along North side of Steveston Highway from Palmberg to Sideway	lin m	350	$219	$76,650
		Upgrade 15 culverts to 900mm dia. along West side of Sideway from Steveston Highway to Francis Alignment	lin m	120	$2,363	$283,560
		Clean and re-grade existing ditch along West side of Sideway from Steveston Highway to Francis Alignment	lin m	1450	$219	$317,550
		Install new 600mm dia. cross culvert on Sidaway Rd at Francis Alignment	lin m	15	$2,188	$32,820
						$855,000
					Design (6%)	$51,300
					Eng. Satff Charges (4%)	$34,200
					Subtotal	$940,500
					Contingency (25%)	$235,125
					Project Total	$1,176,000
D2	No 6 Road South of Blundell Road (Section 4.3.2)	Clean and re-grade existing ditch along East side of No 6 Rd from Triangle Rd to Blundell Rd	lin m	2000	$219	$438,000
		Upgrade 2 culverts to 1050mm dia. along East side of No 6 Rd	lin m	25	$2,625	$65,625
						$504,000
					Design (6%)	$30,240
					Eng. Satff Charges (4%)	$20,160
					Subtotal	$554,400
					Contingency (25%)	$138,600
					Project Total	$693,000
D4	Blundell Road East of Sidaway (Section 4.3.4)	Install 1 new 600mm dia. cross culvert connecting the North and South side ditches along Blundell Rd	lin m	15	$2,188	$32,820
						$33,000
					Design (6%)	$1,980
					Eng. Satff Charges (4%)	$1,320
					Subtotal	$36,300
					Contingency (25%)	$9,075
					Project Total	$46,000
D5	Westminster Highway West of No 7 Road (Section 4.3.5)	Clean and re-grade existing ditch along North side of Westminster Hwy from No 6 Rd to No 7 Rd	lin m	1400	$219	$306,600
		Upgrade all existing culverts to 900mm dia.	lin m	153	$2,363	$361,539
		Install 1 new 900mm dia. cross culvert connecting the North side ditch with the 900mm storm sewer	lin m	16	$2,800	$44,800
						$713,000
					Design (6%)	$42,780
					Eng. Satff Charges (4%)	$28,520
					Subtotal	$784,300
					Contingency (25%)	$196,075
					Project Total	$981,000
D6	Cambie Road East and West of No 7 (Section 4.3.6)	Clean existing ditch on Cambie from the box culvert East of No 6 Road to No 8 Road	lin m	3200	$175	$560,000
		Clean existing ditch on No 7 Rd from Cambie Rd to No 7 Rd North PS	lin m	1965	$175	$343,875
		Clean existing ditch on No 8 Rd from Cambie Rd to No 8 Rd North PS	lin m	1461	$175	$255,675
						$1,160,000
					Design (6%)	$69,600
					Eng. Satff Charges (4%)	$46,400
					Subtotal	$1,276,000
					Contingency (25%)	$319,000
					Project Total	$1,595,000
D7	Burrows Road (Section 4.3.7)	Install 1 new 600mm dia. cross culvert to connect the storm sewer East of Victory Street with existing ditch on South side of Burrows Street	lin m	15	$2,363	$35,445
						$36,000
					Design (6%)	$2,160
					Eng. Satff Charges (4%)	$1,440
					Subtotal	$39,600
					Contingency (25%)	$9,900
					Project Total	$50,000
					Grand Total	*$4,541,000*

Note: *Items D3 and D8-D12 either have no associated project or are low priority projects and therefore not costed*

4.4 Irrigation Improvement Options

Irrigation options were analysed keeping in mind that irrigation deficiencies are of a biggest concern in the study areas south west portion. Although no major irrigation concern was reported in the area north of Hwy 91, the proposed ditch cleaning along No 7 Rd, No 8 Rd and Cambie will improve irrigation water flows in this area. The south-east portion of study area (south of Westminster Hwy and east of No 7 Rd) may warrant more detailed analysis in subsequent studies.

Two options were reviewed for the recommended irrigation system upgrades: Option 1 – Irrigation Upgrades for water supply from the Fraser River's North Arm and Option 2 – New Irrigation Pump Station near No 6 Rd South PS for water supply from the Fraser River's Main Arm. Details for these Options are summarized below.

4.4.1 Option 1 – Irrigation Upgrades for Supply from North Arm (I-1)

Option 1 includes a combination of items to facilitate the transfer of irrigation water from the North Arm of the Fraser River to the Southwest portion of the study area that do not have sufficient water supply during irrigation periods. The upgrades proposed are such that only surplus water from the area north of Westminister Hwy can be transferred south. The differential controls on the proposed automatic gate on No 7 Rd north of Westminister Hwy should be set in such a way that this gate only opens when the water level on north side exceeds the target level. This will make sure that the irrigation water supply for the north side is not affected by the proposed upgrades. It is assumed that all the proposed drainage upgrades North of Granville Ave are complete prior to implementing this option. Option 1 upgrades are divided into 3 phases. The following list of items are included in each phase of Option 1 and shown in ***Figure 4.7.*** The control settings for automatic gates as shown in ***Figure 4.7*** are preliminary elevations and can be easily adjusted based on field conditions and water demands.

Phase -1A

- Adjust settings at No 7 North irrigation intake and drainage pump station as shown in ***Figure 4.7.1*** and described below:
  - Increase target water level elevation from 0.217m to 0.575m (to match existing No 8 Rd North PS target level)
  - Modify irrigation gate settings such that it closes at elevation of 0.75m (gate open elevation to remain as is at 0.14m)
  - Set irrigation gate to only open if tide level is higher than wetwell/ditch water level
  - Apply a 20 minute delay before irrigation gate reopens to reduce frequency of unintended opening and closing due to fluctuating water levels
  - Modify drainage pump start level and gravity outlet elevation to 0.8m
- Adjust settings at No 8 North drainage pump stations as shown in ***Figure 4.7.2*** and described below:
  - Target water level elevation remains at 0.575m
  - Modify irrigation pump ON elevation to 0.575m if tide level is lower than wetwell/ditch elevation
  - Modify irrigation pump OFF elevation to 0.8m
  - Set the gravity gate to open only if the tide level is greater the wetwell/ditch water level
  - Set the gravity intake irrigation gate to close at 0.8m or above
  - Apply a 20 minute delay before irrigation gate reopens to reduce frequency of unintended opening and closing due to fluctuating water levels
- Install two new seasonal flap gates
  - East of No 7 Rd on Westminster Hwy
  - East of No 7 Rd on Granville Ave Alignment
- Install two new gates with automated controls
  - No 7 Rd south of Granville Ave
  - No 6 Rd south of Granville Ave
- Add controls to existing gate on No 7 Rd (North of Westminster) to provide differential upstream/downstream elevations such that area south of Westminster Hwy does not flood.

When the water level in No 7 Rd ditch north of Westminster Hwy exceeds the target water level, the automatic gate north of Westminster Hwy (Gate-1 in ***Figure 4.7***) opens to facilitate supply of surplus water to the south side. Gate-2 and Gate-3 will stay closed in summer to prevent flow towards east side. Automatic gates (4&5) will detain water in the ditches and prevent water from flowing south to the pump stations. These gates will stay closed until the water level in ditches rise to 0.75 (in case of a summer storm). Once the high level is reached they will automatically open to prevent flooding in upstream area. High level open setting is selected such that it is close to maximum level that can be achieved when No 7 Rd North gravity inlet is open. This will make sure there is no water flow to pump stations during dry irrigation period.

Phase -1B

Phase-1B should be initiated only after the successful completion of phase-1A. Following is the list of items included in this phase:

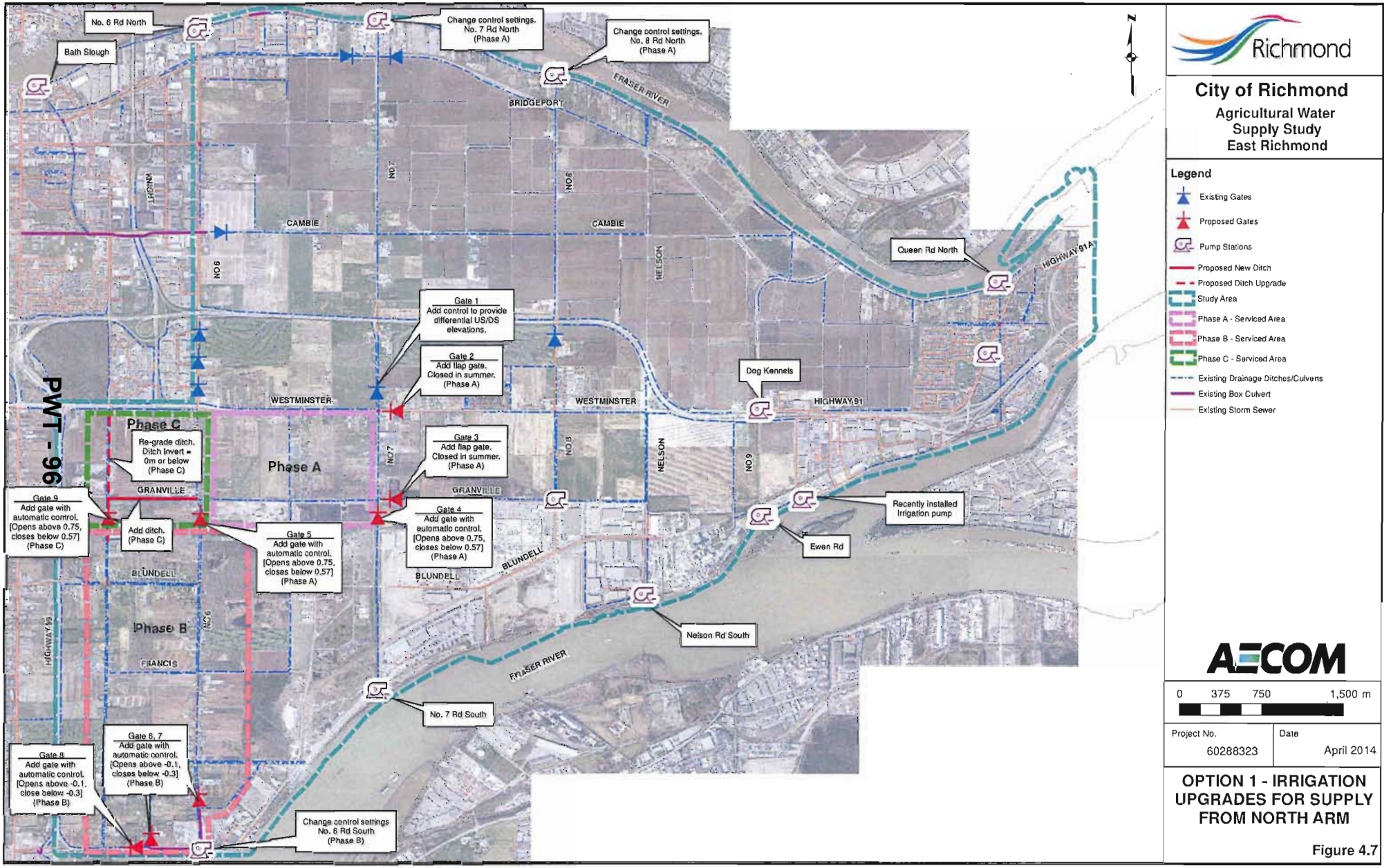
- Install three new gates with automated controls
  - Palmberg Road upstream of box culvert (Gate-6)
  - No 6 Rd and Triangle Road upstream of box culvert (Gate-7)
  - Steveston Hwy upstream of box culvert (Gate-8)

In phase-1B, the settings of Gate-5 can be adjusted such that it opens when the water level in Granville ditch exceeds its target level. Gates-6, 7 & 8 will detain water in the No 6 Rd and No 7 Rd ditches and prevent water from flowing south to the pump stations. Preliminary control settings are shown in ***Figure 4.7*** based on ground profile.

Phase -1C

This final phase will require construction of new ditch along Granville alignment between No 6 Rd and Sidaway. Prior to initiating this phase, we recommend that the City should look at the available right of way along this alignment. Following is the list of items included in this phase:

- Construct a new ditch along the Granville Alignment connecting No 6 Rd with Sidaway Rd (assuming 1m base width with 1.5H:1V side slopes and average depth of 1.5).
- Re-grade the existing ditch on the East side of Sidaway Rd for 1400m from North of Blundell Rd to Westminster Hwy
- Install a new gate (Gate-9) with automated control on Sidaway south of the proposed ditch.



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Legend

- Existing Gates
- Proposed Gates
- Pump Stations
- Proposed New Ditch
- Proposed Ditch Upgrade
- Study Area
- Phase A - Serviced Area
- Phase B - Serviced Area
- Phase C - Serviced Area
- Existing Drainage Ditches/Culverts
- Existing Box Culvert
- Existing Storm Sewer

AECOM

0 375 750 1,500 m

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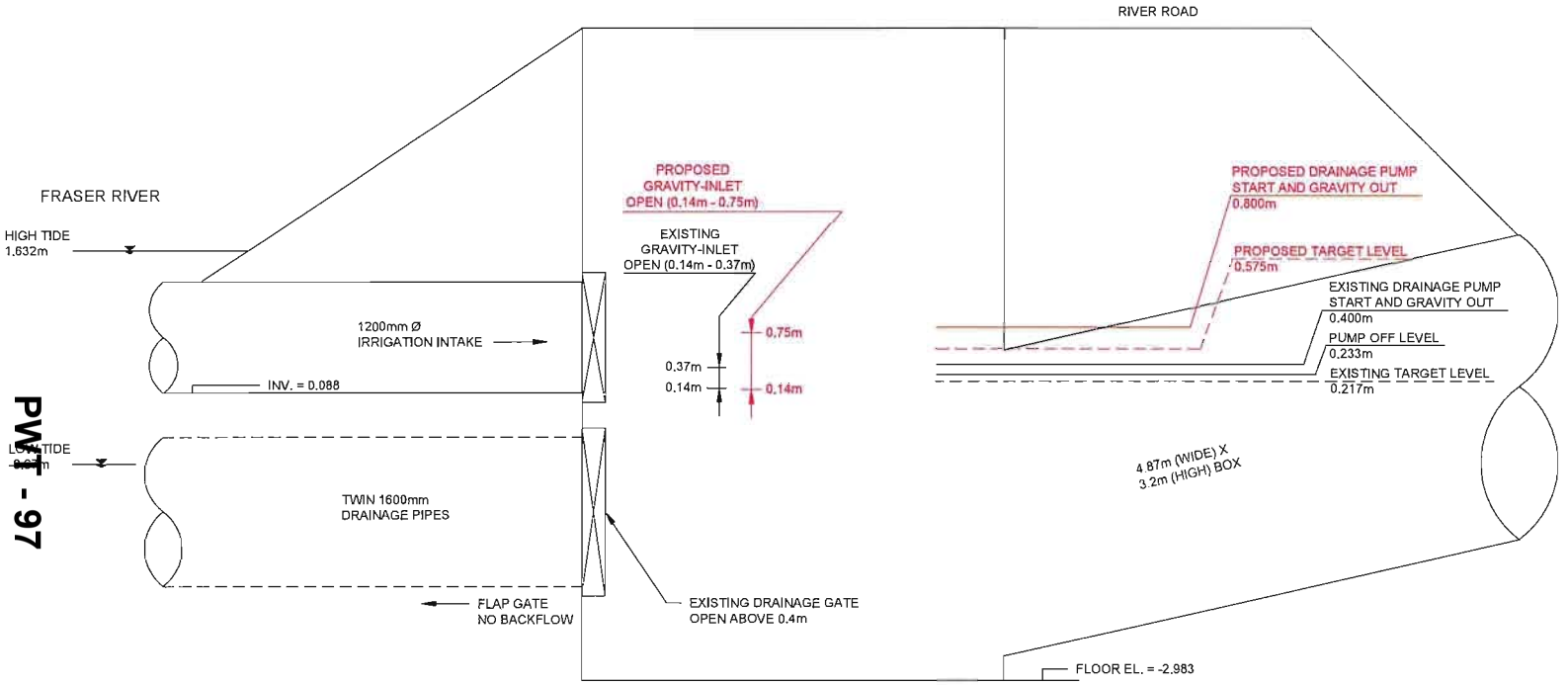
OPTION 1 - IRRIGATION UPGRADES FOR SUPPLY FROM NORTH ARM

Figure 4.7

No. 7 ROAD NORTH SCHEMATIC FOR IRRIGATION SETTINGS

NOT TO SCALE



WET-WELL SECTION

NOTES:

1. ALL ELEVATIONS ARE GEODETIC
2. LOW TIDE AND HIGH TIDE BASED ON DESIGN TIDE USED IN MODEL
3. ABOVE SKETCH IS SCHEMATIC TO SHOW ELEVATIONS ONLY

EXISTING SETTINGS:

1. TARGET LEVEL IS 0.217m
2. IRRIGATION INTAKE OPENS AT 0.14m AND CLOSES AT 0.37m
3. EXISTING DRAINAGE PUMPS START AND GRAVITY-OUT FALLS OPEN AT 0.4m OR ABOVE (TO PREVENT FLOODING DURING SUMMER STORMS)

PROPOSED SETTINGS:

1. THE PROPOSED TARGET LEVEL AT No. 7 ROAD IS 0.575m WHICH IS THE SAME AS THE EXISTING No. 8 TARGET LEVEL
2. IRRIGATION GATE OPENS AT 0.14m (NO CHANGE) AND GATE CLOSES AT 0.75m GEODETIC
3. IRRIGATION GATE OPENS ONLY IF TIDE IS HIGHER THAN WET-WELL/DITCH LEVEL
4. PROPOSED DRAINAGE PUMPS START AND GRAVITY OUT FALLS OPEN AT 0.8m OR ABOVE

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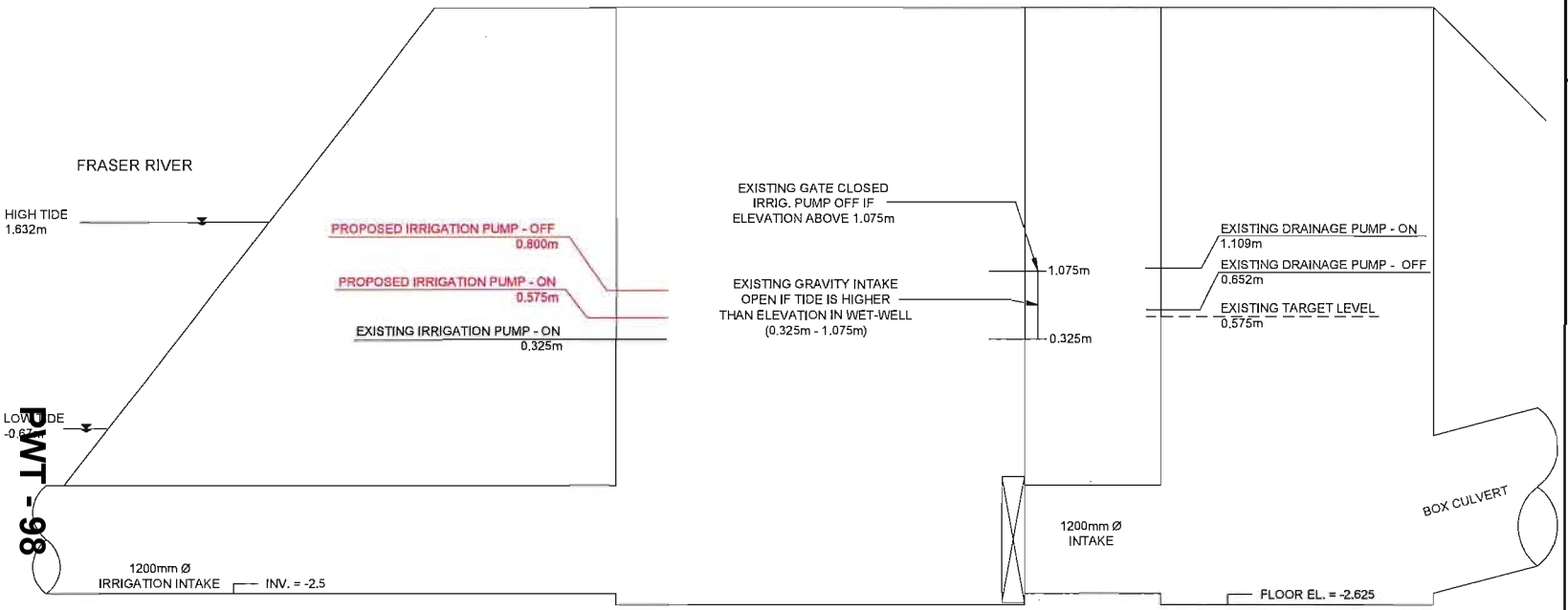
No. 7 Rd. North Schematic for Proposed Irrigation Settings

Figure 4.7.1

No. 8 ROAD NORTH SCHEMATIC FOR IRRIGATION SETTINGS

NOT TO SCALE



IRRIGATION PUMP STATION CHAMBER

No. 8 ROAD DRAINAGE PUMP STATION WET-WELL

NOTES:

1. ALL ELEVATIONS ARE GEODETIC
2. ONLY ONE IRRIGATION-INFLOW TAKES PLACE (PUMP OR GRAVITY) AT ONE TIME
3. LOW TIDE AND HIGH TIDE BASED ON DESIGN TIDE USED IN MODEL
4. ABOVE SKETCH IS SCHEMATIC TO SHOW ELEVATIONS ONLY

EXISTING SETTINGS:

1. TARGET LEVEL IS 0.575m
2. IRRIGATION PUMP TURNS ON ONLY IF LEVEL DROPS BELOW 0.325m. ONCE IT TURNS ON THEN IT TURNS OFF AT 1.075m
3. PUMP/GATE CONTROLS ARE MANUALLY OVERRIDDEN WITH A TEMPORARY SETTING TO MAINTAIN A HIGHER WATER LEVEL (START 0.825, STOP 1.575) DURING CRANBERRY HARVEST & SPRING FROST PROTECTION
4. GRAVITY INTAKE GATE OPENS AT 0.325m AND CLOSES AT 1.075m

PROPOSED SETTINGS:

1. NO CHANGE IN TARGET LEVEL (0.575m)
2. IRRIGATION PUMP ON IF LEVEL DROPS BELOW 0.575m AND TIDE IS LOWER THAN WET-WELL/DITCH LEVEL
3. IRRIGATION PUMP OFF AT 0.8m GEODETIC
4. GRAVITY IRRIGATION GATE OPENS ONLY IF TIDE IS HIGHER THAN WET-WELL/DITCH LEVEL
5. GRAVITY INTAKE IRRIGATION GATE CLOSED AT 0.8m OR ABOVE

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No. 8 Rd. North Schematic for Proposed Irrigation Settings

Figure 4.7.2

4.4.2 Option 2 – New Irrigation Pump Station near No 6 Rd South PS (I-2).

Option 2 includes construction of a new irrigation pump station in the south to supply water to the southwest part of the study area as shown in ***Figures 4.8***.

To provide water supply for growth irrigation (assuming an average rate of 5.33mm/day) for a 300hectare area, an irrigation pump station with a capacity of approximately 0.2 m^3/s (200L/s) is required. One possible option is to build a new pump station at the foot of No 6 Rd. Based on the surrounding existing ground elevations the maximum possible target water level for the pump station and ditches is approximately 0m geodetic.

A feasibility study for such a pump station and intake would need to be completed prior to initiating any conceptual design for this Option. The current location is preliminary and depended on available land. An alternative location may be the foot of Willams Rd as the Fraser River depth may be deeper in this area.

For Option 2, it is assumed that the drainage upgrades in the vicinity on Steveston Hwy, Sidaway Rd and No 6 Rd have been implemented. Costs for these items have not been included on the irrigation cost estimates.

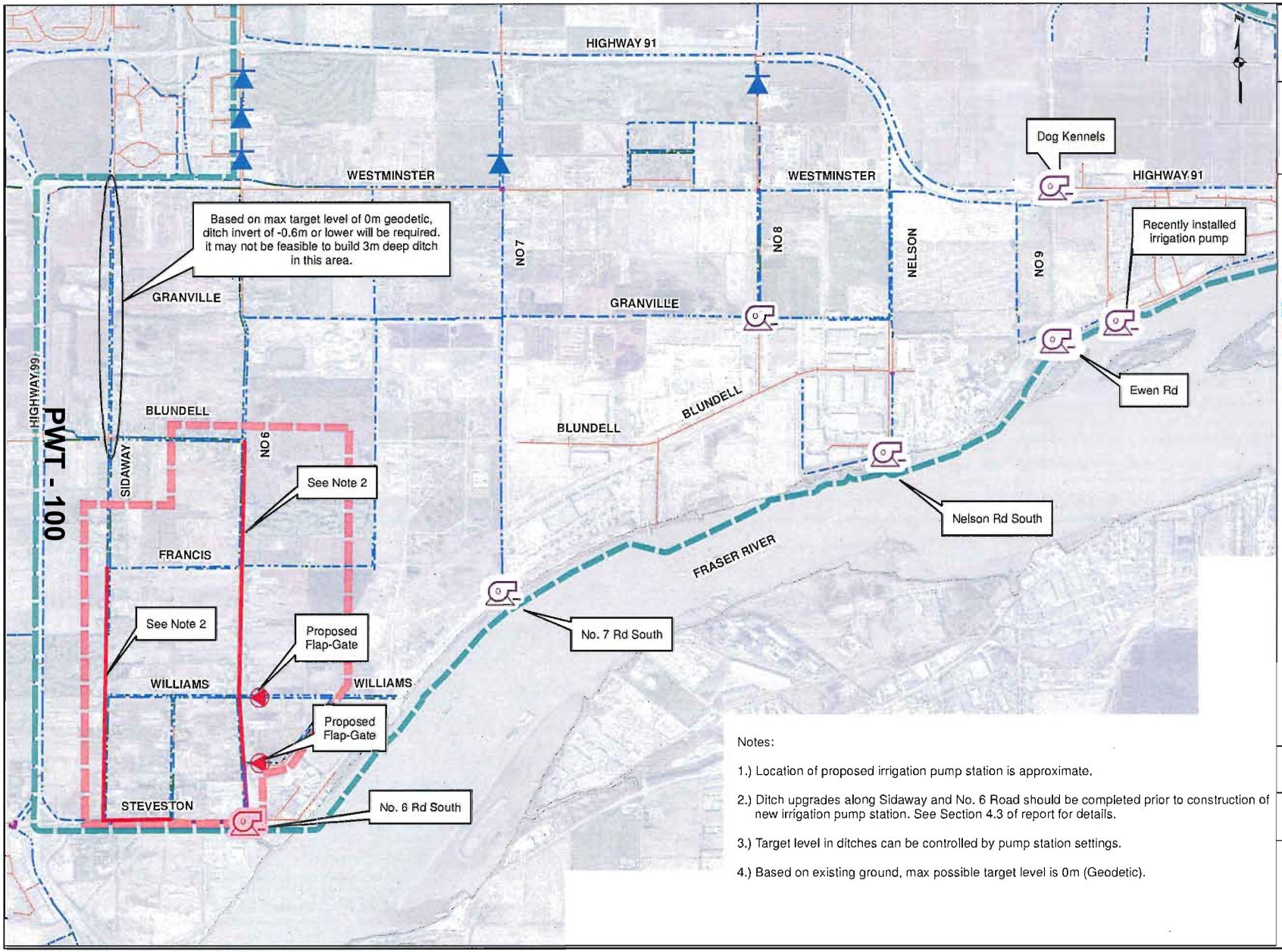
As shown in ***Figure 4.8***, the ditch along Sidaway Rd north of Blundell would need to have an invert of -0.6m elevation to facilitate the supply water from the new PS to this area. Based on the existing ground elevations, an approximately 3m deep ditch would be required, which may not be feasible.

4.4.3 Cost Estimate for Irrigation Options

Cost estimates for irrigation improvement Options 1 and 2 are presented in ***Table 4.3***. As noted in ***Section 4.3.9***, all estimates are in 2013 CAD dollars and an allowance for engineering design and construction contingency of 25% has been added to each Option.

Table 4.3 Cost Estimate for Irrigation Options

ITEM NO.	Name (Ref Section)		DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	AMOUNT
I-1	Option 1 – Irrigation Upgrades for Supply from North Arm (Section 4.4.1)	Phase1 A	Modify settings at No 7 North PS and No 8 North PS	LS	2	$0	$0
			Install two new seasonal flap gates	LS	2	$60,000	$120,000
			Install two new gates with automated controls	LS	2	$175,000	$350,000
		Phase1B	Re-grade existing ditch on East side of Sidaway Rd from North of Blundell Rd to Westminster Hwy	Lin m	1400	$219	$306,600
			Construct a new ditch along the Granville Alignment connecting No 6 Rd with Sidaway Rd	Lin m	835	$340	$283,900
		Phase1C	Install three new gates with automated controls	LS	3	$175,000	$525,000
							$1,586,000
						Design (6%)	$95,160
						Eng. Satff Charges (4%)	$63,440
						Subtotal	$1,744,600
						Contingency (25%)	$436,150
						Project Total	$2,181,000
I-2	Option 2 - New Irrigation Pump Station near No 6 Rd South PS (Section 4.4.2)		Irrigation Pump Station	LS	1	$1,400,000	$1,400,000
			Intake piping	LS	1	$500,000	$500,000
			Power supply	LS	1	$110,000	$110,000
			Install three new seasonal flap gates	LS	3	$60,000	$180,000
							$2,190,000
						Design (6%)	$131,400
						Eng. Satff Charges (4%)	$87,600
						Subtotal	$2,409,000
						Contingency (25%)	$602,250
						Project Total	$3,012,000



Notes:

1.) Location of proposed irrigation pump station is approximate.

2.) Ditch upgrades along Sidaway and No. 6 Road should be completed prior to construction of new irrigation pump station. See Section 4.3 of report for details.

3.) Target level in ditches can be controlled by pump station settings.

4.) Based on existing ground, max possible target level is 0m (Geodetic).

Richmond

City of Richmond

Agricultural Water Supply Study East Richmond

Legend

- Existing Gates
- Proposed Flap-Gates
- Existing Pump Stations
- Proposed Irrigation Pump Station
- Study Area
- Approx. Service Area of Pump Station
- Existing Drainage Ditches
- Existing Circular Culvert
- Existing Box Culvert
- Existing Storm Sewer

AECOM

0 250 500 1,000 m

Project No.	Date
60288323	April 2014

OPTION 2 - PROPOSED IRRIGATION UPGRADES FOR SUPPLY FROM SOUTH ARM

Figure 4.8

5. Cost Benefit Analysis

A cost benefit analysis typically includes a review of the costs and savings that can be realized in terms of the economic, social and environmental components resulting from implementation of a project. The analysis completed here is primarily economic in nature as the social and environmental costs and benefits are challenging to quantify. However, it is evident that there is motivation from stakeholders (including the farming community and the City) to maintain the viability of agricultural production in East Richmond's ALR areas such that the social impact of drainage and irrigation improvement projects are viewed as benefits. In terms of the environmental components, such as water quality and habitat enhancement, there are also benefits to be realized from the improvements.

In 2010, cranberries (33%), blueberries (19%), mixed vegetables (11%) and potatoes (5%) were the main irrigated field crops grown in Richmond, accounting for 67% of the cultivated farmland (2010 LUI report). Irrigation is a critical input for crop production with irrigation of about 71% of the berry area and 56% of the vegetables area.

In ***Table 5.1***, target yields, average prices and gross revenue per hectare are indicated for the various crops. Target yields are yields attainable for mature crops using good agricultural practices. Cranberry yields range widely, with the newer higher yielding strains capable of producing yields in excess of 34,000 kgs per hectare. While newer varieties of blueberries are higher yielding, yields also vary depending upon the harvest method with hand harvesting resulting in somewhat higher yields than machine harvesting.

Average prices are the farm gate prices received over the last 5 years. Over 90% of BC cranberries are marketed to the Ocean Spray cooperative under a schedule of Pool A pricing. Future prices are expected to be pressured somewhat by increasing production.

In the case of blueberries, the average price is the blended price of product going to the fresh and processed markets. The average farm gate price of blueberries is anticipated to decline over the near term future, compared to prices received historically, due to a significant increase in blueberry crop coming into mature production.

As ***Table 5.1*** shows, conventional mixed vegetable cropping, including potatoes, does not generate the returns per hectare that cranberries and blueberries do. However, organic vegetable production does occur in the area and farm gate pricing is considerably more favourable.

Table 5.1 Estimated Average Yields, Prices and Gross Revenues Associated with Main Irrigated Crop Types

Crop	Cranberries	Blueberries	Potatoes	Mixed Vegetables
Target Yield – Full Production (kgs/ha)	22,414- 33,600	14,569 – 18,000	33,621	5,940
Average Price ($/kg)	1.32	1.76	0.55	0.86
Gross Revenue per Hectare	29,640 – 44,460	25,688 – 35,568	18,525	5,105

For the purposes of this updated study, an average crop value of $30,000 per hectare has been selected, which is based on the anticipated conversion of un-used farmland to berries. An estimate of un-used land is provided in the 2010 LUI data (Map 6), which indicates that there is approximately 520 ha of additional land available or that has potential for farming in East Richmond, with potential average annual revenue from irrigated production of $15.6 million (Table 5.2).

It should also be noted that the crop value estimates do not reflect other economic and financial benefits that farmers may realize from improved drainage and irrigation such as improved crop yields or ability to growing higher value crops. Furthermore, the analysis presented herein assumes that all un-used farm lands will be under full production.

When comparing the cost estimates for the drainage upgrades and irrigation improvement options, as per ***Tables 4.2*** and ***4.3*** respectively, the potential revenue for un-used land is greater (as shown below in ***Table 5.2***) resulting in a positive benefit cost ratio.

Table 5.2 Average Annual Potential Revenue Vs. Cost of Infrastructure

Area of Un-used Agricultural Land for East Richmond	Average Annual Potential Revenue (based on $30,000 / Ha)	Cost of Infrastructure (drainage upgrades & irrigation options)
520 Ha	$15.6M	$6.0M to $7.0M

A few additional costs and savings that may influence the analysis include the following items:

- *Water Purchase Cost*: Savings for farmers that are currently irrigating with potable water supplied by the City. Based on an average irrigation rate of 5.33 mm/day (growth irrigation rate from ***Section 1.5.2***) this equates to a cost per Hectare of $63.83 / Ha / day using the City's current water rates (Schedule B to Bylaw 5637). Several farmers in the vicinity of Westminster Hwy and Sidaway Rd are currently using City supplied potable water for irrigation of vegetable farms such that implementation of Option 1 for the irrigation upgrades for water supply from the North Arm of the Fraser River would be a significant savings for these individuals.

- *Irrigation Pump Station Cost*: Cost of additional pump station maintenance and fuel due to longer pump run times for supplying more irrigation water from No 8 Rd North PS (or from a new irrigation pump station in the South). An estimate for pump station operations and maintenance cost per year can be made from data obtained through AECOM's National Stormwater Benchmarking Initiative. 2011 benchmarking data for thirteen major cities across Canada for pump station O&M costs per total pump station horsepower indicate that the average cost is $150 / PS Hp. For the No 8 Rd North PS (at 134 Hp) this equates to approximately $20,000 / year. The portion of annual expense due to additional pump run time combined with extra power costs is significant.

  It is also recommended that the City should contact DFO to determine potential environment concerns resulting from increased pumping from Fraser River.

- *Crop Failure:* Potential savings and reduced risk of economic impacts from flooding or loss of crops. This is difficult to quantify and would vary greatly across the study area. North for Hwy 91 for example, the primary crop is cranberries for which the farmers rely on the ability to flood the fields such that they typically have capability to drain there fields as well when required. In the Southwest where more vegetable crops are grown, there are typically water shortage issues during the growing season such that flooding is not a concern.

- *Right of Way:* Additional costs for purchase of rights-of-way for ditch enlargement or larger infrastructure would also increase the capital costs for infrastructure improvements. With exception of Irrigation improvement Option 1, there are no new ditches or rights-of-way recommended.

In summary, the cost benefit ratio for implementing the drainage and irrigation upgrades is positive when viewed from the perspective of the farming community. Improvements to system conveyance and irrigation water supply will increase the amount of land potentially available for farming and is likely to increase current crop yields.

From the City's perspective, the economics are not favourable given the farmers reap the benefits but the social and environmental gains are positive. In addition, the City has committed to maintaining and improving ALR drainage and irrigation systems to support agriculture as per the 2041 OCP. This commitment includes facilitating the improvement of irrigation and drainage infrastructure to provide secure and affordable water supplies that support the agricultural sector.

6. Recommendations

6.1 Review of 2006 Study Upgrades not Completed

At the onset of the project, a review of the drainage and irrigation upgrade recommendations from the 2006 Study was completed. ***Table 6.1*** provides a summary of the projects and the rationale for why they are either not included, no longer required or if the project has been included as a low priority for completion when funds are available.

There are four drainage upgrade projects on the list (projects 6.1 to 6.4). Project 6.1 is listed as low priority as proposed upgrades along Sidaway from Francis to Steveston will reduce this projects need. Project 6.2 is not feasible due to construction constraints resulting from jet fuel pipeline. The majority of project 6.3 is already included in the proposed drainage upgrades (with the remainder deemed not required) and project 6.4 is not required partly due to the proposed Ecowaste Facility that will change drainage pattern in this area.

Projects 6.5 to 6.23 are irrigation upgrade projects. Projects 6.6 & 6.12 are already included as part of the proposed Option 1 irrigation upgrades and four projects (6.9, 6.10, 6.19 & 6.23) are included as low priority. The remaining projects are not required based on the updated assessment and shift in strategy, particularly the previously recommended screw pump at Granville Ave and No 6 Rd, and No 7 Rd North irrigation pump station and associated ditch, culvert and flap gates.

6.2 Recommended Capital Projects

Drainage and irrigation upgrades recommended under the current study are listed in order of priority in ***Table 6.2***. Cost estimates include a 25% engineering design and construction contingency and all costs are in 2013 dollars.

Table 6.2 Prioritized List of Upgrades

Project ID	Project Description	Cost Estimate	Time Horizon
D1	Sidaway Road South of Francis Alignment (Section 4.3.1)	$1,176,000	1-2 years
D2	No 6 Road South of Blundell Road (Section 4.3.2)	$693,000	3-5 years
D4	Blundell Road East of Sidaway (Section 4.3.4)	$46,000	3-5 years
D7	Burrows Road (Section 4.3.7)	$50,000	3-5 years
D6	Cambie Road East to No 8 Rd, No 7 Rd & No 8 Rd from Cambie to PS (Section 4.3.6)	$1,595,000	5-10 years
D5	Westminster Highway West of No 7 Road (Section 4.3.5)	$981,000	5-10 years
(I-1). Irrigation-Option 1 Upgrades for Supply from	Phase A	$647,000	5-10 years (or sooner if funds are available)
	Phase B	$812,000	
	Phase C	$722,000	
	Total Cost	**$6,722,000**	

Note: "D" represents drainage projects and "I" represent irrigation projects.

As discussed in section 1.3.4, each projects detailed design should protect and enhance RMA's to protect and improve water quality.

Table 6.1 – Future Upgrades Recommended by the 2006 Study

Project ID	LOCATION	SCOPE OF WORK (AS PER 2006 STUDY)	RATIONALE IF EXCLUDED
6.1	Sidaway Rd (Blundell Rd to Francis Rd)	Construct 600m of ditch along Sidaway-East to connect the Blundell and Francis ditch systems	Upgrades proposed for Sidaway on Francis to Steveston will reduce the HGL such that this project is not required. Included as low priority project.
6.2	No 6 Rd (Highway 91 to No. 6 Rd Pump Station North)	Re-profile and smooth inverts through 2650m of ditches and storm sewers (delayed due to Kinder Morgan jet fuel pipeline conflicts and scope issues)	Not feasible due to jet fuel pipeline. Also of limited benefit and construction constraints present along No 6 Rd.
6.3	Cambie Rd	Re-profile 4000m of ditches	Approx. 3,200m of cleaning proposed for Cambie ditch. Additional length East of No 8 Rd deemed not required as no flooding is predicted after improvements to Cambie ditch as well as No 7 Rd and No 8 Rd ditches.
6.4	Blundell Rd (No 6 Rd to No 7 Rd)	Construct 1600m of ditch	Not required due to proposed upgrades on Sidaway and No 6 Rd. Proposed Ecowaste facility to drain south to Fraser which makes up significant portion of catchment area.
6.5	West Boundary	Install an additional 6 flap gates with manual override along Highway 99 and No. 6 Rd. (1 of the initial 7 proposed was installed in 2008)	Existing gate on Cambie ditch East of No 6 is closed during harvest to prevent water from agricultural areas draining to industrial lots west of No 6 Rd so additional gates are not required.
6.6	No 7 Rd (South of Granville Rd)	Install 1 drop leaf gate to prevent potential irrigation water discharging at the No. 7 Rd South Pump Station	Included as part of irrigation upgrades Option 1
6.7	No 8 Rd (East side between Hwy 91 and Westminster Hwy)	Upgrade 400m of storm sewers (existing sewer is 900mm)	Cannot find rationale for this project in 2006 Study. Irrigation water can be supplied by the temporary flap gate at Hwy 91 and No 8 Rd.
6.8	Westminster Hwy (No 6 Rd to ditch near Kartner Rd)	Upgrade / realign 2400m of storm sewers (existing sewer is 600mm increasing to 900mm)	Proposed drainage ditch upgrade in North side of Westminster Hwy between No 6 Rd and No 7 Rd will increase conveyance such that storm sewer upgrade is not required.
6.9	No 6 Rd (Westminster Hwy to Granville Ave)	Upgrade / realign 800m of storm sewers (existing sewer is 800mm)	Proposed drainage upgrade on No 6 Rd south of Blundell Rd to increase conveyance. Included as low priority project.
6.10	No 6 Rd (Granville Rd to No 6 Rd Pump Station South)	Upgrade 3200m of ditches and storm sewers	Proposed drainage upgrade on No 6 Rd South of Blundell Rd to No 6 Rd PS South increase conveyance. Granville Rd to Blundell Rd included as low priority.
6.11	Williams, Blundell & Francis Roads	Upgrade ditches (scope undetermined)	Proposed drainage upgrades on Sidaway Rd and No 6 Rd to improve conveyance such that Williams, Blundell and Francis ditch upgrades are not required.
6.12	Granville Ave Alignment (Sidaway Rd to No 6 Road)	Construct 800m of ditch to connect Sidaway to No. 6 Rd.	Included as part of irrigation upgrades Option 1
6.13	Granville Ave & No 6 Rd	Install screw pump and 2 drop leaf gates (to irrigate Sidaway Rd)	Not feasible or cost effective. See irrigation upgrades Option 1 as alternative solution
6.14	No 7 Rd North PS	Install irrigation pump	See irrigation upgrades Option 1 for alternative solution to adjust gravity intake settings and target irrigation water elevation level
6.15	Blundell Rd (East of No 6 Rd)	Install 1 drop leaf gate	Not required as project was related to new ditch between No 6 Rd and No 7 Rd that is not recommended
6.16	General study wide upgrades with low priority in the 2006 Study	Culvert connecting Nelson Rd to Ewen Rd	Not required due to Westminster Hwy improvements and modifications to surface drainage in the area
6.17		Culvert connecting ditches on the West side of No 6 Rd to Granville Ave Alignment	Not required as Granville Ave alignment ditch upgrades improved conveyance in area
6.18		Flap gates with manual override at No 8 Rd and Westminster Hwy	Existing gate at Hwy 91 serves same purpose and proposed irrigation Option 1 includes a gate at No 7 and Granville Ave for area isolation
6.19		Manually operated gate at Nelson-east and Westminster Hwy	Low priority and no concerns raised from local area farmers at time of study
6.20		Drop-leaf gate at No 6 Rd, North of Bridgeport Rd	Not required as existing gate on Cambie Rd ditch controls flow
6.21		Drop-leaf gates at No. 7 Rd and Cambie Rd ditch (both sides of No 7 Rd)	Not required as Cambie Rd ditch cleaning reduced HGL and increased conveyance
6.22		Drop-leaf gate at No 8 Rd and Cambie Rd ditch (on West side of No. 8 Rd)	Not required as Cambie Rd ditch cleaning reduced HGL and increased conveyance
6.23		Deepen ditch along Westminster Hwy between Nelson Rd and Ewen Rd	Low priority and no concerns raised from local area farmers at time of study

Drainage Projects
Irrigation Projects

6.3 Additional Recommendations

Further recommendations and improvements that were discussed at the Staff workshop and require additional investigation prior to inclusion in the current Capital Plan include the following items:

- Survey ground elevation (field elevations) along existing ditch on Cambie Rd (east and west of No 7 Rd). The ground elevation survey should also be completed for low lying areas along Sidaway and No 6 Rd south of Williams Road.
- Review capacity of the No. 7 Road South PS and flood box as it was identified as under capacity in ***Table 4.1***
- Consider implementing the following projects identified in the 2006 Study as low priority works:
    - Construct 600m of ditch along Sidaway-East to connect the Blundell and Francis ditch systems
    - Upgrade ditch on east side of No 6 Rd between Granville Rd and Blundell Rd. This will further increase conveyance along No 6 Rd and facilitate supply of irrigation water from North Arm.

- Repair or replacement of the failing headwall at the south ditch box culvert inlet on Cambie Rd just east of No 6 Road
- Ditch cleaning and re-profiling along CN Rail corridor between No 7 Rd and No 8 Rd (City needs permission from the railway for access)
- Ditch cleaning and re-profiling for south side of River Rd from the CN box (Cambie Rd alignment) east to Queens PS
- Box culvert flushing and cleaning for No 6 Rd north drainage corridor and further investigation of the jet fuel pipeline elevations
- Review the need and methods to remove invasive species such as Japanese Knotweed and Parrot Feather.
- Review possibility of lowering the No 7 Rd North PS culvert and impact this would have on the downstream ditch systems
- Create a culvert inspection program for entire study area and in particular a review of who is responsible for maintenance of culverts crossing Hwy 91
- Consider implementing a procedure that requires farmers to identify when and where new outfalls from fields to municipal ditches are constructed
- Coordinate operation of the CN box gravity intake (River Rd and Cambie Rd alignment) between farmers and Operations staff
- Facilitate farmers to coordinate water use from No 7 Rd North PS during harvest

APPENDIX A
Feedback from Open House

City of Richmond

East Richmond Agricultural Water Supply Study Update Public Feedback Form

Thank you for taking the time to provide feedback on East Richmond's drainage and irrigation system. Please describe below, successes, concerns or other relevant feedback relating to the City's irrigation and drainage system:

Feedback (*Please provide specific information and the property addresses of where it relates to*):

15391 Westminster Hwy

- Drainage not effective enough thru winter + spring (Ditch observed to flow in both directions)
- Summer – NO irrigation water.

to use City water

Water temp too cold

Chlorine is not good for plants – limits vegetable quality.

Cost concerns

Grow Daikon, Bok Choy, Tong Choy, You Choy

Chlorine makes Daikon crack

Cold water on ~~Daikon leaf in hot summer weather~~ Cabbage/Daikon in hot weather damages inside of plant.

Ditch water too high / field too low for City drainage to work well.

Better drainage will allow earlier planting + better production.

- If water was available in fronting ditch they would use for irrigation.
- Hot line ditch not draining into Westminster Hwy ditch (northside)

Please provide your contact details should City staff wish to further discuss your feedback:

Name: Jason Huang Zhi Gang Farm LTD farm owner

Contact Telephone Number: 604 374 0287 / 604-782-8520 (Mr. Su)

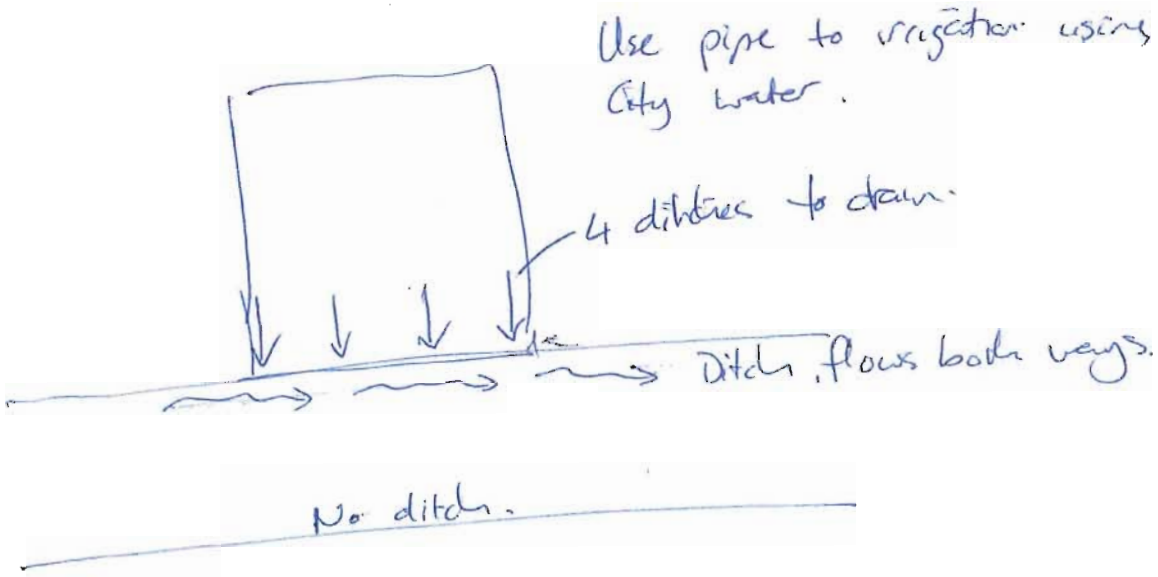
Email: Kanlove2000@hotmail.com

NOT land owner

Your input is important to us and will be compiled and considered within the East Richmond Agricultural Water Supply Study Update. Please submit your comments by **Friday, May 3, 2013 at 5:00 p.m.**

- **Fax:** 604-276-4197
- **Email:** andy.bell@richmond.ca
- **Mail or drop off at City Hall:** 6911 No. 3 Road, Richmond, BC V6Y 2C1
- **Online:** www.LetsTalkRichmond.ca

PTO


Use pipe to irrigation using City water.
4 ditches to drain.
Ditch. flows both ways.
No ditch.

City of Richmond

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Thank you for taking the time to provide feedback on East Richmond's drainage and irrigation system. Please describe below, successes, concerns or other relevant feedback relating to the City's irrigation and drainage system:

Feedback (*Please provide specific information and the property addresses of where it relates to*):

14780 Westminster Hwy
& 14540 " "
Mr Chan
South ditch - not enough irrigation water (it's there, but low)
No. 6 Rd
Sept. Rain starts. Internal drainage stops working as city ditch water level to high.

~~Lot time ditch not draining~~

Please provide your contact details should City staff wish to further discuss your feedback:

Name: Mr Chan

Contact Telephone Number: _____

Email: _____

Your input is important to us and will be compiled and considered within the East Richmond Agricultural Water Supply Study Update. Please submit your comments by **Friday, May 3, 2013 at 5:00 p.m.**

- **Fax:** 604-276-4197
- **Email:** andy.bell@richmond.ca
- **Mail or drop off at City Hall:** 6911 No. 3 Road, Richmond, BC V6Y 2C1
- **Online:** www.LetsTalkRichmond.ca

City of Richmond

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Thank you for taking the time to provide feedback on East Richmond's drainage and irrigation system. Please describe below, successes, concerns or other relevant feedback relating to the City's irrigation and drainage system:

Feedback (*Please provide specific information and the property addresses of where it relates to*):

15391 Westminster
No. 7 road north of Westminster
perhaps a culvert to cross road to provide
water to farm land on west side of
No. 7 road in summer
discharge/drainage ~~ditch~~ along Westminster Hwy.
Granville ditch maybe too high of invert
~~Some~~ need water in summer (14780 Westminster)
Westminster Infilled not
draining properly

Please provide your contact details should City staff wish to further discuss your feedback:

Name: _____

Contact Telephone Number: _____

Email: _____

Your input is important to us and will be compiled and considered within the East Richmond Agricultural Water Supply Study Update. Please submit your comments by **Friday, May 3, 2013 at 5:00 p.m.**

- **Fax:** 604-276-4197
- **Email:** andy.bell@richmond.ca
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- **Online:** www.LetsTalkRichmond.ca

City of Richmond

East Richmond Agricultural Water Supply Study Update Public Feedback Form

Thank you for taking the time to provide feedback on East Richmond's drainage and irrigation system. Please describe below, successes, concerns or other relevant feedback relating to the City's irrigation and drainage system:

Feedback (*Please provide specific information and the property addresses of where it relates to*):

I live on Blundell between Sideway & No 6 Road. It appears no drainage projects are planned for our area & that is ok with me. We have no ditch drainage problems. However we are seeing more large homes being built on old farm properties & then they build a guest house & tennis court/pool etc & pave everything in between. I can see that if enough homeowners do this, there could be drainage problems in the future as pavement & concrete do not perk.

Please provide your contact details should City staff wish to further discuss your feedback:

Name: D. Whalen

Contact Telephone Number: 604.230.3158

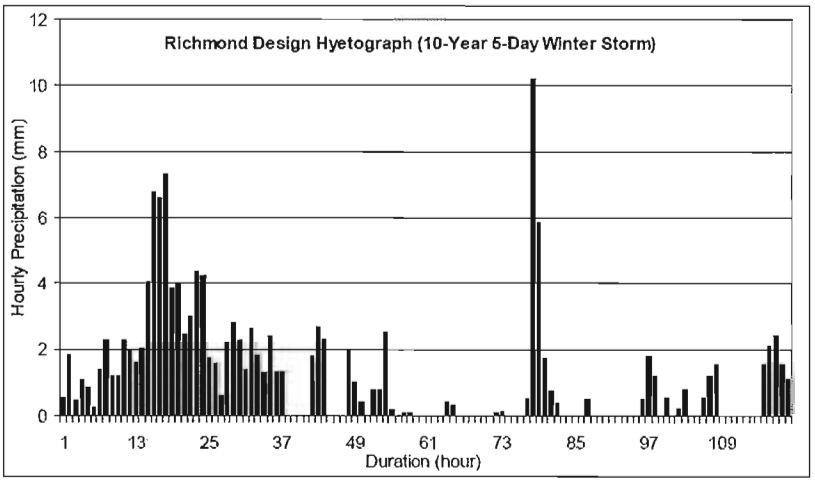
Email: de_whalen@hotmail.com

Your input is important to us and will be compiled and considered within the East Richmond Agricultural Water Supply Study Update. Please submit your comments by **Friday, May 3, 2013 at 5:00 p.m.**

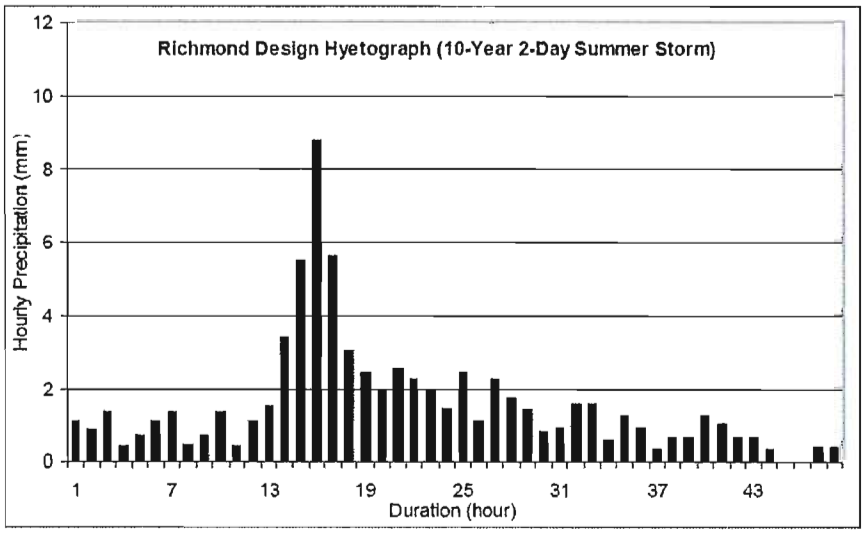
- **Fax:** 604-276-4197
- **Email:** andy.bell@richmond.ca
- **Mail or drop off at City Hall:** 6911 No. 3 Road, Richmond, BC V6Y 2C1
- **Online:** www.LetsTalkRichmond.ca

APPENDIX B
Design Storm Hyetographs

Duration (hr)	1	2	6	12	24	48	72	96	120
Intensity (mm/hr)	10.19	8.03	5.43	4.21	3.05	2.05	1.60	1.32	1.18



Duration (hr)	1	2	6	12	24	48
Intensity (mm/hr)	8.80	7.20	4.80	3.45	2.38	1.55



City of Richmond

Report to Committee

To:	Public Works and Transportation Committee	**Date:**	June 30, 2014
From:	John Irving, P.Eng. MPA Director, Engineering	**File:**	10-6150-01/2014-Vol 01
Re:	**Fraser River Dredging and Environmental Considerations for Steveston Harbour and Sturgeon Bank**		

Staff Recommendation

That the report titled "Fraser River Dredging and Environmental Considerations for Steveston Harbour and Sturgeon Bank," dated June 30, 2014, from the Director, Engineering, be received for information.

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

Att. 1

REPORT CONCURRENCE		
ROUTED TO:	**CONCURRENCE**	**CONCURRENCE OF GENERAL MANAGER**
Law	☑	
REVIEWED BY STAFF REPORT / AGENDA REVIEW SUBCOMMITTEE	**INITIALS:**	**APPROVED BY CAO**

Staff Report

Origin

Council referred:

1. on April 22, 2014, the article titled *Plan for deeper dredging in Fraser River could have high environmental price* (published April 22, 2014 in Business In Vancouver) to staff for analysis.

2. on February 17, 2014, that staff provide a historical background on the dredging of the Fraser River and report back to Council.

3. and on May 23, 2013, that the matter concerning the Dyke right-of-way at Steveston Harbour be referred to staff to provide information regarding the following:

    1. Ownership of the City owned property east of the rock berm at Steveston Island; and

    2. That Port Metro planning include the potential for a Dyke along the rock berm and Steveston Island.

Background

Staff are actively engaged on several projects and issues around Steveston Harbour and Sturgeon Bank that are interrelated to varying degrees.

This report responds to the above referrals, discusses these issues, identifies significant initiatives in these areas and synergies between these initiatives and staff efforts to ensure the City's interests are addressed.

Analysis

History of Dredging in the Fraser River Main and Secondary Channels

Financial Responsibility for Dredging

Fraser River dredging was initially assigned as a federal responsibility by the *British North America Act*. Maintenance dredging on the river began in the 1880's and Public Works and Government Services Canada (PWGSC) started regular maintenance dredging in 1901. In 1982 the responsibility for maintenance dredging was passed from PWGSC to the Canadian Coast Guard (CCG). The CCG continued maintenance dredging until the 1998 *Canada Marine Act* transferred responsibility for dredging to commercial users and the commercial ports. Subsequent to implementation of the Act, the Fraser River Port Authority chose to conduct maintenance dredging in the main channel of the Fraser River and received a one-time compensation of $14.5 million from the Federal Government. The Vancouver Fraser Port Authority Historical Review of Lower Fraser River report (EBA, April 2013) indicates that "the

settlement does not obligate the Port to dredge, although they continue to do so. Secondary channels are not included in this framework unless the cost of dredging is fully recovered."

Local Channel Dredging and Ladner Steveston Local Channel Dredging Contribution Agreement

The CCG dredged secondary channels that had significant commercial vessel utilization until the 1998 *Canada Marine Act* was implemented. There has not been any federal government funding for the secondary channels since 1998.

In 2008, the Fraser River Port Authority, the North Fraser Port Authority and the Vancouver Port Authority combined to become the Fraser River Port Authority which is known as Port Metro Vancouver (PMV). PMV launched the Local Channel Dredging Contribution Program in 2009. This program allocates $7 million over 10 years for long-term community-based dredging plans. PMV has limited contributions to $500,000 per local channel over a 10 year period.

In 2013, the Province, PMV, the Corporation of Delta and the City of Richmond entered into the Ladner Steveston Local Channel Dredging Contribution Agreement to provide one-time cost sharing and immediate dredging in Ladner and Steveston under PMV's management.

Dredging of the western end of Steveston Harbour was completed in early 2014 at a cost of approximately $1 million. The east end of the harbour still requires dredging. There is further Provincial and City funding available under the contribution agreement, however, PMV has exhausted its dredging funding for Steveston Harbour. Approximately $4 million of PMV's $7 million allocated to secondary channel dredging has been spent or is committed to be spent by the end of 2014.

In February 2014, the Mayor sent a letter to the Provincial Attorney General and Minister of Justice explaining the situation and identifying Steveston Harbour as critical infrastructure. While a long term solution to dredging funding is required, there is a mechanism through PMV's Habitat Enhancement Program to dredge the east end of Steveston Harbour in the near future.

Staff will continue to work with the Province and PMV to develop a long term funding strategy for dredging Steveston Harbour and other secondary channels.

Main Channel Dredging Depth

Over the last century shipping vessels have grown in size considerably and infrastructure that supports shipping has developed to accommodate larger vessels with deeper drafts. By 1960, PWGSC construction and dredging had developed a main channel profile that accommodated vessels with an 8.7 m draft. In the 1960's, the depth of the channel was increased to a 9.1 m draft channel and by 1976 PWGSC was committed to maintaining a 10.7 m draft channel. Today, PMV maintains an 11.5 m draft channel.

With the announced the George Massey Tunnel Replacement Project, Fraser Surrey Docks has requested that depth of the Fraser River main channel be increased to accommodate 13.2 m draft ships once the tunnel is removed from service. If such a request were to be realized, other

significant infrastructure under the main channel, including Metro Vancouver water pipelines and Fortis gas pipelines, would require consideration. Additionally, further dredging would exacerbate long term erosion issues at Sturgeon Bank. Recognized Fraser River expert Dr. Michael Church's comments in an April 22, 2014, article in "Business in Vancouver" support the Dike Master Plan's finding regarding the impacts of dredging on Sturgeon Bank erosion and supports Staff's opinion that the proposed additional dredging will exacerbate this existing issue.

While the proposed additional dredging will not alter Fraser River water levels adjacent to Richmond, the erosion of Sturgeon Bank will impact the west dikes flood protection capacity in the long run. Any proposed work related to deeper dredging must be linked to the stabilization of Sturgeon Bank.

PMV Habitat Enhancement Program

PMV has been creating and enhancing habitat in advance of port development projects since 1991. Their program aims to ensure the viability and sustainability of new and enhanced habitat to benefit fish and wildlife. These projects are intended to maintain a balance between the environment and future port development projects.

Steveston Harbour

As part of their Habitat Enhancement Program, PMV is proposing to build a tidal marsh at the east end of Shady Island as environmental compensation for future projects. PMV's proposal includes utilizing previously dredged material deposited on Shady Island and new material resulting from dredging the east end of Steveston Harbour to construct the tidal marsh habitat (Attachment 1). This plan will allow utilization of dry dredgeate material for marsh construction and replacement with fresh dredgeate resulting in no net loss of material on Shady Island. This proposal has the following benefits:

- facilitates one-time dredging of the east end of Steveston Harbour;,
- has potential to reduce long term dredging costs by reducing sediment infill via marsh construction; and
- creates tidal marsh habitat, which is essential for juvenile salmon.

The City is working in cooperation with PMV, Small Craft Harbours and the Steveston Harbour Authority under a memorandum of understanding to ensure that any works performed in and around Steveston Harbour, including the proposed marsh, benefit all parties. In particular, reducing sediment deposition and required dredging is a key interest shared by all parties.

The City's Dike Master Plan – Phase 1 proposes to utilize Shady Island as the long-term diking solution for the Steveston area. The plan includes connecting Shady Island to Lulu Island with dikes at each end, maintaining water levels in Steveston Harbour that accommodate existing heritage buildings and harbour infrastructure. The planned dike will include sea gates that will allow water and vessels into the harbour most of the time and will be closed during periods of extreme high water levels. While the Dike Master Plan and the proposed marsh have some common elements, care must be taken to ensure the long-term diking plan is accommodated by any works developed in and around Steveston Harbour, including PMV's proposed marsh lands.

Staff have applied to the Province for access to Steveston Island to perform survey and geotechnical work as part of preliminary engineering work to develop Steveston Island as a dike.

The City owns all of the property on Lulu Island that boarders the proposed marsh and has riparian rights associated with this ownership. One of the riparian rights protects the City's access to navigable waters from its upland property. Therefore, if the proposed marsh interferes with this right, the City's permission may be required prior to any development of the proposed marsh.

Staff will continue to work with PMV, Small Craft Harbours and the Steveston Harbour Commission to develop plans that improve Steveston Harbour.

Sturgeon Bank

As identified in the City's Ecological Network Management Plan and the Dike Master Plan – Phase 1, both recently endorsed by Council, Sturgeon Bank is an environmental asset that also provides significant flood protection by dissipating wave energy in front of the west dike. Recent research indicates that the leading edge of the foreshore marsh habitat is receding rapidly (as much as 15 to 20 meters per year over the past 20 years). River training structures and channel dredging have greatly reduced the amount of sediment naturally deposited on Sturgeon Bank and play a large role in this erosion.

The City's Dike Master Plan – Phase 1 identifies potential flood protection issues associated with sea level rise with respect to the west dike. A primary concern is increased wave action on the dike facilitated by deeper water. The Master Plan identifies building barrier islands and strategically placing fill on sections of Sturgeon Bank as a potential long-term response to minimizing the impact of predicted sea level rise on the west dike.

In early 2014, City staff were invited by PMV to participate in a series of discussions to investigate potential habitat restoration works at Sturgeon Bank. The discussions have focused on establishing appropriate baseline reporting, goals, objectives, and next steps required to determine the feasibility of restoration at Sturgeon Bank. Preliminary restoration strategies have been discussed, including the deposit of dredge materials in the Sturgeon Bank tidal flats, with the intention to abate erosion of both the mudflats and the foreshore marsh leading edge (Attachment 1). This approach is congruent with the City's objectives regarding climate change adaptation for the foreshore habitats off of the West Dike as well as the City's Dike Master Plan – Phase 1.

In the late 1970's and again in the 1980's, the Fraser River Port Authority established a tidal marsh on the southern edge of Sturgeon Bank, on the north side of the Steveston Jetty at the mouth of the South Arm. This marsh was initially successful, however, storms caused significant damage to the marsh and it did not recover. PMV is proposing to re-establish and increase the footprint of this marsh with increased storm protection as part of the Sturgeon Bank restoration program (Attachment 1).

Staff will continue to participate in discussions with PMV and other stakeholders regarding the restoration of Sturgeon Bank.

Financial Impact

None at this time.

Conclusion

Funding for dredging operations in Steveston Harbour and other secondary channels has been problematic since 1998 when the Federal Government discontinued funding for dredging operations on the lower Fraser River. The western half of the harbour was dredged earlier this year through a three-way funding agreement between the Province, PMV and the City. PMV is proposing that the remainder of the harbour be dredged as part of a proposal to create marsh land at the east end of the harbour as part of PMV's Habitat Enhancement Program. This proposal has synergy with the City's Dike Master Plan – Phase 1 and could be constructed in a manner that supports both flood management and environmental objectives. PMV may require the City's permission to construct the marsh as the City has riparian rights associated with adjacent property.

Sturgeon Bank provides both environmental and flood protection benefits for the City. There is evidence that the habitat along the leading edge of the foreshore marsh is receding. These issues are influenced by river training structures and dredging that has reduced the transport and volume of sediment that would be naturally deposited on the bank. PMV is exploring habitat enhancement on Sturgeon Bank as part of their Habitat Enhancement Program. PMV has been receptive to staff's efforts to steering the process toward solutions that benefit both environmental and flood protection objectives.

Lloyd Bie, P.Eng.
Manager, Engineering Planning
(604-276-4075)

Lesley Douglas, B.Sc., R.P.Bio.
Manager, Environmental Sustainability
(604-247-4672)

LD/LB:ld/lb

Att. 1: Map of Proposed Enhancement Projects, Sturgeon Bank and Fraser River South Arm

Attachment 1: Map of Proposed Enhancement Projects, Sturgeon Bank and Steveston Harbour

City of Richmond

Report to Committee

To:	Public Works and Transportation Committee	**Date:**	June 25, 2014
From:	Tom Stewart, AScT. Director, Public Works	**File:**	10-6370-01/2014-Vol 01
Re:	**Cigarette Butt Recycling Program**		

Staff Recommendation

1. That the report titled "Cigarette Butt Recycling Program", from the Director, Public Works, dated June 25, 2014, be received for information.

2. That staff work with Vancouver Coastal Health Authority on strategies to reduce cigarette butt litter at the locations identified in this report.

Tom Stewart, AScT.
Director, Public Works
(604-233-3301)

Att. 2

REPORT CONCURRENCE	
CONCURRENCE OF GENERAL MANAGER	
REVIEWED BY STAFF REPORT / AGENDA REVIEW SUBCOMMITTEE	INITIALS:
APPROVED BY CAO	

Staff Report

Origin

At their November 20, 2013 meeting, the Public Works and Transportation Committee referred the issue of cigarette butt recycling to staff, as follows:

That Cigarette Butt Recycling Program be referred to staff to examine:

i) Whether the City has a cigarette butt problem,

ii) The details of the City of Vancouver's program, and

iii) If there are cigarette butt recycling programs other than that launched by the City of Vancouver.

This report responds to this referral and recommends engaging with Vancouver Coastal Health on strategies to reduce cigarette butt litter.

Analysis

Cigarette butts are generally considered the single highest item of discarded litter. According to the Great Canadian Shoreline Cleanup website, over 217,000 cigarette butts were removed through their 2012 clean up programs in British Columbia. Food wrappers and containers were the next highest at over 41,000 items.

In Richmond, there are isolated locations where larger quantities of butts may accumulate; however, the problem is not substantive on a large scale. Locations where larger quantities of cigarette butts will accumulate include:

- the Skytrain stations (Brighouse, Lansdowne, Aberdeen)
- the Richmond Centre bus stop
- the Chatham Street bus stop (south side, between 2nd Avenue and 3rd Avenue)
- northeast corner of No. 1 Road and Bayview Street

These are typical locations where larger groups of people congregate for somewhat longer periods of time. Currently, the City has installed cigarette butt disposal containers at the Skytrain stations (four at Brighouse, two at Lansdowne and one at Aberdeen). Staff are currently working to identify more durable containers as replacements due to vandalism issues. It is estimated that 25% of smokers will use these designated butt disposal containers.

Staff's current approach to address cigarette butt litter is on a site-specific basis, however, in a measured manner as part of discouraging the practice of smoking overall. In addition, identifying suitable locations for containers can be challenging given the need to balance City bylaw requirements with those locations where people will typically smoke and how far they will reasonably walk to dispose of their cigarette butts. City Public Health Protection Bylaw 6989 regulates where individuals may smoke, which includes restrictions within 6 metres of building openings or public transit, and 25 meters of any outdoor sport facility or playground (Attachment

1). Operational considerations include selecting a style of cigarette butt disposal container that will minimize vandalism (those attempting to gain access to the butts in the containers), and ensuring containers will minimize rainwater entry to make servicing containers easier.

Vancouver Program for Cigarette Butt Recycling

In November 2013, the City of Vancouver launched a pilot cigarette butt recycling program with TerraCycle. Through this program, TerraCycle provided 110 aluminum canisters and contracted Embers (a charity organization, which helps people living on low incomes to become economically self-sufficient) to assemble and install the canisters. TerraCycle owns the containers and is responsible for their maintenance, although there appear to be some challenges with how the maintenance aspect is being addressed due to a number of broken canisters, etc. The container design also permits some rainwater entry, which makes emptying the containers more difficult. Maintenance challenges are further compounded by vandalism from those who are trying to break into the bins to obtain the butts. These types of issues can present cost and resource implications.

In Vancouver, canisters are emptied by United We Can, a not-for-profit Vancouver-based agency which hires individuals from the downtown east side exclusively. United We Can is responsible for servicing the containers, and attempt to use plunger-type equipment to get all ashes out, use a strainer to drain water, and pick out any garbage, which has been placed in the canisters. This requires dedicated resource effort to service, empty and wipe down containers every two weeks (takes 1-2 employees between 5-9 hours to empty all 110 canisters). Butts must then be packaged and shipped to TerraCycle who pay United We Can an amount per pound (traditionally $1/lb of cigarette butts), plus $5/lb is donated to their organization by TerraCycle. As with container maintenance, the cost and resource implications of servicing canisters would need to be evaluated.

Collected cigarette butts are shipped to TerraCycle's head office in Toronto. TerraCycle has indicated that they aggregate and then ship the butts to processors in Pennsylvania or New Jersey for recycling. TerraCycle advises that the cigarette butts are mechanically shredded and separated into paper, tobacco and plastics. The tobacco, paper and ash are composted, and plastics are blended and recycled into plastic items such as plastic pallets, plastic decking and plastic lumber. They gamma radiate the plastics to kill contaminants before being recycled. This recycling process is as described by TerraCycle and has not been verified by staff through cross-party checks, etc.

Some challenges with the program include:

- The need to ensure canisters are in locations which comply with smoking bylaw requirements;
- The marginal effects the canisters have had on cigarette butt litter as noted in media reports;
- Vancouver Coastal Health concerns regarding potential negative public health consequences (e.g. increased second hand smoke exposure, etc.). Vancouver Coastal

Health has advised that the City of Vancouver is scaling down deployment of cigarette butt canisters.

- Staff have been unable to identify any other available recycling processes for cigarette butts. While the recycling process used by TerraCycle has not yet been verified, it is suggested practice to ensure broader access to alternative recycling markets before embarking on any recycling initiative to ensure a fallback approach is available in the event the intended market ceases to exist.

In consultations with Vancouver Coastal Health, they have indicated potential concerns that the presence of recycling containers may create de-facto smoking areas which could increase exposure to second-hand smoke, and could make smoking more socially acceptable. They also have concerns that a partnership with TerraCycle could lend unintended positive exposure and support to the tobacco industry overall, given they are the funding partner for TerraCycle's cigarette butt recycling program. While supportive of initiatives to remove cigarette butts from the environment, Vancouver Coastal Health wants to ensure the focus remains at actions designed to discourage smoking. They have provided the attached letter, Attachment 2, which includes their comments and recommendations on this issue.

Summary Comments

Staff do not recommend implementing a cigarette butt recycling program. It is not clear how effective this program has been overall in reducing cigarette butt litter, and there are important considerations relating to Vancouver Coastal Health concerns respecting unintended consequences such a program could potentially cause, i.e. potential back-peddling on the gains made to reduce smoking and exposure to second-hand smoke.

A collaborative approach with Vancouver Coastal Health which helps to formulate strategies to reduce cigarette butt litter, while at the same time ensuring continued focus on efforts designed to reduce smoking rates overall, may result in greater overall benefit and longer term gains.

Financial Impact

None.

If a similar initiative were implemented in Richmond, estimated cost impacts would include the provision of durable/vandalism-resistant containers, program coordination, and for maintenance and servicing (depending on the scale of the program/number of containers installed).

Conclusion

There are some isolated areas in Richmond where larger quantities of cigarette butts will accumulate; however, the problem is not significant on a broader city-wide scale. The current strategy is to evaluate the level of cigarette butt litter and install designated disposal containers, where required, on a selective basis. This approach helps to reduce cigarette butt litter yet maintain balance with environmental health considerations.

While Vancouver has initiated a cigarette butt recycling program, it is not clear the program has been successful in addressing the issue of cigarette butt litter. In addition, Vancouver Coastal Health has concerns that these types of programs could have unintended consequences in creating greater social acceptance of smoking and negatively impact the significant gains made in the region on smoking reduction programs.

Staff suggest working with Vancouver Coastal Health on strategies to address the cigarette butt litter concerns at the locations noted in this report, and in a manner which continues to support reduced smoking rates and second-hand smoke exposure.

Suzanne Bycraft
Manager, Fleet & Environmental Programs
(604-233-3338)

Att. 1: Bylaw 6989, Part 6.1 – Areas of Smoking Prohibition
2: Letter from Vancouver Coastal Health Authority dated June 10, 2014

Attachment 1

5.1.3.2 In the event the order given under the authority of subsection 5.1.3.1 is not complied with, the **Medical Health Officer** is further authorized to enter the property in order to carry out terms of the order to control **rodents** or **mosquitoes,** and in the event the costs are not paid within 30 days after being invoiced, the amount outstanding may be added to and form part of the taxes payable on the property as taxes in arrears."

SUBDIVISION SIX: SMOKING CONTROL AND REGULATION

PART 6.1: AREAS OF SMOKING PROHIBITION

6.1.1 A person must not **smoke**:

(a) in a **building**, other than:

(i) a **dwelling unit**;
(ii) a hotel or motel room or suite designated for **smoking** by an **operator**; or
(iii) enclosed **premises**:

A. that are not open to the public; and

B. where the only occupants of the **building** are the owner or owners of the **business** carried on in the **building**;

(b) in a **vehicle for hire**, other than in Class J (rental vehicles) and Class M (tow trucks);

(c) in a **vehicle** when any other occupant of the **vehicle** is under the age of nineteen (19) years of age;

(d) in, or within three (3) metres of, an enclosed or partially enclosed shelter where persons wait to board a **vehicle for hire** or public transit;

(e) within six (6) metres of a sign post or sign indicating where persons wait to board a **vehicle for hire** or public transit;

(f) within six (6) metres measured on the ground from a point directly below any point of any opening into any **building** including any door or window that opens or any air intake;

(g) in a **customer service area**; or

(h) within six (6) metres of the perimeter of a **customer service area**.

6.1.2 Except as permitted in section 6.1.1, a **responsible person** for any of the following:

(a) a **business** which occupies a **building** or **premises**;

(b) a hospital or health clinic;

(c) a **place of public assembly**;

(d) a **customer service area**;

(e) the **common area** of a **building**;

(f) a **building, premises** or facility that is owned or leased by the **City**, other than a rented one-family dwelling or **dwelling unit**; or

(g) a **vehicle for hire**, other than Class J (rental vehicles) and Class M (tow trucks)

must not permit, suffer or allow a person to **smoke** while the person is:

(h) within any such **building, premises**, place, **common area**, **customer service area** or **vehicle for hire**; or

(i) within any area described in subsections 6.1.1 (e) and 6.1.1 (g), except to the extent that all or part of such area is not part of the parcel on which the **building** or **customer service area** is situated and is not an area over which the **responsible person** has possession or control; and

in accordance with Part 6.2, must post and maintain a sign indicating that **smoking** is prohibited within that **building, premises**, place, **common area**, **customer service area** or **vehicle for hire**.

PART 6.2: SIGN REQUIREMENTS

6.2.1 A person who is required to post and maintain a sign under this Subdivision must ensure that each required sign:

(a) is **prominently** displayed and maintained at the location where the sign is required;

(b) carries the text "No Smoking", in either capital or lower case letters or a combination of both;

(c) consists of two contrasting colours, or if the lettering is to be applied directly to a surface or to be mounted on a clear panel, the lettering must contrast with the background colour;

Attachment 2

Office of the Medical Health Officer
Vancouver Coastal Health – Richmond
9th Floor - 8100 Granville Ave.
Richmond, BC V6Y 3T6

June 11, 2014

Ms. Suzanne Bycraft
Manager, Fleet and Environmental Programs
City of Richmond
6911 No. 3 Road
Richmond, BC V6Y 2C1

Dear Ms. Bycraft,

Re: Cigarette Butt Recycling

Thank you very much for contacting VCH Public Health regarding cigarette waste. We understand that the City is exploring options to reduce cigarette butt litter in public spaces. We also understand that one of the options the City is considering is a project similar to TerraCycle's Cigarette Waste Brigade[i]. We offer the following comments as the City's public health agency.

While we do recognize the need to reduce cigarette litter, Vancouver Coastal Health does not support the TerraCycle Cigarette Waste Brigade program or anything similar. Cigarette butt receptacles often become unofficial designated smoking areas and create a higher concentration of secondhand smoke wherever they are placed[ii]. Moreover, TerraCycle's Cigarette Waste Brigade is funded by Imperial Tobacco [iii iv], the largest tobacco company in Canada, a company whose product will kill up to 50% of long-term users[v].

With less than 8% of the residents currently smoke (Healthy Richmond Survey 2012), the City of Richmond has one of the lowest smoking rates in BC, an achievement that I am sure the City would like to see sustained. However, installing cigarette waste receptacles throughout the City is an unproven method[vi] with potential unintended negative public health consequences[vii].

In communities where they have been installed, these receptacles are often placed within designated no-smoking zones in front of doors, windows and air intakes. This kind of a placement has the potential to undermine the City of Richmond's Public Health Protection bylaw, skirt efforts to de-normalize public smoking, and contribute to an increased concentration of toxic secondhand smoke in the area when tobacco users congregate around the waste receptacle[viii]. As the City Staff Report indicates, 75% of the smokers simply choose to ignore the receptacle; therefore installation of receptacles is inadequate in addressing the cigarette butt litter issue.

The Cigarette Waste Brigade, while seeming well intentioned, is a tobacco industry funded initiative. A review of the tobacco industry documents released through court order demonstrated that "the tobacco industry's cigarette butt litter programs had three goals: (1) to 'prevent' cigarette litter from

impacting the social acceptability of smoking ; (2) to 'remove' cigarette litter as an issue leading to bans/restrictions and (3) to ensure that the tobacco industry was not held practically or financially responsible for cigarette litter (the industry argues that 'the responsibility for proper disposal lies with the user of the product)." [ix] The World Health Organization considers such programs as tobacco industry interference with tobacco control activities[x]. Cigarette butts currently being made in Canada are non-biodegradable and are the number one littered item in our country[xi] and the world[xii]. Programs such as TerraCycle's Cigarette Waste Brigade gives the false impression to environmentally conscious consumers and members of the public that the solution to cigarette litter is cigarette butt recycling rather decreasing tobacco consumption[xiii].

There are solutions for addressing cigarette butt litter that align with positive public health outcomes. A comprehensive solution developed in partnership with Vancouver Coastal Health could include social marketing strategies to shift public attitudes on littering, litter clean up strategies including a deposit return program, fines for littering, strengthen existing city bylaws to further reduce smoking in public places, and implementation of a waste tax to fund these efforts. An example of a successful program is the City of Edmonton's Capital Cleanup Program which could serve as a model[xiv]. Another example is a cigarette waste tax that has been implemented in municipal jurisdictions such as San Francisco to fund cigarette litter clean-up programs.

In finding a solution to cigarette waste, we encourage the City to be wary of being unwittingly co-opted into being part of the tobacco industry's marketing strategy. The City of Vancouver unfortunately made the decision to engage TerraCycle Cigarette Waste Brigade last year without Vancouver Coastal Health's prior knowledge. Vancouver is currently scaling down the deployment of the TerraCycle receptacles. The City of North Vancouver recently decided not to engage the TerraCycle Cigarette Waste Brigade after being made aware of the link to the tobacco industry. Vancouver Coastal Health would be more than happy to work with the City to develop a comprehensive approach to decreasing cigarette butt litter in Richmond.

Yours truly,

Dr. James Lu MD, MHSc
Medical Health Officer, Richmond
Vancouver Coastal Health

CC Claudia Kurzac, Manager Health Protection Richmond, VCH
Dalton Cross, Senior Environmental Health Officer, VCH

2

Attachment 2 (Cont'd)

Office of the Medical Health Officer
Vancouver Coastal Health – Richmond
9th Floor - 8100 Granville Ave.
Richmond, BC V6Y 3T6

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[xiii] Forsythe, J. (2010). Smoke-Free Outdoor Public Spaces: A Community Advocacy Toolkit. Physicians for a Smoke-Free Canada, Ottawa, Ontario.

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City of Richmond

Report to Committee

To:	Public Works and Transportation Committee	**Date:**	June 26, 2014
From:	Tom Stewart, AScT. Director, Public Works Operations	**File:**	10-6375-05/2014-Vol 01
Re:	**Report 2013: Achieving Goals Through Community Engagement**		

Staff Recommendation

That the annual report titled, "Report 2013: Achieving Goals Through Community Engagement" be endorsed and made available to the community through the City's website and through various communication tools including social media channels and as part of community outreach initiatives.

Tom Stewart, AScT.
Director, Public Works Operations
(604-233-3301)

Att. 1

REPORT CONCURRENCE	
CONCURRENCE OF GENERAL MANAGER	
REVIEWED BY STAFF REPORT / AGENDA REVIEW SUBCOMMITTEE	INITIALS:
APPROVED BY CAO	

Staff Report

Origin

The City has established a waste diversion target of 70% by 2015, aspiring to 80% by 2020 in accordance with the regional Integrated Solid Waste and Resource Management Plan (ISWRMP). As well, the City's vision for sustainability includes a key goal to be a Recycling Smart City. The City offers a number of waste reduction and recycling programs to the community in working toward these targets. To help support full utilization of recycling programs and services in Richmond, the City also implements a range of communication and outreach programs to ensure residents are aware of the services available and understand how to use them.

The annual "Report 2013: Achieving Goals Through Community Engagement" (The Report) is presented (Attachment 1) to track progress on these programs and report back to the community. This report summarizes Richmond's comprehensive programs, highlights results achieved in 2013, provides insights into upcoming initiatives, and includes tips and resources to support recycling and sustainable waste management.

This report supports Council's Term Goal #8 Sustainability:

> *8.1: Continued implementation and significant progress towards achieving the City's Sustainability Framework, and associated targets. A key component of the sustainability framework is the Solid Waste Strategic Program within the goal area of Sustainable Resource Use.*

Analysis

The Report highlights outcomes from the expanded services, introduced in 2013, and the importance of communication, outreach and community engagement as key to supporting residents in their recycling. The City continues to expand its services to provide convenient recycling programs that are easy to use, and each year increases the range of products accepted at the Richmond Recycling Depot. At the same time, the City has remained committed to ensuring residents are informed about the progressive suite of recycling services available to them, including details on how to use each program. Success with this combination of service delivery and outreach is measured by the continued increase in recycling and waste diversion along with continued low contamination levels thanks to residents sorting their recycling properly.

The most notable success measure for 2013 is the achievement of 70% waste diversion for single-family residents – two years ahead of the goal for 2015. This is an increase of 9% over 2012 levels. With the launch of the new Green Cart program, increasing amounts of food scraps and yard trimmings were collected curbside in 2013, i.e. nearly 4,000 tonnes more than the prior year. The new Large Item Pick Up program launched in June 2013 increased access to residents for disposing of large items from the convenience of their curbside. In 2013, over 8,235 items were collected with approximately 200 tonnes recycled.

The Report features outreach and community engagement as a key contributor to increased recycling at home and while at community events thanks to hosted recycling stations by Richmond's Green Ambassadors. City staff reach out to the community by hosting recycling displays at local shopping centres to share information and educational materials, answer questions and engage community members in fun activities that emphasize how to use recycling programs. Richmond's outreach also includes connecting with students who share their commitment to recycling at school and at home. Richmond's partnership with schools provides important recycling and litter management information to students using fun and engaging shows, and then reinforces those behaviours through contests that turn the new ideas and tips into action.

The "Report 2013: Achieving Goals Through Community Engagement" highlights key accomplishments, which included the:

- Achieved 70% waste diversion from single-family homes.
- Recognized with a Golden Shovel Award for excellence in environmental leadership and stewardship.
- Launched the new and enhanced Green Cart program to single-family homes and expanded the program to include townhomes who also receive City garbage and/or Blue Box Recycling services.
- Launched the new Large Item Pick Up program.
- Initiated a multi-family food scraps recycling program to test options for Green Cart recycling.
- Expanded collection services including Styrofoam, batteries, cell phones and plastic bags, as well as completed surface improvements at the Richmond Recycling Depot.
- Expanded communication and community outreach, including student engagement through the Green Ambassador program along with educational shows and contests for elementary school students.
- Assisted with more than 20,000 calls on the Environmental Programs Information Line and completed updates to the Integrated Voice Response (IVR) system tailored to customer information priorities.
- Expanded on-line tools and resources through the City's website including on-line purchase of extra garbage tags for curbside pickup, and garbage disposal vouchers for use at the Vancouver Landfill.

Proposed Communication

Subject to Council's approval, the annual "Report 2013: Achieving Goals Through Community Engagement" will be posted on the City's website and made available through various communication tools including social media channels and as part of community outreach initiatives.

Report 2013 Overview

The 2013 report contains four chapters that summarize outcomes and accomplishments in current waste management and recycling services, and highlights the variety of public education/community outreach programs delivered across the city. The report also includes a

comprehensive tips and resources section. The report content features information to raise awareness about how recycled materials are used as a new resource, and tips for residents to help them connect with City and product stewardship programs for disposing of a variety of items.

A summary overview of each chapter follows.

Chapter 1: Annual Outlook – Community Engagement to Increase Recycling highlights the importance of communication and outreach to increase awareness about programs and how to use them, as well as community engagement to gain insight into what residents want in their recycling programs. The Annual Outlook features the achievements from the past year, including the valuable contributions by Green Ambassadors, and the continued success of partnership with schools. This section also provides a brief summary of the new initiatives and service targets for the upcoming year.

Chapter 2: Programs and Services – Expanding Services to Make Recycling Easy and Convenient describes the City's comprehensive recycling and waste reduction initiatives and highlights how each program contributes to overall diversion targets and sustainability goals. Details on the quantities collected through programs such as Blue Box, Blue Cart, the Recycling Depot, Yard Trimmings Drop Off, Green Cart, the Multi-family Green Cart Pilot Program and litter collection services are provided. This section also includes helpful information on tipping fee trends, materials that are banned or prohibited from disposal, and measures the City takes to promote recycling space in commercial and multi-family buildings.

Chapter 3: Outreach and Customer Service – Connecting with Community for Shared Success presents the City's commitment to support waste reduction and reuse by providing residents information and education through workshops and displays. Our extensive public education and community outreach initiatives aim to raise awareness and foster sustainable behaviours where recycling and waste reduction practices become a way of life. Free workshops on composting, waste reduction, eco-cleaning, reuse and more are offered throughout the year, as are outreach displays at various events and in local shopping centres. City staff partner with the Richmond School District to engage both high school and elementary school students to promote sustainable stewardship behaviours. They learn about how to recycle and reduce litter, and then they practice those skills through school contests. City staff members also mentor the high school Green Ambassadors by hosting information-sharing meetings and coordinating these volunteers as they assist with public spaces recycling centres at community events.

Chapter 4: Tips and Resources – This section provides a comprehensive guide to recycling. It includes specific information on how and what to recycle in the City's Blue Box, Blue Cart and Green Cart programs. There is information on how to compost at home, the items accepted for recycling at Richmond's Recycling Depot, and what do to with many household items ranging from flower pots to recyclable mattresses and box-springs. The resources section also includes information on what to do with special waste items and banned materials, including recycling and disposal options through take-back programs. There is also contact information and locations for Richmond services and community partners involved in stewardship programs.

Moving Forward
As the City continues to grow and expand our services to further advance toward 70% waste diversion for all residents, key focus areas going forward include:

- Expand Blue Box and Blue Cart recycling through partnership with Multi-Material BC (MMBC),
- Explore initiatives to increase recycling in multi-family, mixed use and potentially the commercial sector,
- Expand food scraps recycling for residents in multi-family developments,
- Build on enhanced community outreach to increase participation in existing and emerging recycling programs,
- Expand organics recycling at City facilities,
- Conduct a building demolition waste recycling pilot project,
- Adopt a policy with recycling targets for waste reduction and recycling of materials from demolition and construction activities at City facilities,
- Continue to expand and broaden the City's public spaces recycling program,
- Explore Eco-Centre centre concept, including possible expansion of services at the Richmond Recycling Depot; and
- Continue involvement in regional planning and implementation efforts for the ISWRMP.

Financial Impact

None. Programs related to solid waste that impact service levels are brought to Council for review and consideration throughout the year.

Conclusion

Through the annual "Report 2013: Achieving Goals Through Community Engagement", the City is providing its residents with a progress report of the many recycling and waste management programs and activities delivered in the community. The report also serves as a comprehensive resource and guide that supports recycling, reuse and reduction activities throughout the year. By tracking progress towards its goals for waste diversion and reporting this to the community, the City is demonstrating Richmond's commitment to responsive services, responsible government and accessible information and communication.

It is through residents' participation and commitment to recycling that those living in single-family homes have achieved 70% waste diversion in 2013 – two years ahead of the 2015 target. Future years will see continued efforts to expand recycling services to residents in multi-family homes as part of helping all residents work toward achieving the 70% waste diversion target.

Suzanne Bycraft
Manager, Fleet & Environmental Programs
(604-233-3338)

Attachment 1

ACHIEVING GOALS THROUGH COMMUNITY ENGAGEMENT

Let's trim our waste!

Richmond


LET'S
TRIM
OUR
WASTE!

CONTENTS


RICHMOND IS A RECYCLING SMART CITY
Let's trim our waste!
EXPANDING OUTREACH TO ACHIEVE OUR GOALS

ANNUAL OUTLOOK

COMMUNITY ENGAGEMENT TO INCREASE RECYCLING

AWARENESS ABOUT RECYCLING IS INTEGRAL TO ACHIEVING GOALS

With its extensive array of programs and services, the City of Richmond makes it easy and convenient for residents and visitors to recycle, but its ultimate success lies with the community. Thanks to residents who use the City's recycling programs, those living in single-family homes are now diverting 70% of their waste from the landfill – two years ahead of schedule.

This resounding success is due to the City's formula of implementing recycling programs and services tailored to residents' needs and interests, combined with effective communication and community outreach. The City intends to build on recycling services available to residents in multi-family homes to also help them reach the 70% waste diversion target by 2015. Richmond recognizes that simply providing services is not enough. It's equally important to raise awareness about why recycling is needed, provide details on the programs available, and provide instructions on how to use each program. Community engagement is the essential link to maximize the benefits of City recycling programs by prompting increased participation in recycling. Residents not only have access to services, they understand how to use each program and take personal ownership of their household recycling and waste management. Their commitment to recycling translates into Richmond's success as it strives to be a Recycling Smart City.

Community engagement and outreach are particularly important when introducing new programs. In 2013, Richmond launched its new and enhanced Green Cart program, which involved more than 29,000 single-family homes and 11,000 townhomes. The Green Cart program was an enhanced service for single-family homes and a new service for townhomes. To reach residents and the community overall, Richmond applied multiple communication tactics ranging from direct communication to homeowners to broader community information campaigns. Richmond designed its communication materials to address barriers such as resistance to food scraps recycling, and reinforced key messages about the upcoming ban on food scraps disposal and the easy steps to use Green Carts. The success of its communication outreach and operational planning was evident during the seamless launch of the new program followed by extensive use of Green Cart recycling throughout the community.

In addition to the Green Cart program roll out, Richmond continued to expand its recycling services in 2013 through both its curbside collection programs and drop-off options at the Richmond Recycling Depot. Richmond's Recycling Depot expanded the materials accepted to include Styrofoam, used books, batteries, cellphones and plastic bags. The City's new Large Item Pick Up program was also launched in 2013, making it easier for residents to recycle and safely dispose of larger household items like appliances and furniture.

To help ensure residents can maximize the benefits of these programs, Richmond created new information materials and hosted information displays to raise awareness about how to recycle. The redesign of the Richmond Collection Calendar for 2013 provided a more user-friendly reference guide to the many City services available, along with tips and information on the most recent program enhancements. Residents learned about the new programs and initiatives through information kits delivered to their homes, newspaper advertising, transit shelter ads and online via the City's website and Facebook page. Richmond also provided helpful seasonal reminders, such as tips for recycling pumpkins following Halloween and ideas for reducing waste and increasing recycling during the Christmas holidays.

CITY OF RICHMOND

Residents in single-family homes achieved 70% waste diversion in 2013 – two years ahead of schedule!

In addition to these communication methods, Richmond goes out into the community to share information and provide tips and resources residents can use at home. Staff reach out to residents at hosted displays in local malls, including Richmond Centre, Aberdeen Mall and Yaohan Centre and through information sessions with residents and townhome stratas. Staff and volunteers help with recycling at community festivals and other events, and engage people through games and other activities. These event recycling centres and information displays help to raise awareness about recycling in Richmond.

Richmond's youth are integral to generating awareness and understanding about how to recycle and why it's important to our future. As members of Richmond's Green Ambassador program, these youth volunteers dedicate hundreds of hours to help at events, share their expertise in recycling and demonstrate leadership in the community. Their energy, enthusiasm and commitment to environmental stewardship are a tremendous asset in the community. In 2013, more than 185 students volunteered as Green Ambassadors to support community outreach.

As well, the City's outreach includes educational programs. Working with the school district, the City funds entertaining theatrical programs at elementary schools to promote the importance of recycling and keeping the City litter free. As well, Richmond offers free workshops that promote recycling and waste reduction using simple tactics that can easily be applied at home. More details on these programs are highlighted in the Outreach and Customer Service section of this report.

Together, the combination of effective, responsive services and proactive community engagement and outreach have helped Richmond achieve its goals to reduce waste and increase recycling as a more sustainable approach to waste management. With residents in single-family homes now recycling 70% of their waste, the City is well-positioned to move forward towards the aspirational goal for 80% reduction by 2020 for these residents. The City also intends to review added recycling services for residents in multi-family complexes to help them achieve stated recycling objectives. The City remains committed to achieving excellence in its recycling services to benefit all residents today and in the future.

THREE EASY STEPS

Richmond can achieve its targets with the help of community commitment to these three easy steps to reduce waste:

OUR GOALS

Richmond has set its long-term goal to be a Recycling Smart City and has established annual goals to help achieve this target. Each goal is designed to provide easy and convenient services for residents, along with creating opportunities for innovation, partnership and continuous improvement.

1 **Multi-family food scraps recycling**
Report to Council with pilot program results and recommendations to expand food scraps recycling to residents in multi-family complexes in preparation for the planned regional disposal ban on food scraps scheduled for 2015.

2 **Garbage Cart Pilot Program**
Test service level options for garbage collection using carts, including weekly versus bi-weekly collection, optional cart sizes and price incentives for reducing garbage.

3 **Organics recycling at City facilities**
Expand the City of Richmond's successful compost collection program to a full organics food scraps recycling program, including a staff awareness and education campaign.

4 **Packaging and printed paper stewardship program**
Expand the Blue Box and Blue Cart recycling programs to include a broader range of materials through partnership with Multi-Material BC (MMBC).

5 **Expand community outreach**
Build on the success of existing outreach and education programs to deliver workshops, theatrical shows, contests and the third annual REaDY Summit, along with engagement of youth through the Green Ambassador program.

6 **Expand recycling of building demolition waste**
Conduct a pilot project with the small building industry to trial different methods of recycling housing demolition materials and explore options to expand commitment to recycling of construction and demolition materials at City facilities.

7 **Explore eco-centre concept**
Explore options including expansion of the City's existing Recycling Depot into a larger facility that accepts a much broader range of materials and offers additional services such as a re-use centre and education facility.

8 **Increase awareness and understanding of sustainable waste management**
Implement a quarterly "Let's trim our waste!" communication campaign to raise awareness about the importance of recycling and waste reduction and promote increased use of Richmond's programs and services.

9 **Expand public spaces recycling**
Accept an expanded range of materials for recycling in public spaces and enhance the container replacement program.

CITY OF RICHMOND

OUR TOP ACCOMPLISHMENTS IN 2013

The following are some of the key accomplishments in 2013:

GREEN CART PROGRAM

Implemented the new and enhanced Green Cart program for recycling food scraps and yard trimmings to reach approximately 41,000 single-family homes and townhomes. In the first four months, single-family residents were recycling 68% of their garbage – up 7% from the prior year.

COMMUNITY OUTREACH

Hosted 18 information displays and coordinated 14 adult workshops about composting, harvesting compost, eco-cleaning and how to make used items new again.

GOLDEN SHOVEL AWARD

Recognized for environmental leadership and stewardship with the "Golden Shovel Award" presented by Harvest Power.

RECYCLING DEPOT IMPROVEMENTS

Upgraded the Richmond Recycling Depot through paving to improve surfaces and reduce dust, and expanded accepted materials to include Styrofoam, books, batteries, cell phones and plastic bags.

LARGE ITEM PICK UP PROGRAM

Introduced a new Large Item Pick Up program to approximately 41,000 single-family homes and townhomes as an added level of service to make it easier for residents to recycle and safely dispose of large household items. Over 325 tonnes of materials have been collected in 2013 for proper disposal and recycling.

CUSTOMER SERVICE

Updated the Integrated Voice Response service and assisted with more than 20,000 customer calls to the Environmental Programs Information Line. Sold 68 compost bins, 9,261 Garbage Tags and 853 Garbage Disposal Vouchers out of the City's Recycling Depot and other City facilities.

MULTI-FAMILY FOOD SCRAPS PILOT

Launched a 15-month pilot program for food scraps recycling in apartments and condominiums involving approximately 5,500 units to test options for effective Green Cart recycling in these complexes.

STUDENT ENGAGEMENT

Sponsored the second annual Richmond Earth Day Youth (REaDY) Summit, involving more than 450 delegates from eight high schools with leadership by 120 Green Ambassadors who assisted at the event. Engaged students and staff through theatrical productions to raise awareness about recycling, litter problems and reducing waste and reinforced benefits through two school contests: "My School Sparkles" and "Zero Heros" involving more than 3,800 students and 200 teachers.

THANK YOU RICHMOND RESIDENTS

70% waste diversion goal achieved by single-family residents in 2013!

Richmond's goals to reduce waste are being achieved through the dedication of Richmond residents, and 2013 is a year to celebrate thanks to their commitment to recycling. This past year, residents in single-family homes achieved the City's goal to keep 70% of household waste out of the landfill. This important target has been achieved two years ahead of schedule, and the credit for this achievement goes to the residents who make it a priority to recycle using the City's Blue Box program, Green Cart program and Richmond Recycling Depot. The City will continue to work with all residents to increase recycling, including expanding services and engaging residents living in multi-family complexes like condominums, townhomes and apartments.

Residents are also integral to the design and implementation of new programs and services. Thanks to their feedback through pilot programs, surveys and input at community displays, Richmond is gaining insight into opportunities for enhancing services tailored to the needs and interests of residents. Through community engagement and outreach, Richmond is proud to connect with residents to increase awareness of the many recycling and take-back programs and services available, as well as provide tips and resources to ensure that recycling in Richmond remains easy and convenient for all residents.

Working together, residents, community, industry partners and the City of Richmond can achieve targets to reduce garbage and create a more sustainable approach to waste management. Thank you for recycling, for reducing waste and for sharing ideas and feedback that contribute to this continuous improvement.

DID YOU KNOW?

It's more expensive to dispose of garbage than it is to recycle. Garbage disposal costs are currently about 40% higher than recycling costs, and landfill fees continue to increase. This means recycling is not only good for the environment, its also more cost effective too.


CITY OF RICHMOND
2
FIRST TARGET ACHIEVED IN 2013
8

PROGRAMS AND SERVICES

EXPANDING SERVICES TO MAKE RECYCLING EASY AND CONVENIENT

Richmond residents in single-family homes are now diverting 70% 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 opportunities for residents to recycle by creating new and enhanced programs for recycling at home and when on the go in the community. To support use of new programs, Richmond makes communication and community engagement a priority to encourage and assist residents as they expand their household recycling. Residents can also drop off a growing list of recyclable items at the City's Recycling Depot and other drop-off facilities.

Richmond works with residents, industry partners, product stewardship groups and businesses to achieve its goal to be a Recycling Smart City and implement sustainable waste management.

Residents in single-family homes are now diverting 70% of their waste.

RICHMOND RECYCLING AND WASTE MANAGEMENT

Richmond delivers a wide range of recycling and waste management services for residents to ensure that all waste is managed effectively and efficiently, and adheres to sustainability principles. In 2013, Richmond began work with industry partners to explore opportunities to expand Blue Box and Blue Cart recycling. The following are the key recycling and waste management services offered through the City of Richmond.

BLUE BOX

Weekly curbside collection for recycling paper and newsprint, glass, plastic containers, and tin and aluminium containers. This program is provided to more than 40,220 residential units in single-family homes and townhomes. For details on this program, see page 32.

BLUE CART

Weekly recycling collection for paper and newsprint, glass, plastic containers, and tin and aluminium containers. This program is provided to more than 29,545 multi-family units. For details on this program, see page 34.

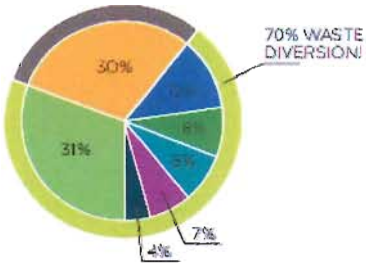
GREEN CART

Curbside collection for recycling foods scraps and yard trimmings. This program is provided to residents in single-family homes and some townhomes. For details on this program, see page 36.

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 Depot also sells compost bins, rain barrels, Garbage Tags and Garbage Disposal Vouchers for use at the Vancouver Landfill. For details on this program, see page 40.

SINGLE-FAMILY RECYCLING



- FOOD SCRAPS / YARD TRIMMINGS (14,236.88 TONNES)
- BLUE BOX (5,813.24 TONNES)
- RECYCLING DEPOT (3,290.94 TONNES)
- HOME COMPOSTING & YARD TRIMMINGS DROP OFF (3,664.12 TONNES)
- GARBAGE (14,170.39 TONNES)
- WASTE DIVERSION (3,771 TONNES)*
- WASTE REDUCTION (1,857.79 TONNES)*

Residents in single-family homes recycled or reduced nearly 32,633.97 tonnes in 2013 – 70% of total estimated waste generated – through a number of recycling and waste reduction opportunities, including curbside and Recycling Depot collection, as well as composting programs.

* Estimated

GO! RECYCLE 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 stop.

COMPOSTING AT HOME

Support for residential composting includes the sale of compost bins, a composting demonstration garden and related workshops. These services are available to all residents. For details, see page 37.

CURBSIDE GARBAGE COLLECTION

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. For details, see page 38.

EXTRA GARBAGE DISPOSAL

Garbage disposal tags and vouchers for the Vancouver Landfill provide options for residents when they need to dispose of additional garbage or large items. For details, see page 38.

LARGE ITEM PICK-UP PROGRAM

Residents in single-family homes and some townhomes can arrange for curbside collection of four large household items per year. For details, see page 39.

COMMUNITY AND SCHOOL ENGAGEMENT

Through partnerships with students, teachers and the School District, Richmond sponsors educational shows, awareness programs and volunteer opportunities to increase understanding of recycling and the benefits of reducing waste. For details see the Outreach and Customer Service section on page 25.

DID YOU KNOW?

Plastic takes one million years to break down in a landfill, whereas recycled plastic can be used to make bottles, clothing, carpet, picnic tables, drainage pipes, bags, trash cans, paneling, flower pots and pallets.

RESIDENTIAL RECYCLING PROGRAMS

With weekly collection services, drop-off programs, public spaces recycling and community take back programs, it's easy and convenient to recycle in Richmond. Richmond offers residents a range of services to support recycling at home and on the go.

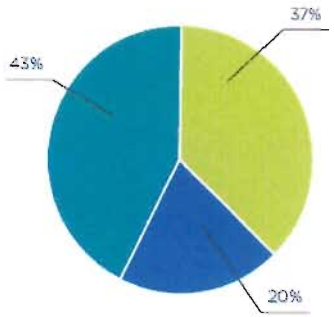
BLUE BOX RECYCLING PROGRAM

The Blue Box Recycling program provides convenient collection services in the community. Residents in single-family homes and some townhome complexes use the City's Blue Box program to recycle newspaper, paper products and cardboard along with tin, aluminium, glass bottles and jars, and plastic containers. More than 40,220 residential units are serviced with weekly collection under this program.

In 2013, more than 6,590 tonnes of materials were recycled in the Blue Box program. Of this, 43% was mixed paper, 37% was newspaper and 20% was co-mingled containers.

Items that can be recycled through this program are listed in the Tips and Resources section of this publication and at www.richmond.ca/recycle.

BLUE BOX RECYCLING MIX



BLUE CART RECYCLING PROGRAM

People who live in multi-family complexes can recycle the same products as residents who use the Blue Box program through the City's Blue Cart recycling program. The City provides recycling carts for a mini-recycling depot at each complex, which is generally located in the garbage enclosure or other convenient location. This service is currently available to over 29,545 multi-family units, and the City has information tools such as Blue Cart decals, posters and brochures that are offered to stratas and property managers to help raise awareness and increase participation.

In 2013, more than 2,220 tonnes of materials were recycled through the Blue Cart recycling program.

For a detailed list of items that can be recycled through the Blue Cart recycling program, see the Tips and Resources section or visit www.richmond.ca/recycle.

TIP FOR RESIDENTS

Residents in single-family homes and some townhomes can pick up complimentary Blue Box supplies at the Richmond Recycling Depot and City Hall, or order them online at www.richmond.ca/recycle.

Residents in multi-family complexes with Blue Cart service can pick up an indoor collection bag at Richmond Recycling Depot or order a bag online at www.richmond.ca/recycle.

+

= **8,820.68 TONNES RECYCLED IN 2013**

2,228.77 TONNES **6,591.91 TONNES**

CITY OF RICHMOND

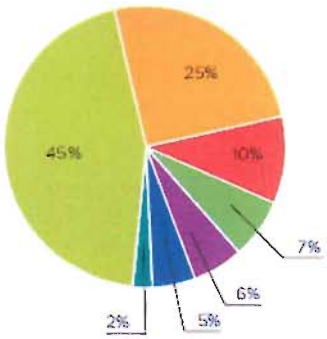
RECYCLING DEPOT PROGRAM

The Richmond Recycling Depot is located at 5555 Lynas Lane and is open from 9:00 a.m. – 6:15 p.m., Wednesday to Sunday for drop off of a broad range of materials. The Depot also sells compost bins, rain barrels, Garbage Tags and Garbage Disposal Vouchers. The Recycling Depot is a Product Stewardship (Take Back) collection site for small appliances, paints, solvents, flammable liquids, pesticides, lights and lighting fixtures.

RECYCLING DEPOT SERVICES

This facility accepts a wide range of materials including cardboard, yard and garden trimmings, mixed paper and newspapers, and now also accepts Styrofoam, used books, cell phones, household batteries and plastic bags. The facility also accepts large appliances (e.g. fridges, stoves, washing machines), metal items (e.g. bike frames, barbecues, lawn mowers), glass bottles, jars, tin and aluminium cans, paints, pesticides and solvents. For a detailed list of items see page 41. The Recycling Depot is owned and operated by the City of Richmond, with two full-time staff and additional staff support in the summer months to manage increased recycling volumes. Staff on site are available to answer questions and provide assistance with unloading awkward or heavy items.

DEPOT RECYCLING: BREAKDOWN OF MATERIALS COLLECTED IN 2013



- YARD TRIMMINGS (1,476.34 TONNES)
- SCRAP METAL (806.27 TONNES)
- MIXED PAPER (319.55 TONNES)
- CARDBOARD (197.33 TONNES)
- NEWSPRINT/MAGAZINES (179.68 TONNES)
- CONTAINERS (74.48 TONNES)
- PRODUCT STEWARDSHIP (237.29 TONNES)

TOTAL TONNAGE = 3,290.94

In 2013, 3,290.94 tonnes of recyclable materials were collected at the Recycling Depot. This includes yard trimmings, scrap metal, mixed paper products and rigid plastic containers. For more information on drop-off programs for yard trimmings, see page 17.

DEPOT RECYCLING: MATERIALS AND AMOUNTS COLLECTED THROUGH TAKE BACK PROGRAMS IN 2013

PAINT
207,360 EQUIVALENT LITRES

AEROSOLS
1,400 EQUIVALENT LITRES

SOLVENTS & PESTICIDES
10,800 EQUIVALENT LITRES

SMALL APPLIANCES
79.69 TONNES

CFLS
136 BOXES

4' TUBES
253 BOXES

8' TUBES
35 BOXES

FOR SALE AT THE RECYCLING DEPOT

Residents can purchase the following items from the Depot:

- Compost bins - $25 each
- Rain barrels - $30 each
- Extra Garbage Tags - $2 each
- Garbage Disposal Vouchers - $5 each for Richmond residents and it is worth $20 at the Vancouver Landfill

NEW IN 2013

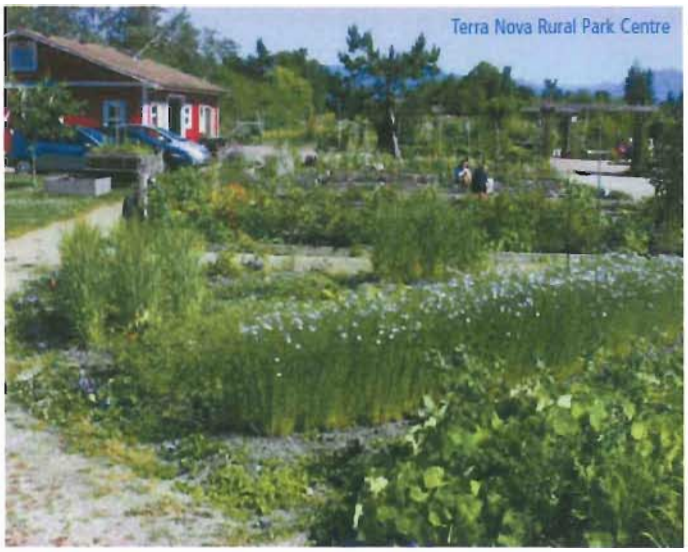
In 2013, Richmond expanded its free drop-off program to include:

- Styrofoam;
- Batteries (household batteries 5 kg or under);
- Cell phones;
- Used books; and
- Plastic bags.

For a full list of items that can be recycled at the Recycling Depot, see page 41.

TIP FOR RESIDENTS

Fats, oils and grease should never be disposed down sinks, drains or garburators as the material hardens and builds up on the inside of sewage lines, causing blockages. This can lead to breaks and sewage spills or overflows. Recycle food scraps and grease in your Green Cart, and take used cooking oils and liquid fats in a sealed container to the Recycling Depot (5555 Lynas Lane, open Wednesday to Sunday from 9:00 a.m. to 6:15 p.m.) for free disposal.


Terra Nova Rural Park Centre

COMPOSTING PROGRAMS

Composting is a simple and organic process that can reduce household waste by up to 40%—significantly reducing the amount of waste that goes to the landfill. Fruit and vegetable peelings, along with grass, leaves and other yard trimmings, can be added to a compost bin. In addition, composted matter produces a very nutrient-rich soil to keep lawns and gardens healthy.

BACKYARD COMPOST BIN DISTRIBUTION PROGRAM

The City of Richmond supports composting by providing free composting workshops from January to November, which include information on backyard and worm composting and how to harvest compost. The City offers compost bins for sale at the Recycling Depot for $25 each. Backyard composting is the most effective way to dispose of fruit and vegetable peelings, eggshells, coffee grounds, filters, tea bags and yard trimming materials. Since this program started in 1992, 10,538 compost bins have been distributed.

Additional tips and information on composting are provided in the Tips and Resources section and at www.richmond.ca/recycle.

COMPOST DEMONSTRATION GARDEN

To help residents learn about backyard composting, the City offers a Compost Demonstration area in the Terra Nova Rural Park Centre located at 2631 Westminster Highway just west of No.1 Road. It is open from dawn to dusk year-round, and is supplemented by workshops. Residents are encouraged to take a self-guided tour to learn about different types of compost bins and the benefits of composting.

TIP FOR RESIDENTS

The Compost Hotline at 604-736-2250 offers tips and advice on how to compost and use the nutrient-rich soil produced for home gardens. Compost from yard trimmings drop-off programs and through the Green Cart and Green Can collection programs are sold for residential use and for use in the landscaping industry.

Richmond residents are generating their own compost to enrich their garden soil. With 10,538 bins sold, home composting is an excellent way to help keep recyclable organic materials out of the garbage.

YARD TRIMMINGS DROP-OFF PROGRAMS

ECOWASTE INDUSTRIES

The City offers residents the option to drop off unlimited quantities of yard and garden trimmings for free at Ecowaste Industries located at 15111 Triangle Road. Proof of Richmond residency is required.

Visit ecowaste.com or call 604-277-1410 for hours of operation and directions.

RECYCLING DEPOT

Residents may drop off limited quantities of yard and garden trimmings (up to 1 cubic yard) at the City's Recycling Depot. A fee of $20 applies for each additional cubic yard. Commercial operators may also use the Recycling Depot for dropping off of trimmings for a fee of $20 per each cubic yard. The Recycling Depot is located at 5555 Lynas Lane and is open from 9:00 a.m. – 6:15 p.m., Wednesday to Sunday.

For a detailed list of all items that can be recycled at the Depot, please refer to the Tips and Resources section on page 41.

DID YOU KNOW?
Richmond residents can take free workshops to learn how to compost at home. For details, see page 37.

DROP OFF TONNAGE IN 2013

In 2013, more than 3,093 tonnes of yard trimmings were collected at the Recycling Depot and through the Ecowaste residential and commercial drop-off service.

GREEN CART PROGRAM

In June 2013, Richmond introduced Green Cart recycling for food scraps and yard trimmings as a new service for townhomes and an enhanced program for single-family homes. The Green Cart program expanded on the existing Green Can service that was previously provided to single-family homes. Green Cart recycling totaled approximately 14,237 tonnes in 2013 – a 35% increase over 2012.

Food scraps and yard trimmings represent about 40% of household waste, and the increase in Green Cart recycling along with Richmond's other recycling services has contributed to Richmond residents in single-family homes reducing their garbage by 70%. The Green Cart program is also an important service to support residents with an easy and convenient recycling option prior to the anticipated disposal ban on food scraps in 2015.

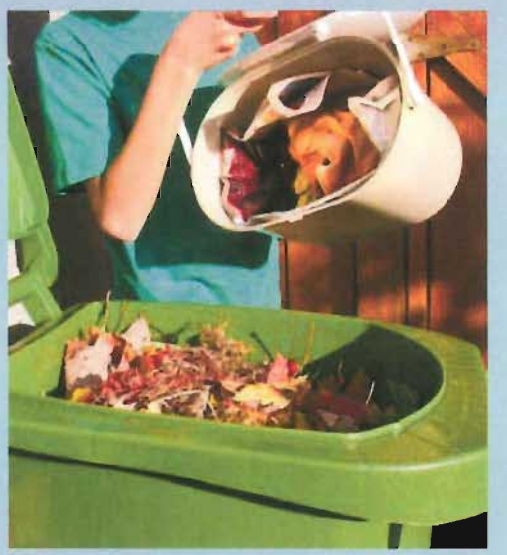
Richmond was recognized by Harvest Power with a Golden Shovel Award for environmental leadership and stewardship, including its commitment to programs like Green Cart, which was designed based on residents' preferences and is aligned with sustainable waste management.

TIPPING FEES, CURRENT AND PROJECTED, PER TONNE

Recycling food scraps and yard trimmings is becoming increasingly important as the cost of tipping fees at the landfill continue to rise. Regional tipping fees are expected to increase to more than $157/tonne in 2018 – more than double the cost since 2008.

GREEN CART SIZE OPTIONS AND BENEFITS

Richmond's Green Cart program currently serves approximately 41,000 homes – 60% of all Richmond residents – to provide convenient access to yard trimmings and food scraps recycling. Green Carts are easy to use thanks to wheels and attached lids. As well, Green Carts are available in a range of sizes.



MULTI-FAMILY GREEN CART PILOT PROGRAM

Building on the success of the Green Cart program launched in 2013, the City of Richmond received approval from Council to initiate a pilot program to assess options for expanding the Green Cart program to multi-family complexes such as multi-level townhomes, condominiums and apartments. The pilot program will be completed in 2014.

PILOT PROGRAM HIGHLIGHTS:

- The pilot program is in place from October 2013 to December 2014.
- There is very low contamination (non-organic materials in the carts) with 0.01-0.25% thanks to extensive communication and outreach with residents to inform them about how to use the Green Carts.
- There are approximately 5,500 units involved in the pilot program.

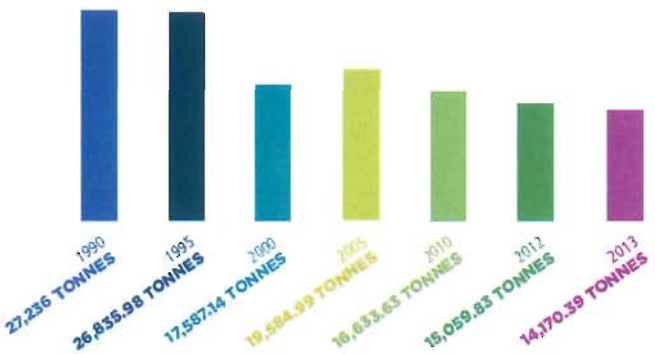
GARBAGE COLLECTION SERVICES

Weekly curbside collection of garbage provides residents with a convenient service for waste disposal. This includes the Large Item Pick Up program to provide curbside collection of up to four large household items each year.

GARBAGE COLLECTION

The City of Richmond provides weekly garbage collection services for all single-family homes and some townhome developments. In providing these services, the City has aimed to strike a realistic balance between meeting its recycling goals while enabling residents to have reasonable means to dispose of garbage by implementing a two-can limit each week for curbside collection. Additional garbage cans may be put out, but each extra container or bag must display a tag that can be purchased at City facilities for $2 each. Certain items, such as hazardous waste materials and those items that can be recycled, are prohibited from garbage bins (see the chart on page 46 for more information on prohibited items).

GARBAGE DISPOSAL OVER THE YEARS



As conscientious recyclers, residents have drastically reduced the amount of garbage disposed since 1990. The City is reviewing options to help reduce garbage, such as incentives to decrease garbage and possible use of City-provided garbage carts.

LARGE ITEM PICK UP PROGRAM

Richmond's Large Item Pick Up program provides curbside collection of up to four large items per year. This program is provided to residents in single-family homes and townhomes with the City's garbage collection and/or Blue Box program. Curbside collection makes it easier for residents who do not have access to a vehicle to dispose of large items. Residents contact the City's service provider at 604-270-4722 to arrange for collection of up to four large items per year. All four large items can be picked up at the same time, or in varying bundles for a total of four items annually.

Items accepted in this program include furniture, appliances and small household goods. Restrictions apply to ensure items can be handled safely from the curbside and mattresses must be covered in plastic to keep them dry. If residents have more than four large items to dispose of, they can purchase a Garbage Disposal Voucher for $5 from any City facility and use the voucher to dispose of up to $20 worth of garbage items at the Vancouver Landfill.

For more information on this program, see page 39 or visit www.richmond.ca/recycle.

COMMON MATERIALS AND AMOUNTS COLLECTED THROUGH LARGE ITEM PICK UP PROGRAM FROM JUNE TO DECEMBER 2013

MATTRESSES
47% OF REQUESTS

TELEVISIONS
12% OF REQUESTS

WASHERS & DRYERS
12% OF REQUESTS

FRIDGES & FREEZERS
8% OF REQUESTS

BARBECUES
7% OF REQUESTS

DISHWASHERS & TOILETS
7% OF REQUESTS

STOVES
5% OF REQUESTS

MICROWAVES
2% OF REQUESTS

OVER **5,100** REQUESTS FOR SERVICE **8,237** ITEMS COLLECTED

325 TONNES WERE COLLECTED AND OF THIS, **200** TONNES WERE RECYCLED

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 cans, and in many cases recycling options, in public spaces throughout the city.

In addition, City crews work seven days a week to collect litter from parks, school grounds, roadsides, sidewalks and boulevards. They empty garbage and recycling from approximately 4,500 City litter and recycling receptacles in the community each week, and assist with removing graffiti from City garbage cans. As well, they collect illegally-dumped materials found on City property and provide safe disposal and recycling of these items. Together, these measures help to support a safe and appealing community.

DID YOU KNOW?
In 2013, the Great Canadian Shoreline Clean-Up removed 429,798 pieces of litter and close to half of the litter items were cigarettes and cigarette filters.

4,008 LOADS OF LITTER & RECYCLABLES COLLECTED

FROM APPROXIMATELY **4,500** CITY LITTER & RECYCLING RECEPTACLES

Commercial buildings and multi-family complexes share a responsibility for recycling. Property owners and managers can facilitate recycling with well-designed recycling and garbage centres. Richmond has developed guidelines to help ensure commercial buildings and multi-family complexes are designed with accessible, centralized and well-organized recycling facilities. Increasing recycling in these buildings is integral to achieving the City's goals for reducing garbage going to landfills.

COMMERCIAL BUILDING GUIDELINES

Effective garbage and recycling management at commercial buildings is most successful when these facilities are integrated into the design and operations of the building or site. To support this, the City of Richmond has developed commercial building guidelines that are outlined in the City of Richmond Design Considerations for Commercial Properties: Recycling and Garbage. These guidelines assist designers and developers of commercial buildings in three key areas:

- the design of storage facilities for garbage and recycling;
- selection of containers for garbage and recycling; and
- planning of access for both tenants and collection service providers.

These guidelines help commercial property owners by giving general advice for meeting City regulations and suggesting goals for effective garbage and recycling programs. This information is provided as a resource and should be used with, not in place of, all applicable building codes, City standards and other relevant legislation.

For more information, visit www.richmond.ca/recycle.

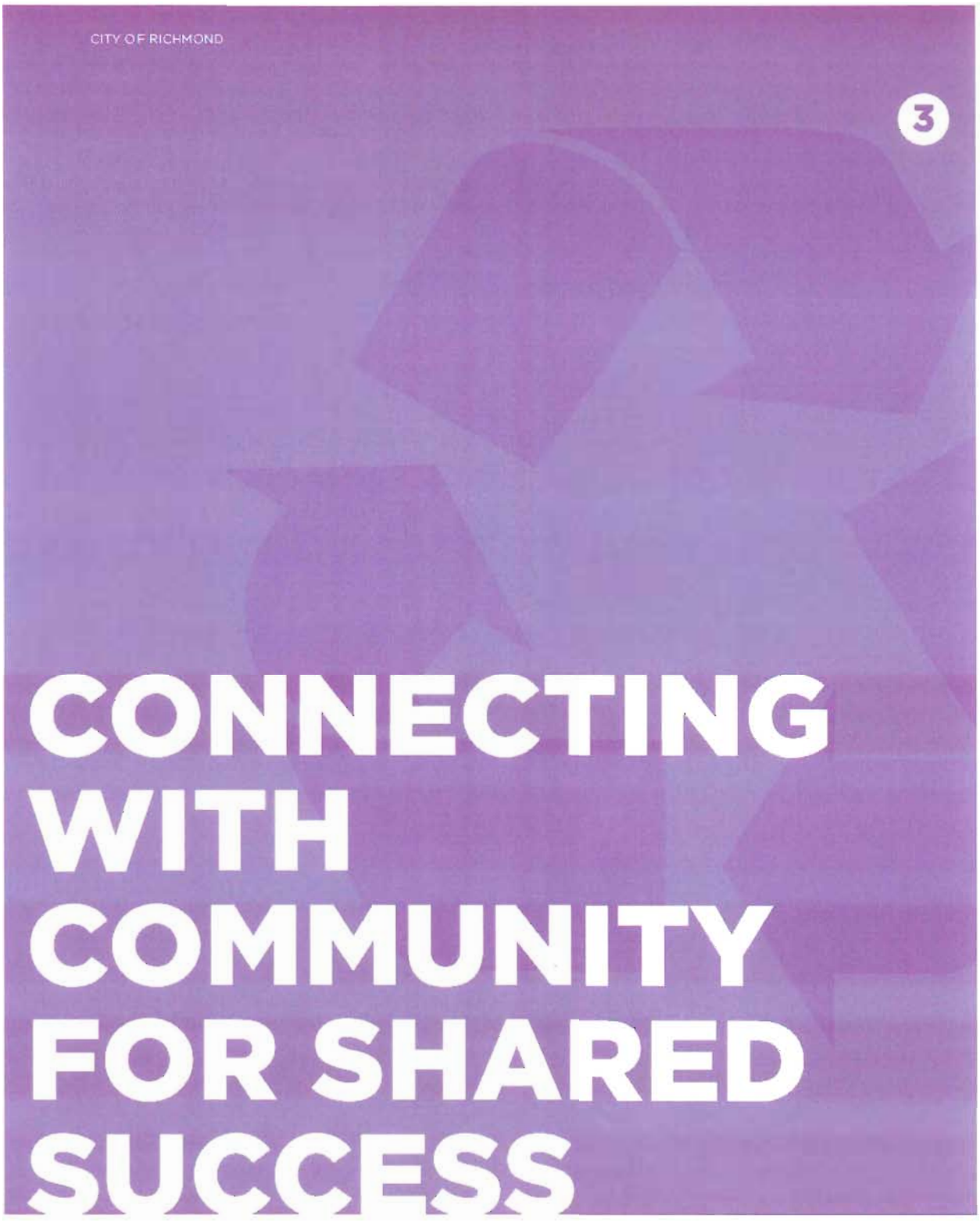
MULTI-FAMILY BUILDING GUIDELINES

All multi-family residential and mixed-use buildings in Richmond require adequate storage for garbage and recycling, and these storage areas must meet Building Code Regulations. At the same time, garbage and recycling collection at multi-family and mixed-use buildings is an area where there is potential for future expansion and improvement.

As an important foundation, the City of Richmond has developed Multi-family Building Guidelines to help support consistent standards at all buildings. The guidelines include information such as basic service requirements, container access for residents and collection, and maximum container size. The information is provided as a convenient source of information, and property owners are responsible for ensuring they meet all applicable building codes, City standards and other relevant legislation.

For more information, visit www.richmond.ca/recycle.

DID YOU KNOW?
In 2015, it is anticipated that there will be a disposal ban on food scraps which means they will not be accepted in the garbage. This affects multi-family complexes and commercial buildings.


CITY OF RICHMOND
3
CONNECTING WITH COMMUNITY FOR SHARED SUCCESS
24

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OUTREACH AND CUSTOMER SERVICE

SUPPORTING AWARENESS AND EDUCATION

Richmond recognizes that providing recycling services is the first important step in reducing waste; however, the second critical step is communication and community engagement. This includes informing residents about City and partner programs and services available in the community, educated them on how to use the programs, raising awareness about why recycling and reducing waste is important, and engaging the community to help design programs that fit their needs and priorities. The third essential step is providing excellent customer service. With its commitment to community outreach and customer service, the City goes beyond providing services – it supports residents so they can be successful in reducing their waste.

In 2013, approximately 185 youth volunteered in Richmond's Green Ambassador program to support recycling awareness at events and outreach displays.

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

The Environmental Programs Information Line staff assisted customers with more than 20,000 calls in 2013, answering questions, assisting with requests relating to garbage and recycling and providing guidance on where to go for additional information and resources. Staff completed updates to the Integrated Voice Response (IVR) system tailored to customer information priorities. Richmond also assists customers directly at the Recycling Depot, and through its outreach programs in the community.

At the 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.

20,000
CUSTOMER SERVICE CALLS SUPPORTED

9,261
GARBAGE TAGS SOLD

853
GARBAGE DISPOSAL VOUCHERS SOLD

68 **COMPOST BINS SOLD**

Richmond measures the success of its programs, customer service and community engagement by monitoring a number of performance indicators, such as continued progress towards its goals for reducing waste, the community's impressive track record for using programs properly to keep banned recyclables out of the garbage, and low contamination levels thanks to residents sorting recyclable materials into the correct containers.

2013 HIGHLIGHTS

RICHMOND HOSTS SECOND ANNUAL EARTH DAY SUMMIT

The Richmond Earth Day Youth (REaDY) Summit was a resounding success again in 2013 thanks to volunteer support and community partnerships, City staff, the Richmond School Board, the David Suzuki Foundation, and the Richmond Green Ambassadors.

The summit was again successful in increasing awareness of environmental sustainability, fostering continual interest in recycling and reducing waste, and raising awareness on sustainability issues identified by local youth. Approximately 12 workshops including recycling and waste reduction, a climate change showdown, and energy and water conservation were offered. The Green Ambassadors spent approximately 1,750 hours to support this successful outreach initiative. Over 400 delegates attended, including 120 Richmond Green Ambassadors from eight Richmond high schools.

SCHOOL SHOWS AND CONTESTS

In 2013, the City hosted Clean Up Your Act and Zero Heroes shows at elementary schools to promote responsible actions to avoid littering, graffiti and vandalism. The shows reached 3,801 elementary school students and 200 teachers. To reinforce what they learned, these schools participated in the My School Sparkles Contest, which has two categories, and the Zero Heroes Contest. For the My School Sparkles Contest, schools are evaluated on levels of littering before and after the show. The winners of the "My School Always Sparkles" category for the school with the least amount of litter on its school grounds and adjacent public space were DeBeck Elementary School and Thomas Kidd Elementary School. The winner of the "My School is Sparkling" category for the school that demonstrated the most improvement was awarded to Daniel Woodward Elementary School. The Zero Heroes Contest is based on collecting pledges to reduce and recycle waste. The winners of the Zero Heroes Contest were Sea Island Elementary School in the small school category and James McKinney Elementary School in the large school category.

ENHANCED COMMUNITY ENGAGEMENT

As part of its continued commitment to communication, Richmond is increasing its outreach by going out into the community to host information displays at local shopping centres, community centres and multi-family complexes. The City also continues to ensure residents are kept informed about expanded and enhanced programs as well as seasonal recycling priorities through its "Let's trim our waste!" campaign. The City also engages residents through surveys to collect input on programs to support continuous improvement of the City's recycling and garbage programs.

GREAT CANADIAN SHORELINE CLEAN-UP

The Great Canadian Shoreline Clean-Up doubled in 2013, with more than 600 volunteers at 18 community clean-up events on the City's waterfront. Jointly led by the Vancouver Aquarium and World Wildlife Foundation, the Great Canadian Shoreline Clean-Up focuses on educating and empowering people to make a difference through community clean-up events. As part of this initiative, Environmental Programs partnered with Parks to support the volunteers.

RICHMOND GREEN AMBASSADORS

Richmond's Green Ambassadors are dedicated high school students who participate in monthly workshops to learn about environmental sustainability and apply what they have learned as volunteers at City events and activities. In 2013, approximately 185 students in the program contributed about 3,250 volunteer hours to promote recycling at community events and organize the REaDY Summit. These energetic and environmentally conscious individuals also manage green initiatives in their school. In 2013, they helped divert 83% of waste at Ships to Shore, 75% at the Steveston Salmon Festival and 86% at Richmond Maritime Festival.

CHRISTMAS TREE RECYCLING

The City hosted its annual Christmas Tree Recycling service at Garry Point and the South Arm Community Centre. Thanks to the participation of residents who brought their trees in for recycling, Richmond collected and chipped 14 tonnes of chips and sent them to Harvest Power and Ecowaste for composting.

COMMUNITY WORKSHOPS

Richmond's free community workshops provide education and tips that support recycling and waste reduction techniques. In 2013, the City hosted 9 community workshops. A summary of workshops that focus on helping residents towards the City's goal for 70% waste diversion is provided below.

For information on the workshops, email esoutreach@richmond.ca. To attend free workshops offered by the City, visit richmond.ca/register or call 604-276-4300 and press "2" at the prompt (Monday to Friday from 8:30 a.m. to 5:30 p.m.) to register.

COMMUNITY WORKSHOPS	
Backyard and Worm Composting	Whether a novice or an experienced compost creator, participants learn how to effectively convert organic food and yard waste into an organic soil conditioner.
Second Hand to First Rate	Turn second hand items into amazing treasures. Participants learn party ideas, how to make great kids products and decorating items, and tricks and tips to dress from head to toe all for under $30.
Harvest Compost	Participants learn some simple compost harvesting techniques and how to use compost to increase the health of soil and plants. A composting expert also provides an assessment of finished composting samples provided by participants.
Eco-cleaning	Homemade household cleaners work well, save money and are less harmful to people, animals and the environment. With a few easy steps, participants learn to make and use eco-friendly cleaners. Eco-cleaning reduces the use of toxic household items, and the course includes tips on how to recycle and safely dispose of these harmful materials.


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4
LET'S MAKE RECYCLING A WAY OF LIFE!
30

TIPS AND RESOURCES

EASY STEPS TO INCREASE RECYCLING AND REDUCE WASTE

In Richmond, we care about our community, and we are working together to trim our waste. The City works with residents and community partners to make it easy and convenient to reuse and recycle at home and on the go. It's all about making recycling a way of life. This at-a-glance resource on the various types of recycling programs and services available through the City of Richmond is a valuable guide to support being recycling smart in Richmond. The Tips and Resources include highlights such as how and where to recycle, what to do with hazardous waste and where to find additional information.

Resources also include 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 with minimum contamination in the waste going to the landfill.

Richmond's Environmental Program staff share information on tips and resources by phone, through outreach events and on the website.

CITY OF RICHMOND

BLUE BOX

Starting the week of May 19, 2014, Richmond expanded its Blue Box program to include more types of plastic containers plus milk cartons, paper and plastic drink cups, flower pots and spiral wound tins like frozen juice concentrate containers.

Recyclable materials from the Blue Box program are collected from single-family homes and some townhome complexes on the same day that garbage is collected. Containers are placed into the Blue Box, glass bottles and jars are placed in the grey Glass Recycling Bin and all paper products, including newspaper and cardboard are placed in the yellow Mixed Paper Recycling Bag.

For a list of items accepted in Blue Box recycling, see page 33 or visit www.richmond.ca/recycle.

Set Out Time
Before 7:30 a.m. on collection day.

Report a Missed Collection
Call 604-276-4010 or email garbageandrecycling@richmond.ca.

How to Get a Mixed Paper Recycling Bag, Glass Recycling Bin or Blue Box
There is no charge for new or replacement Blue Boxes, Glass Recycling Bins or Mixed Paper Recycling Bags.

For additional Blue Box supplies call 604-276-4010, order them online at www.richmond.ca/recycle, or pick them up at the following locations:

City Recycling Depot
5555 Lynas Lane
Wednesday to Sunday (Closed on Mondays, Tuesdays & Statutory Holidays)
9:00 a.m. to 6:15 p.m.

City Hall
6911 No. 3 Road
Monday to Friday (Closed on Saturdays, Sundays & Statutory Holidays)
8:15 a.m. to 5:00 p.m.

WHAT GOES WHERE:

MIXED PAPER RECYCLING BAG

ACCEPTED	HOW TO RECYCLE	NOT 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 ✓ Telephone books ✓ Writing paper (notepads, loose leaf paper, white or coloured paper, printed paper, shredded paper)	• Remove plastic liners/covers. • Remove any food residue. • Flatten boxes. • **Place in Mixed Paper Recycling Bag.** • Cardboard is limited to one bundle per week. Bundle size: 3 ft x 2 ft x 4 in (90 cm x 60 cm x 10 cm) *Note:* Oversized/excessive amounts of cardboard can be dropped off at the City's Recycling Depot at 5555 Lynas Lane.	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

GLASS RECYCLING BIN

ACCEPTED	HOW TO RECYCLE	NOT ACCEPTED
✓ Clear or coloured glass bottles & jars (pickle jars, jam jars, spaghetti sauce jars, soy sauce bottles)	• Remove lids & caps. • Remove food residue. • Empty & rinse. • **Place in Glass Recycling Bin.**	x Glasses, dishes, cookware, window glass or mirrors x Ceramic products x Lids & caps (place in Blue Box)

BLUE BOX FOR CONTAINERS

ACCEPTED	HOW TO RECYCLE	NOT ACCEPTED
✓ **New! Aerosol cans & caps (food items, air fresheners, shaving cream, deodorant, hairspray)** ✓ **New! Microwavable bowls, cups & lids** ✓ **New! Paper food containers & cartons (ice-cream, milk, liquid whipping cream)** ✓ **New! Paper & plastic drink cups with lids** ✓ **New! Plastic containers, trays & caps (bakery containers & deli trays)** ✓ **New! Plastic and paper garden pots & trays** ✓ **New! 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	• Remove food residue. • Remove caps or lids; place loose in the Blue Box. • Empty and rinse. • **Place in Blue Box.** *Note:* Flatten and/or stack containers where possible.	x Ceramic plant pots x Compostable/biodegradable plastic bags & containers x Containers for motor oil, or vehicle lubricant or wax products x Foil-lined cardboard lids from take-out containers x Garden hoses x Plastic bags & over wrap (take to Recycling Depot) x Plastic string or rope x Spray paint cans (take to Recycling Depot) x Styrofoam materials (take to Recycling Depot)

CITY OF RICHMOND

BLUE CART

All multi-level multi-family complexes like apartments and condominiums and some townhomes have a recycling depot with Blue Carts for recycling mixed paper, containers and glass. They are generally located in the garbage room or other convenient location.

Starting the week of May 19, 2014, Richmond expanded its Blue Cart program to include more types of plastic containers plus milk cartons, paper and plastic drink cups, flower pots and spiral wound tins like frozen juice concentrate containers.

For sorting recycling, containers are placed in the Containers Recycling Cart, glass bottles and jars are placed in the Glass Recycling Cart and paper products including newspaper and cardboard are placed in the Mixed Paper Recycling Cart. These recyclable materials are banned from landfill.

The carts are emptied once a week. Statutory holidays do not generally affect the collection; however, Christmas Day may delay collection by one day if it falls on a weekday. For information about the recycling depot location in your building, contact your building manager or property manager.

For a list of items accepted in Blue Cart recycling, see page 35 or visit www.richmond.ca/recycle.

Cart Emptying

Some carts are retrieved from their site, however, some are brought out to a collection area.

Carts brought out must be at the collection area before 7:30 a.m.

Report a Missed Collection

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

How to Get an Indoor Collection Bag for Blue Cart Recycling

There is no charge for new or replacement Blue Cart recycling bags. For additional bags call 604-276-4010, order them online at www.richmond.ca/recycle, or pick them up at the following locations:

City Recycling Depot
5555 Lynas Lane
Wednesday to Sunday (Closed on Mondays, Tuesdays & Statutory Holidays)
9:00 a.m. to 6:15 p.m.

City Hall
6911 No. 3 Road
Monday to Friday (Closed on Saturdays, Sundays & Statutory Holidays)
8:15 a.m. to 5:00 p.m.

WHAT GOES WHERE:

MIXED PAPER RECYCLING CART

ACCEPTED	HOW TO RECYCLE	NOT 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 ✓ Telephone books ✓ Writing paper (notepads, loose leaf paper, white or coloured paper, printed paper, shredded paper)	• Remove plastic liners/covers. • Remove any food residue. • Flatten boxes. • **Place in Mixed Paper Recycling Cart.** *Note:* Oversized/excessive amounts of cardboard can be dropped off at the City's Recycling Depot at 5555 Lynas Lane.	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

GLASS RECYCLING CART

ACCEPTED	HOW TO RECYCLE	NOT ACCEPTED
✓ Clear or coloured glass bottles & jars (pickle jars, jam jars, spaghetti sauce jars, soy sauce bottles)	• Remove lids & caps. • Remove food residue. • Empty & rinse. • **Place in Glass Recycling Cart.**	x Glasses, dishes, cookware, window glass or mirrors x Ceramic products x Lids & caps (place in Blue Box)

CONTAINERS RECYCLING CART

ACCEPTED	HOW TO RECYCLE	NOT ACCEPTED
✓ New! **Aerosol cans & caps (food items, air fresheners, shaving cream, deodorant, hairspray)** ✓ New! **Microwavable bowls, cups & lids** ✓ New! **Paper food containers & cartons (ice-cream, milk, liquid whipping cream)** ✓ New! **Paper & plastic drink cups with lids** ✓ New! **Plastic containers, trays & caps (bakery containers & deli trays)** ✓ New! **Plastic and paper garden pots & trays** ✓ New! **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	• Remove food residue. • Remove caps or lids; place loose in the Blue Box. • Empty and rinse. • **Place in Containers Recycling Cart.** *Note:* Flatten and/or stack containers where possible.	x Ceramic plant pots x Compostable/biodegradable plastic bags & containers x Containers for motor oil, or vehicle lubricant or wax products x Foil-lined cardboard lids from take-out containers x Garden hoses x Plastic bags & over wrap (take to Recycling Depot) x Plastic string or rope x Spray paint cans (take to Recycling Depot) x Styrofoam materials (take to Recycling Depot)

CITY OF RICHMOND

GREEN CART

Residents in single-family homes and townhomes with City garbage and/or Blue Box service have Green Carts to recycle food scraps and yard trimmings. When you recycle with Green Cart, you are helping turn food scraps and yard trimmings into compost for nutrient-rich soil.

Residents may continue to use Green Cans for excess food scraps and yard trimmings. Paper yard waste bags and tied bundles of yard trimmings are also accepted. Please visit www.richmond.ca/recycle for more information.

Please note that Green Carts stay with the property. If residents move to another house in Richmond, they will have a Green Cart at that location. If there is no cart, please call 604-276-4010.

WHAT GOES IN THE GREEN CART:

FOOD SCRAPS

ACCEPTED	HOW TO RECYCLE	NOT ACCEPTED
✓ Fruit ✓ Breads, pasta, rice & noodles ✓ Coffee grounds & filters ✓ Table scraps & food scrapings ✓ Meat, poultry, fish, shellfish & bones ✓ Eggshells ✓ Paper towels/napkin/plates ✓ Pizza delivery boxes ✓ Vegetables ✓ Tea bags ✓ Dairy products ✓ Solid grease	• Collect food scraps in your kitchen container. • Empty materials from your kitchen container into your Green Cart. • Place your Green Cart at the curb along with unlimited paper yard trimmings bags and/or Green Cans, Blue Box recycling and garbage by 7:30 a.m. on your regular collection day.	× Coffee cups × Cork or Styrofoam cups, meat trays or takeout containers × Liquid grease × Pet feces or kitty litter × Plastic bags, biodegradable or compostable bags × Plastic wraps

YARD TRIMMINGS

ACCEPTED	HOW TO RECYCLE	NOT ACCEPTED
✓ Flowers ✓ Grass clippings ✓ Leaves ✓ Other organic yard materials ✓ Plants (living or dead/dried) ✓ Plant trimmings ✓ Tree & hedge prunings	• Place yard trimmings into Green Cart along with your food scraps. • Extra yard trimmings can go in large paper bags or additional labeled Green Cans. • Place your Green Cart at the curb along with unlimited paper yard trimmings bags and/or Green Cans, Blue Box recycling and garbage by 7:30 a.m. on your regular collection day.	× Plastic bags, biodegradable or compostable bags × Diseased plants × Garden hoses or flower pots × Prunings over 4 inches (10 cm) in diameter × Rocks, dirt or sod × Wood products

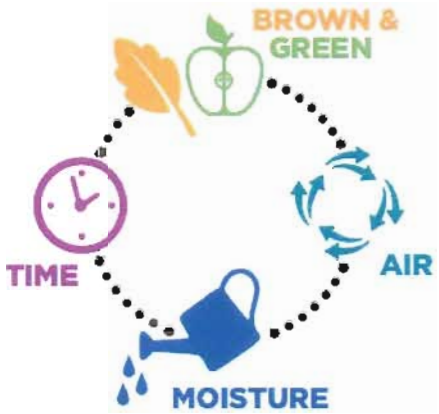
Yard Trimmings Drop-off Locations

Richmond residents can drop off yard trimmings (see above for materials accepted) at the following locations, free of charge with proof of residency.

Ecowaste Industries
15111 Triangle Road
Open Monday to Friday from 7:00 a.m. to 5:30 p.m. (last load in at 4:30 p.m.)
Open Saturday and Sunday from 8:00 a.m. to 4:00 p.m. (last load in at 4:00 p.m.)
Visit ecowaste.com or call 604-277-1410 for detailed information.

City Recycling Depot
5555 Lynas Lane
Wednesday to Sunday (Closed on Mondays, Tuesdays & 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.



HOME COMPOSTING

Home composting turns your food scraps and yard trimmings into nutrient-rich soil that can be spread on lawns and flowerbeds.

BACKYARD COMPOST BIN

"Garden Gourmet" compost bins are available to Richmond residents at the Recycling Depot for $25 plus tax. The bin dimensions are 36 inches (90 cm) high, 22 inches (56 cm) wide and 22 inches (56 cm) deep. They are suitable for residential backyard composting of grass, leaves, vegetable trimmings, fruit trimmings and other miscellaneous organic garden trimmings.

COMPOSTING WORKSHOPS

To learn about composting, attend a Richmond composting workshop, held from January to November. Visit www.richmond.ca/register for workshop dates and locations or call Parks & Recreation at 604-276-4300 and press "2" from Monday to Friday between 8:30 a.m. to 5:30 p.m.

COMPOST HOTLINE

The Compost Hotline offers support and tips for best practices in home composting. It is operated by City Farmer, which has researched and promoted the best methods of urban composting since 1978.

Compost Hotline
Phone: 604-736-2250
Email: composthotline@telus.net

COMPOST DEMONSTRATION GARDEN

A compost demonstration garden is located at 2631 Westminster Highway in the Terra Nova Rural Park. Composting demonstration units are on display for viewing year-round, from dawn to dusk.

Nitrogen Rich Green Materials:

- PLANT TRIMMINGS
- FRUIT & VEGETABLE PEELINGS
- FRESH GRASS CLIPPINGS
- COFFEE GROUNDS & TEA LEAVES

Carbon Rich Brown Materials:

- DRY LEAVES
- SAWDUST
- STRAW
- SHREDDED NEWSPAPER CLIPPINGS

HOW TO COMPOST

1. USING A BACKYARD COMPOST BIN, START WITH A GOOD LAYER OF COARSE ORGANIC MATERIAL, SUCH AS STRAW, LEAVES OR PRUNING AT THE BOTTOM TO ALLOW AIR TO CIRCULATE.
2. ADD A GOOD LAYER OF NITROGEN-RICH GREEN MATERIAL FOLLOWED BY ONE LAYER OF CARBON-RICH BROWN MATERIAL, UNTIL THE BIN IS FULL.
3. COMPOST REQUIRES AIR. TURN AND STIR YOUR COMPOST WEEKLY SO THE ORGANISMS GET NECESSARY OXYGEN.
4. COMPOST REQUIRES MOISTURE. WATER YOUR COMPOST BIN FREQUENTLY TO ENSURE IT STAYS AS MOIST AS A WRUNG-OUT SPONGE.
5. GIVE IT TIME - IN 12-18 MONTHS, MATERIAL AT THE BOTTOM AND MIDDLE OF THE BIN SHOULD BE COMPOSTED. USE THIS THROUGHOUT YOUR GARDEN. USE THE UN-COMPOSTED MATERIAL TO START A NEW BATCH. CHIPPING OR CHOPPING THE MATERIAL CAN INCREASE THE SPEED OF THE PROCESS. REGULAR AERATION IS KEY TO SUCCESSFUL COMPOSTING.

CITY OF RICHMOND

GARBAGE COLLECTION

CURBSIDE COLLECTION SERVICE

Two Can Limit

Garbage is collected weekly for all single-family residents and some townhome complexes.

Garbage pickup in Richmond is limited to two containers (cans or bags) per week for each address or service. A $2 Garbage Tag is required for each additional container or equivalent.

How Big is a "Can"?

For the purposes of garbage pickup in Richmond, each of the following represents one can:

- A garbage can with lid
- Standard size: 19 inches x 22 inches (48 cm x 56 cm)
- Maximum size allowed: 24 inches x 32 inches (61 cm x 81 cm)
- An equivalent container should not exceed 3 cubic feet (100 L)

How Big is a "Bag"?

- Standard size: 24 inches x 36 inches (61 cm x 91 cm)
- Maximum size allowed: 30 inches x 48 inches (76 cm x 120 cm)
- Any other container being used should not exceed 3 feet x 2 feet (91 cm x 60 cm)

Preparing Garbage for Collection

Loose garbage must be securely packed in plastic bags. This includes ashes, kitty litter, disposal diapers, vacuum cleaner sweepings and other loose household garbage.

To reduce litter and damage by animals, place bags and other garbage in plastic cans wherever possible. Garbage must be packed in plastic bags and then placed in cans with secure lids. Loose plastic bags must not rip when lifted.

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

Purchase Garbage Tags or Garbage Disposal Vouchers to dispose of extra garbage.

$2 Garbage Tags

Garbage Tags 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 $20 at the Vancouver Landfill, and are valid anytime. They are limited to one per household. Visit www.richmond.ca/recycle for a list of City facilities selling Garbage Tags and Garbage Disposal Vouchers.

Large Item Pick-Up Program

Residents in single-family homes and some townhomes can arrange for curbside collection of four large household items each year.

The following items are **not** accepted in the garbage:

MATERIAL	HOW TO RECYCLE OR DISPOSE
x DEMOLITION WASTE	• Take to Ecowaste Industries at 15111 Triangle Road, or call the RCBC Recycling hotline at 604-RECYCLE (732-9253).
x DIRT, ROCK, CONCRETE OR BRICKS	• Take to Ecowaste Industries. Visit ecowaste.com or call 604-277-1410 for accepted items & hours.
x DRYWALL (GYPSUM, SHEETROCK PLASTERBOARD,GYPROC & WALLBOARD)	• Take to the Vancouver Landfill at 5400 72nd Street, Delta or Ecowaste Industries. Visit ecowaste.com or call 604-277-1410 for accepted items & hours.
x GARBAGE BEYOND THE TWO CAN LIMIT	• Purchase a $2 Garbage Tag at City facilities and put on can or bag. See Extra Item Disposal Options.
x HAZARDOUS WASTE	• Call RCBC Recycling Hotline at 604-RECYCLE, visit www.metrovancouverrecycles.org or see page 46 for drop-off locations.
x MATERIALS THAT ARE TOO BIG OR MAY DAMAGE GARBAGE TRUCK	• See Large Item Pick Up program on page 39 for disposal options.
x PROVINCIAL PRODUCT STEWARDSHIP COLLECTION (TAKE-BACK) ITEMS	• Visit bcstewards.com or call 604-RECYCLE.
x RECYCLABLES (BLUE BOX & BLUE CART)	• Place in appropriate recycling receptacle unless it is contaminated by food or other waste.
x UNWRAPPED OR LOOSE GARBAGE	• Must be in garbage bag or can.
x YARD TRIMMINGS	• Place in Green Carts or paper yard waste bags. • If one cubic yard or less, drop off at Recycling Depot. Unlimited amounts can be dropped off at Ecowaste Industries with proof of residency. • Check Green Cart section for restrictions and accepted materials on page 36.

CURBSIDE COLLECTION FOR LARGE HOUSEHOLD ITEMS

Richmond's Large Item Pick Up program provides a convenient curbside collection service for up to four large household items per year, including mattresses, furniture and appliances. The program is available to residents in single-family homes and townhomes with the City's garbage collection service and/or Blue Box program.

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, which will help Richmond achieve its goal for 70% waste diversion from the landfill by 2015.

STEPS ON HOW THE PROGRAM WORKS:

1. To schedule collection of up to four items per year, residents can contact the City's service provider, Sierra Waste Services at 604-270-4722 or schedule online at www.richmond.ca/recycle.
2. Sierra Waste Services will contact you to provide a pick up date and confirmation number.
3. On your scheduled pick up date only, place items at the curb before 7:30 a.m. or no earlier than 8:00 p.m. the night before.

Safety Consideration: If the large item is a freezer, refrigerator, icebox or other container that is equipped with a latch or locking device, the door/latch must be removed and placed beside the large item for safety reasons.

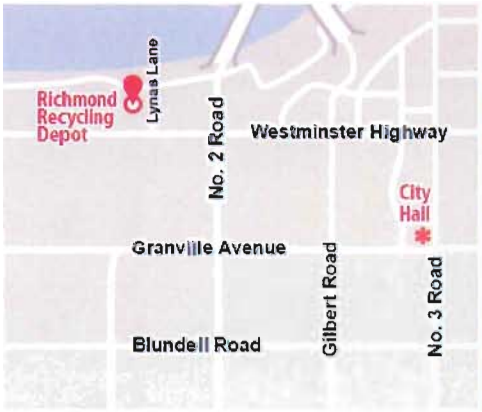
DID YOU KNOW?

Wet mattresses cannot be recycled and pose safety hazards for lifting. Please ensure the mattress stays dry and mould-free by covering it in a plastic bag. Reuse the bag from newly purchased mattresses or purchase bags from home hardware and supply stores. Mattresses not wrapped in plastic will not be picked up.

LIST OF ITEMS ACCEPTED

ACCEPTED	NOT ACCEPTED
✓ Furniture (e.g. couches, coffee tables, chairs, desks, dressers, TV stands, cabinets, drawers, tables, hutches, cribs, high chairs, entertainment centres) ✓ Appliances (e.g. stoves, dishwashers, washers and/or dryers, hot water tanks, refrigerators, freezers, microwaves, coolers) ✓ 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 four allotted items) ✓ Barbecues (remove propane tank and/or lava rock briquettes) ✓ Outdoor furniture (e.g. chairs, patio tables, patio umbrellas) ✓ Weight training equipment (e.g. treadmills, ellipticals, stationary bikes, stair masters, weight sets) ✓ Electric lawnmowers ✓ Mattresses (including headboard and frame) – please cover your mattress with a plastic bag.	x Car bodies or parts x Tree stumps x Carpets x Lumber, demolition or home renovation materials x Hazardous waste x Propane tanks x Tires x Gas mowers x Construction materials Note: Items that contain any hazardous liquids such as gas, oil, etc. will not be accepted. See page 46 - 52 for disposal locations.

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



RECYCLING DEPOT

The Richmond Recycling Depot is located at 5555 Lynas Lane and is open from Wednesday through Sunday from 9:00 a.m. to 6:15 p.m. The Depot accepts Styrofoam, batteries, cell phones, used cooking oil, large appliances, large metal items and yard trimmings, as well as recyclables normally placed at curbside.

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

In addition, the Depot is a Product Stewardship (Take Back) Collection site for paint, solvents, flammable liquids, pesticides, lights, lighting fixtures and small appliances.

FOR SALE AT THE RECYCLING DEPOT

Residents can purchase the following items from the Depot:

- Compost bins - $25 each
- Rain barrels - $30 each
- Extra Garbage Tags - $2 each
- Garbage Disposal Vouchers (cost is $5 for Richmond residents and value is $20 at the Vancouver Landfill)

TIP FOR RESIDENTS

Residents can purchase compost bins from the Richmond Recycling Depot. To learn more about how to compost, see page 37, or visit the Compost Demonstration Garden located at 2631 Westminster Highway in the Terra Nova Rural Park.

MATERIALS ACCEPTED AT THE RICHMOND RECYCLING DEPOT

Please note: All materials must be sorted into different containers at the Recycling Depot. Please visit www.richmond.ca/recycle for drop-off details.

- ✓ Aluminium materials (aluminium foil, pie plates)
- ✓ Appliances (small and large electrical/battery operated appliances including Dishwashers, washing machines, stoves, barbeques, ovens, microwaves, fridges, freezers, vacuums, hair dryers, toaster ovens, etc.)
- ✓ Batteries (small household batteries less than 5 kg)
- ✓ Books
- ✓ Cell phones (including batteries)
- ✓ Cooking oil and animal fat
- ✓ Corrugated cardboard (flattened, clean corrugated boxes)
- ✓ Exercise and hobby machines (treadmills, elliptical / cross trainers, cycling machines)
- ✓ Flammable aerosols
- ✓ Flammable liquids
- ✓ Flower pots (paper/plastic garden pots)
- ✓ Gasoline
- ✓ Glass bottles and jars (clear and coloured)
- ✓ Lights (fluorescent tubes, compact fluorescent lights, light emitting diodes, halogen and incandescent lights, high intensity discharge and other mercury containing lamps
- ✓ Lighting fixtures
- ✓ Magazines
- ✓ Metal items (bike frames, clean 45 gallon drums, clean automotive parts, lawn chairs, steel coat hangers, steel or lead piping)
- ✓ Paper (mixed paper products including flattened boxboards, envelopes, junk mail, flyers, inserts, office paper, paper egg cartons, telephone books, etc.)
- ✓ Newspaper
- ✓ Paints (household paints)
- ✓ Paint aerosols
- ✓ Pesticides (domestic pesticides)
- ✓ Plastic containers
- ✓ Plastic grocery shopping bags and film plastics
- ✓ Sewing, knitting and textile machines
- ✓ Styrofoam packaging
- ✓ Tin cans
- ✓ Tools (power tools such as angle saws, jigsaws, trimmers, drum machines, etc.)
- ✓ Yard and garden trimmings

TIP FOR RESIDENTS

Many electronics products can be reused by others and there are convenient services to sell them or give them away. You can also give them to a number of organizations who accept donated equipment to redistribute in the community. Please contact these agencies in advance to ensure they will accept specific items for donation.

BC Electronics Material Exchange: bcemex.ca

Free Geek Vancouver: freegeekvancouver.org

COMMUNITY RESOURCES AND PARTNERS

METRO VANCOUVER RECYCLES — REUSE AND RECYCLE IN THE REGION

A convenient web tool called Metro Vancouver Recycles makes it easy to connect with people who could use products you don't need, or to find options for recycling products that cannot be included in your curbside collection, visit metrovancouverrecycles.org.

There are also convenient links to online services if you want to sell or give away goods. The following are just a few examples in the Metro Vancouver region:

weRecycle
iPhone app (available from iPhone App Store and at metrovancouverrecycles.org)

Metro Vancouver Recycling Directory
metrovancouverrecycles.org

MetroVan Reuses
bc.reuses.com

Richmond Shares
richmondshares.bc.ca

RCBC COMMUNITY RESOURCES

Recycling Hotline
Monday to Friday, 9 a.m. to 4 p.m.
Phone: 604-RECYCLE (604-732-9253)
Email: hotline@rcbc.bc.ca
RCBC Recyclepedia at rcbc.bc.ca/recyclepedia
Smart Phone App: BC Recyclepedia App
(available at iPhone App Store and Android Market)

RCBC MATERIALS EXCHANGE PROGRAM (MEX)

The RCBC MEX program is a completely self-serve web-based program comprised of Residential Reuse Programs and the BC Industrial Materials Exchange (BC IMEX) and is available at bc.reuses.com

DID YOU KNOW?
Four, 2-litre plastic bottles can be recycled into one t-shirt, filling for a ski jacket and two ball caps.

PRODUCT STEWARDSHIP PROGRAMS

The City of Richmond works with local companies and organizations like Product Care and Encorp to support BC's Product Stewardship Programs.

These programs are often called take back programs or Extended Producer Responsibility (EPR) programs, and they are based on the principle that whoever designs, produces, sells or uses a product is also responsible for minimizing that product's environmental impact. The key participants in these programs are the BC government, local governments, producers, retailers and consumers who bring their products to designated collection sites when they are at their end of life. The cost of these programs is covered by consumers and producers, sometimes in the form of a deposit or levy that is charged at the time of purchase. In the case of beverage containers, there are refunds available when they are returned at a collection site.

Take back programs are important as they expand the opportunities for recycling beyond the curbside collection services. There are many household items that can be recycled through businesses and organizations in the community who participate in BC's Product Stewardship Program. Many of these items are also considered hazardous waste, and they are restricted from garbage as they are not accepted at the landfill. The take back programs helps to ensure that these expired or end-of-life products will be disposed of safely, and recycled where possible.

PRODUCT STEWARDSHIP PROGRAM CATEGORIES

The following categories highlight the products that can be returned to retailers and other community partners. For a list of drop-off locations for each category, please see pages 47 to 52.

TAKE BACK PROGRAMS	WHAT IS INCLUDED	STEWARDSHIP AGENCY
BATTERIES	Household batteries	Call2Recycle **Contact** call2recycle.ca 1-888-224-9764 info@call2recycle.ca Drop off site locator 1-877-273-2925
BEVERAGE CONTAINERS	Almost all types of beverage containers	Encorp Pacific (Canada) **Contact** return-it.ca/locations 1-800-330-9767 or 604-473-2400 returnit@returnit.ca Note: Beverage containers like pop and juice cans and bottles can be recycled with the Blue Box or Blue Cart or can be dropped off at Richmond's Recycling Depot as part of the City's recycling services. Beverage containers can also be returned for a refund on the deposit at a number of Return-it Depot locations in Richmond.
CELL PHONES	Mobile/wireless devices that connect to a cellular or paging network, including all cell phones, smart phones, wireless personal digital assistants (PDAs), external air cards and pagers, as well as cell phone batteries and accessories, including headsets and chargers	Canadian Wireless Telecommunications Association **Contact** RecycleMyCell.ca 1-888-797-1740 info@recyclemycell.ca
ELECTRONICS	Televisions and computer and printer products such as desktop computers, display devices, portable (laptop) computers, desktop printers and fax machines and computer accessories like keyboards, pointing devices, track balls and mice	Encorp Pacific (Canada) **Contact** return-it.ca/electronics 1-800-330-9767 or 604-473-2400 returnit@returnit.ca
MEDICATION	All expired or leftover prescription medication, non-prescription medication and mineral supplements, anti-fungal and anti-bacterial creams	Health Products Stewardship Association **Contact** healthsteward.ca/returns/british-columbia 613-723-7262 info@healthsteward.ca

DID YOU KNOW?
100% of brewer packaging is either reusable or recyclable, and in addition to standard beer cans and bottles, brewers reuse or recycle their aluminum kegs and their secondary packaging including plastic shrink wrap, cardboard and wooden pallets.

DID YOU KNOW?
A littered aluminum can takes 500 years to disintegrate, but it only takes six weeks to be manufactured, filled, sold, recycling, remanufactured, refilled and be back out on the marketplace.

TAKE BACK PROGRAMS	WHAT IS INCLUDED	STEWARDSHIP AGENCY
PACKAGING AND PRINTED PAPER	Aerosol cans, microwavable bowls/cups/lids, paper food containers & cartons, plastic & paper drink cups with lids, plastic containers/jars/tubs/trays, aluminium cans, tin cans, etc. Visit recyclinginbc.ca for a complete list	Multi Material British Columbia (MMBC) **Contact** Twitter: @recyclemorebc www.multimaterialbc.ca
PAINTS, SOLVENTS, PESTICIDES AND GASOLINE	Paints, solvents, pesticides and gasoline	Product Care Association **Contact** productcare.org/BC-Paint-Program
SMALL APPLIANCES AND POWER TOOLS	Kitchen countertop appliances (e.g. toasters, microwaves, coffee makers and food processors), electric bathroom scales, hair dryers, carpet cleaners, vacuum cleaners, portable fans, power tools, sewing and exercise machines	ElectroRecycle is a non-profit, province-wide, small electrical appliance recycling program in B.C. and the first of its kind in Canada through the Canadian Electrical Stewardship Association (CESA) with the help of BC's Product Care Association **Contact** electrorecycle.ca 1-800-667-4321
TIRES	Car tires, truck tires and some agricultural and logger/skidder tires	Tire Stewardship BC (TSBC) **Contact** tsbc.ca 1-866-759-0488
THERMOSTATS	Mercury-containing and electronic thermostats	Heating, Refrigeration and Air Conditioning Institute of Canada in partnership with the Canadian Institute of Plumbing and Heating, and delivered by Summerhill Impact. **Contact** switchthestat.ca 416-922-2448 (ext 232) jcourt@summerhillgroup.ca
USED OIL AND ANTIFREEZE	Motor oil, oil filters, empty oil containers, antifreeze and used antifreeze containers	BC Used Oil Management Association **Contact** usedoilrecycling.com/bc 1-866-254-0555 reception@usedoilrecycling.ca

CITY OF RICHMOND

HAZARDOUS WASTE AND OTHER DISPOSAL ITEMS

The 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 $50 minimum surcharge, plus the cost of removal, clean-up or remediation. Loads containing banned materials are assessed a 50% tipping fee surcharge.

Many common hazardous household and automotive products must be recycled or disposed through special depots. Disposal sites and take back collection options for hazardous and banned 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 t o accept these take-back products and to check hours of operation.

Please visit www.richmond.ca/recycle for more information.

BANNED/PROHIBITED FROM LANDFILL

EXAMPLES OF MATERIALS

Please refer to the Tips and Resources section for ways to safely dispose of these materials or call RCBC at 604-RECYCLE (732-9253).

- x Asbestos
- x Automobile bodies and parts
- x Batteries
- x Barrels or drums in excess of 205 litres (45 gallons)
- x Clean or treated wood exceeding 2.5 metres in length
- x Electronics and electrical products (limited)
- x Fluorescent lights
- x Gypsum
- x Hazardous waste
- x Inert fill materials including soil, sod, gravel, concrete and asphalt in quantities exceeding 0.5 cubic metres per load
- x Lead acid batteries
- x Liquids and sludge
- x Mattresses
- x Oil containers, oil filters, paint products, solvents and flammable liquids
- x Household or commercial appliances
- x Pesticide products
- x Pharmaceuticals
- x Propane tanks
- x Thermostats
- x Tires
- x Any material in new or expanded product categories for the Recycling Regulation that comes into effect while the 2013 Tipping Fee Bylaw No. 281 is in effect.

BANNED MATERIALS THAT CAN BE RECYCLED

- x Corrugated cardboard
- x Recyclable paper
- x Containers made of glass, metal or banned recycled plastic
- x Beverage containers (all except milk cartons)
- x Yard and garden trimmings

For a list of Banned and Prohibited Materials, please visit www.metrovancouver.org/services/solidwaste/disposal/Pages/bannedmaterials.aspx

TIP FOR RESIDENTS

To spot hazardous waste, look for the words Danger, Warning, or Caution on the product label, and any of the symbols shown above.

ANTIFREEZE AND EMPTY CONTAINERS [DB]

DROP-OFF LOCATION	ADDRESS	PHONE
Richmond Audi	5680 Parkwood Way	604-279-9663
Canadian Tire	3500 No. 3 Road	604-273-2970
Certigard Petro-Canada	4011 Francis Road	604-277-3620
Cowell Motors Ltd. - Volkswagen	13611 Smallwood Place	604-273-3922
Esso Service	7991 No. 1 Road	604-277-1105
Jaguar Land Rover of Richmond	5660 Parkwood Way	604-273-6068
Lubeworld	10991 No. 4 Road	604-951-6662
Metron Auto Service Ltd.	104 - 8077 Alexandra Road	604-270-1668
Mr. Lube	9120 Westminster Highway	604-273-5823
Rainbow Auto Service	142 - 11788 River Road	604-276-2820

For a complete list of antifreeze or containers accepted, visit http://usedoilrecycling.com/en/bc or call 604-RECYCLE.

APPLIANCES - SMALL [DB]

DROP-OFF LOCATION	ADDRESS	PHONE
City's Recycling Depot	5555 Lynas Lane	604-276-4010
Ironwood Bottle & Return-It Depot	110 - 11020 Horseshoe Way	604-275-0585
OK Bottle Depot	7960 River Road	604-244-0008
Regional Recycling	13300 Vulcan Way	604-276-8270
Steveston Return-It Depot	2 - 12320 Trites Road	604-241-9177

For a complete list of small appliances accepted, visit electrorecycle.ca or call 604-RECYCLE.

AUTOMOTIVE BATTERIES [DB]

DROP-OFF LOCATION	ADDRESS	PHONE
Canadian Tire	3500 No. 3 Road	604-273-2970
	11388 Steveston Highway	604-271-6651
Kal Tire	6551 No. 3 Road	604-207-1203
	2633 No. 5 Road	604-278-9181
Regional Recycling *	13300 Vulcan Way	604-276-8270
Sota Battery Canada	11871 Horseshoe Way	604-271-9727

Note: All retail locations accept a used car battery for each new one purchased. For a list of collection sites, please visit www.recyclemybattery.ca

DB: Disposal ban | * A fee is charged
Please note: Drop-off locations may change without notice. Please call individual locations to confirm address and hours of operation.

CITY OF RICHMOND

BABY CAR SEATS

DROP-OFF LOCATION	ADDRESS	PHONE
City of Vancouver Landfill *	5400 72nd Street, Delta	604-873-7000

BATTERIES AND MOBILE PHONES DB

Batteries weighing five kilograms or less.

DROP-OFF LOCATION	ADDRESS	PHONE
Batteries Included	319 - 5300 No. 3 Road	604-270-9989
City's Recycling Depot	5555 Lynas Lane	604-276-4010
Canadian Tire	11388 Steveston Highway	604-271-6651
Dr Battery	135 - 13900 Maycrest Way	604-273-8248
Future Shop	102 - 5300 No. 3 Road	604-232-9772
	150 - 2780 Sweden Way	604-207-0199
Home Depot	2700 Sweden Way	604-303-7360
London Drugs	5971 No. 3 Road	604-448-4811
	3200 - 11666 Steveston Highway	604-448-4852
Pharmasave	116 - 10151 No. 3 Road	604-241-2898
Rona	7111 Elmbridge Way	604-273-4606
Staples	1 - 6390 No. 3 Road	604-270-9599
	110 - 2780 Sweden Way	604-303-7850

For a complete list of batteries accepted, please visit call2recycle.ca or call 1-888-224-9764.

For a complete list of mobile phones drop off locations, visit call2recycle.ca/locator

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

To erase information from your device, including text messages, contacts and personal files, use Cell Phone Data Erasers by recyclemycell.ca/recycling-your-device available for free.

CARBON MONOXIDE (CO), SMOKE AND COMBINATION SMOKE AND CO ALARMS DB

DROP-OFF LOCATION	ADDRESS	PHONE
London Drugs	5971 No. 3 Road	604-448-4811
	3200 - 11666 Steveston Highway	604-448-4852
Regional Recycling	13300 Vulcan Way	604-276-8270
Steveston Return-It Depot	2 - 12320 Trites Road	604-241-9177

For a complete list of alarms accepted, please visit productcare.org/Smoke-Alarms or call 604-RECYCLE.

ELECTRONICS: AUDIO VISUAL EQUIPMENT, COMPUTERS, MONITORS, TVs, PRINTERS, FAX MACHINES, SCANNERS, VIDEO GAMES & ACCESSORIES

DROP-OFF LOCATION	ADDRESS	PHONE
Best Buy	700 - 5300 No. 3 Road	604-273-7335
Future Shop	102 - 5300 No. 3 Road	604-232-9772
	150 - 2780 Sweden Way	604-207-0199
Ironwood Bottle & Return-It Depot	110 - 11020 Horseshoe Way	604-275-0585
OK Bottle Depot	7960 River Road	604-244-0008
Regional Recycling	13300 Vulcan Way	604-276-8270
Staples	1 - 6390 No. 3 Road	604-270-9599
	110 - 2780 Sweden Way	604-303-7850
Steveston Return-It Depot	2 - 12320 Trites Road	604-241-9177

For a complete list of materials accepted, please visit return-it.ca/electronics or call 604-473-2400.

EXERCISE & HOBBY MACHINES DB

DROP-OFF LOCATION	ADDRESS	PHONE
City's 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	604-276-8270

EYEGLASSES

DROP-OFF LOCATION	ADDRESS	PHONE
Drop off at a local optometrist or eye care professional.		

FIRE EXTINGUISHERS

DROP-OFF LOCATION	ADDRESS	PHONE
Contact Recycling Council of BC at 604-RECYCLE for more information.		

DB: Disposal ban | * A fee is charged

Please note: Drop-off locations may change without notice. Please call individual locations to confirm address and hours of operation.

DID YOU KNOW?

The Product Stewardship Program helps with take back of many recyclable materials and is guided by the principle that whoever designs, produces, sells or uses a product takes responsibility for minimizing that product's environmental impact. The costs for recycling these products are covered through environmental handling fees that are charged on the sale of products and through refundable deposits on items like beverage containers.

FLAMMABLE LIQUIDS [DB], PESTICIDES [DB], SOLVENTS [DB], GASOLINE [DB]

(Gasoline must be in approved UCC container)

DROP-OFF LOCATION	ADDRESS	PHONE
City's Recycling Depot	5555 Lynas Lane	604-276-4010
Regional Recycling	13300 Vulcan Way	604-276-8270

For a complete list of flammable liquids, gasoline, pesticides and solvents accepted, please visit productcare.org/BC-Paint-Program or call 604-RECYCLE.

GENERAL HAZARDOUS MATERIALS

DROP-OFF LOCATION	ADDRESS	PHONE
Hazco Environmental (Tervita)*	160 -13511 Vulcan Way	604-214-7000
Newalta Corporation *	9 - 7483 Progress Way, Delta	604-952-1220 604-940-9655

GYPSUM DRYWALL [DB]

No other materials attached to or on drywall

DROP-OFF LOCATION	ADDRESS	PHONE
City of Vancouver Landfill *	5400 72nd Street, Delta	604-873-7000
Ecowaste Industries Ltd. *	15111 Triangle Road	604-277-1410
New West Gypsum Recycling *	38 Vulcan Street, New Westminster	604-534-9925
Vancouver Transfer Station (Maximum 1/2 sheet with a paid load of garbage)	377 W. Kent Avenue N.	604-873-7000

HYPODERMIC NEEDLES

Purchase a "Sharps Container" from a pharmacy and return the container to same pharmacy when full.

LIGHTS & LIGHTING FIXTURES [DB]

DROP-OFF LOCATION	ADDRESS	PHONE
City's Recycling Depot	5555 Lynas Lane	604-276-4010
Canadian Tire	11388 Steveston Highway	604-271-6651
Home Depot	2700 Sweden Way	604-303-7360
London Drugs	5971 No. 3 Road	604-448-4811
	3200 - 11666 Steveston Highway	604-448-4852

For a complete list of lighting products accepted, please visit productcare.org/lights or call 604-RECYCLE.

LUBRICATING (USED) OIL [DB], OIL FILTERS [DB], PLASTIC OIL CONTAINERS [DB]

DROP-OFF LOCATION	ADDRESS	PHONE
Audi of Richmond	5680 Parkwood Way	604-279-9663
Canadian Tire	3500 No. 3 Road	604-273-2939
	11388 Steveston Highway	604-271-6651
Certigard Petro-Canada	4011 Francis Road	604-277-3620
Cowell Motors Ltd - Volkswagen	13611 Smallwood Place	604-273-3922
Esso Service Station (Blundell)	7991 No. 1 Road	604-277-1105
Jaguar Land Rover of Richmond	5660 Parkwood Way	604-273-6068
Jiffy Lube	10991 No. 4 Road	604-951-6662
Metron Auto Service Ltd.	104 - 8077 Alexandra Road	604-270-1668
Mr. Lube	9120 Westminster Highway	604-273-5823
Sky Auto Services	110 - 5791 Minoru Boulevard	604-233-1828

For a complete list of lubricating oil, oil filters and plastic oil containers accepted, visit www.usedoilrecycling.com or call 604-RECYCLE.

DB: Disposal ban | * A fee is charged

Please note: Drop-off locations may change without notice. Please call individual locations to confirm address and hours of operation.

CITY OF RICHMOND

Working together with the City of Richmond, producers, retailers and residents can divert hazardous waste and other special disposal items from the landfill. Producers and retailers who support product stewardship and related take back programs assist with recycling and proper disposal, and residents can use these programs to help turn waste into resources.

MATTRESSES AND BOXSPRINGS DB

DROP-OFF LOCATION	ADDRESS	PHONE
Canadian Mattress Recycling*	1210 Cliveden Avenue, Delta	604-777-0324
City of Vancouver Landfill*	5400 72nd Street, Delta	604-873-7000
MattressRecycling.ca*	8275 Sherbrooke Street, Vancouver	604-961-1534

Richmond's Large Item Pick Up Program: Contact Sierra Waste at 604-270-4722. Please note some restrictions apply. See page 39.

MEDICAL DEVICES & EQUIPMENT DB

DROP-OFF LOCATION	ADDRESS	PHONE
Best Buy	700 - 5300 No. 3 Road	604-273-7335
Future Shop	102 - 5300 No. 3 Road	604-232-9772
	150 - 2780 Sweden Way	604-207-0199
Ironwood Bottle & Return-It Depot	110 - 11020 Horseshoe Way	604-275-0585
OK Bottle Depot	7960 River Road	604-244-0008
Regional Recycling	13300 Vulcan Way	604-276-8270
Staples	1 - 6390 No. 3 Road	604-270-9599
	110 - 2780 Sweden Way	604-303-7850
Steveston Return-It Depot	2 - 12320 Trites Road	604-241-9177

MUSICAL INSTRUMENTS DB

DROP-OFF LOCATION	ADDRESS	PHONE
Best Buy	700 - 5300 No. 3 Road	604-273-7335
Future Shop	102 - 5300 No. 3 Road	604-232-9772
	150 - 2780 Sweden Way	604-207-0199
Ironwood Bottle & Return-It Depot	110 - 11020 Horseshoe Way	604-275-0585
OK Bottle Depot	7960 River Road	604-244-0008
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Staples	1 - 6390 No. 3 Road	604-270-9599
	110 - 2780 Sweden Way	604-303-7850

PAINT & PAINT AEROSOL CONTAINERS DB

DROP-OFF LOCATION	ADDRESS	PHONE
City's Recycling Depot	5555 Lynas Lane	604-276-4010
Regional Recycling	13300 Vulcan Way	604-276-8270
Rona	7111 Elmbridge Way	604-273-4606
Steveston Return-It Depot	2-12320 Trites Road	604-241-9177

For a complete list of paint & paint aerosol containers accepted, please visit productcare.org/BC-Paint-Program or call 604-RECYCLE.

DB: Disposal ban | * A fee is charged
Please note: Drop-off locations may change without notice. Please call individual locations to confirm address and hours of operation.

CITY OF RICHMOND

Working together with the City of Richmond, producers, retailers and residents can divert hazardous waste and other special disposal items from the landfill. Producers and retailers who support product stewardship and related take back programs assist with recycling and proper disposal, and residents can use these programs to help turn waste into resources.

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For a complete list of paint & paint aerosol containers accepted, please visit productcare.org/BC-Paint-Program or call 604-RECYCLE.

DB: Disposal ban | * A fee is charged
Please note: Drop-off locations may change without notice. Please call individual locations to confirm address and hours of operation.

CITY OF RICHMOND

DID YOU KNOW?
Recycled tires are used in products such as athletic tracks, playground safety surfaces, synthetic turf fields and roofing products.

THERMOSTATS [DB]

DROP-OFF LOCATION	ADDRESS	PHONE
Andrew Sheret Ltd.	4500 Vanguard Road	604-278-3766

For more information, visit switchthestat.ca or call 1-416-922-2448 ext 232.

TIRES [DB]

DROP-OFF LOCATION	ADDRESS	PHONE
A & D Workshop Inc	180 -12871 Clarke Place	604-351-7696
Big-O Tires	102-5651 No. 3 Road	604-247-1555
	11251 Bridgeport Road	604-244-0464
Canadian Tire	3500 No. 3 Road	604-273-2939
	11388 Steveston Highway	604-271-6651
Chariot Tire	404 - 5940 No. 6 Road	604-276-2966
Costco Wholesale	9151 Bridgeport Road	604-270-3647
Express Lube & Tune Centre	2840 No. 3 Road	604-278-1018
Kal Tire	6551 No. 3 Road	604-207-1203
	2633 No. 5 Road	604-278-9181
Metro Tires Ltd.	12311 Mitchell Road	604-783-4435
Midas Auto & Tire Service	4660 No. 3 Road	604-273-9664
OK Tire Store	5831 Minoru Boulevard	604-278-5171
Redline Automotive Ltd.	1 - 11711 No. 5 Road	604-277-4269
Richmond Country Tire	11880 Machrina Way	604-241-5555
Roadrunners Dial A Tire Ltd.	125 - 11780 River Road	604-274-8473
Shortstop Auto Service	11251 Bridgeport Road	604-244-0464
Signature Mazda	13800 Smallwood Place	604-278-3185
Vancouver Landfill (Passenger/light truck, with/ without rims limit of 10)	5400 72nd Street, Delta	604-873-7000

Note: All retail locations accept a used tire for a new one purchased.
For a complete list of tires accepted, visit tsbc.ca or call 1-866-759-0488.

TIRES AND TUBES - BICYCLE

DROP-OFF LOCATION	ADDRESS	PHONE
Village Bikes	3891 Moncton Street	604-274-3865

For more information, visit tsbc.ca/bike.php or call 1-866-759-0488.

TOOLS - POWER (ELECTRONIC & ELECTRICAL) [DB]

DROP-OFF LOCATION	ADDRESS	PHONE
City's Recycling Depot	5555 Lynas lane	604-276-4010
Ironwood Bottle & Return-It Depot	110-11020 Horseshoe Way	604-275-0585
OK Bottle Depot	7960 River Road	604-244-0008
Regional Recycling	13300 Vulcan Way	604-276-8270
Steveston Return-It Depot	2 - 12320 Trites Road	604-241-9177

TOYS (ELECTRONIC & ELECTRICAL) INCLUDING VIDEO GAMING SYSTEMS & ACCESSORIES [DB]

DROP-OFF LOCATION	ADDRESS	PHONE
Best Buy	700 - 5300 No. 3 Road	604-273-7335
Future Shop	102 - 5300 No. 3 Road	604-232-9722
	150 - 2780 Sweden Way	604-207-0199
Ironwood Bottle & Return-It Depot	110-11020 Horseshoe Way	604-275-0585
OK Bottle Depot	7960 River Road	604-244-0008
Regional Recycling	13300 Vulcan Way	604-276-8270

NON HAZARDOUS MISCELLANEOUS ITEMS

Vancouver Landfill [*]	5400 72nd Street, Delta	604-873-7000

DB: Disposal ban | * A fee is charged
Please note: Drop-off locations may change without notice. Please call individual locations to confirm address and hours of operation.


CITY OF RICHMOND
Environmental Programs Information Line:
604-276-4010
www.richmond.ca/recycle
Printed on Mohawk Options Smooth,
which contains 100% post-consumer
recycled fibre, is FSC Certified and
is acid and elemental chlorine free.

City of Richmond

Report to Committee

To:	Public Works and Transportation Committee	**Date:**	June 13, 2014
From:	John Irving, P.Eng. MPA Director, Engineering	**File:**	10-6000-01/2014-Vol 01
Re:	**Graybar Road Drainage and Sanitary Main Replacement**		

Staff Recommendation

That funding of $325,000 from the Sanitary Utility Reserve and $275,000 from the Drainage Utility Reserve be included as an amendment to the 5 Year Financial Plan (2014-2018) to complete the Graybar Road Drainage and Sanitary Main Replacement Project.

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

REPORT CONCURRENCE		
ROUTED TO:	**CONCURRENCE**	**CONCURRENCE OF GENERAL MANAGER**
Finance Division Sewerage & Drainage	☑ ☑	
REVIEWED BY STAFF REPORT / AGENDA REVIEW SUBCOMMITTEE	**INITIALS:**	**APPROVED BY CAO**

Staff Report

Origin

In May 2014, staff were advised that ground settlement was occurring on City and private property along the northern portion of Graybar Road near Westminster Highway. Further investigation has indicated that the settlement is likely due to infiltration into the sanitary and drainage mains. While the system is still operational, it is necessary to replace these sections of sewer main to prevent further ground settlement and property damage.

The purpose of this report is to seek Council's support for the replacement of the Graybar Road Sanitary and Drainage Mains under the 2014 Capital Program, with funding from the Sanitary and Drainage Utility Reserves.

Analysis

There are approximately 620km of drainage mains and 565km of sanitary mains owned and maintained by the City. The drainage network collects stormwater throughout the City, and the sanitary network collects wastewater from City residents and businesses. Stormwater is discharged directly to the Fraser River, and wastewater is treated at the Metro Vancouver Lulu Island Wastewater Treatment Plant before it is ultimately discharged to the Fraser River.

The City has a proactive program of utility infrastructure upgrades funded through the appropriate utility. Upgrades are planned utilizing asset management and capacity models developed for Richmond's extensive water, sanitary, drainage and roadway systems. The Graybar Road drainage and sewer mains were not included in the current 5 Year Capital Plan because they are not nearing the end of their original design life.

In May 2014, ground settlement on the western side of Graybar Road was reported to staff. The settlement is affecting the boulevard as well as portions of a paved parking lot on private property. Subsequent inspection of the adjacent drainage and sanitary mains revealed settlement of the pipes and infiltration to both systems.

While the drainage and sanitary systems remain operational, the replacement of approximately 95m of 600mm diameter drainage main and 75m of 200mm diameter sanitary main is necessary to address the settlement issues and prevent further property damage. The estimated cost to complete this work is $600,000.

Financial Impact

The total capital cost is $600,000. Funding of $325,000 for the sanitary portion of the work is available from the Sanitary Utility Reserve. Funding of $275,000 for the drainage portion of the work is available from the Drainage Utility Reserve.

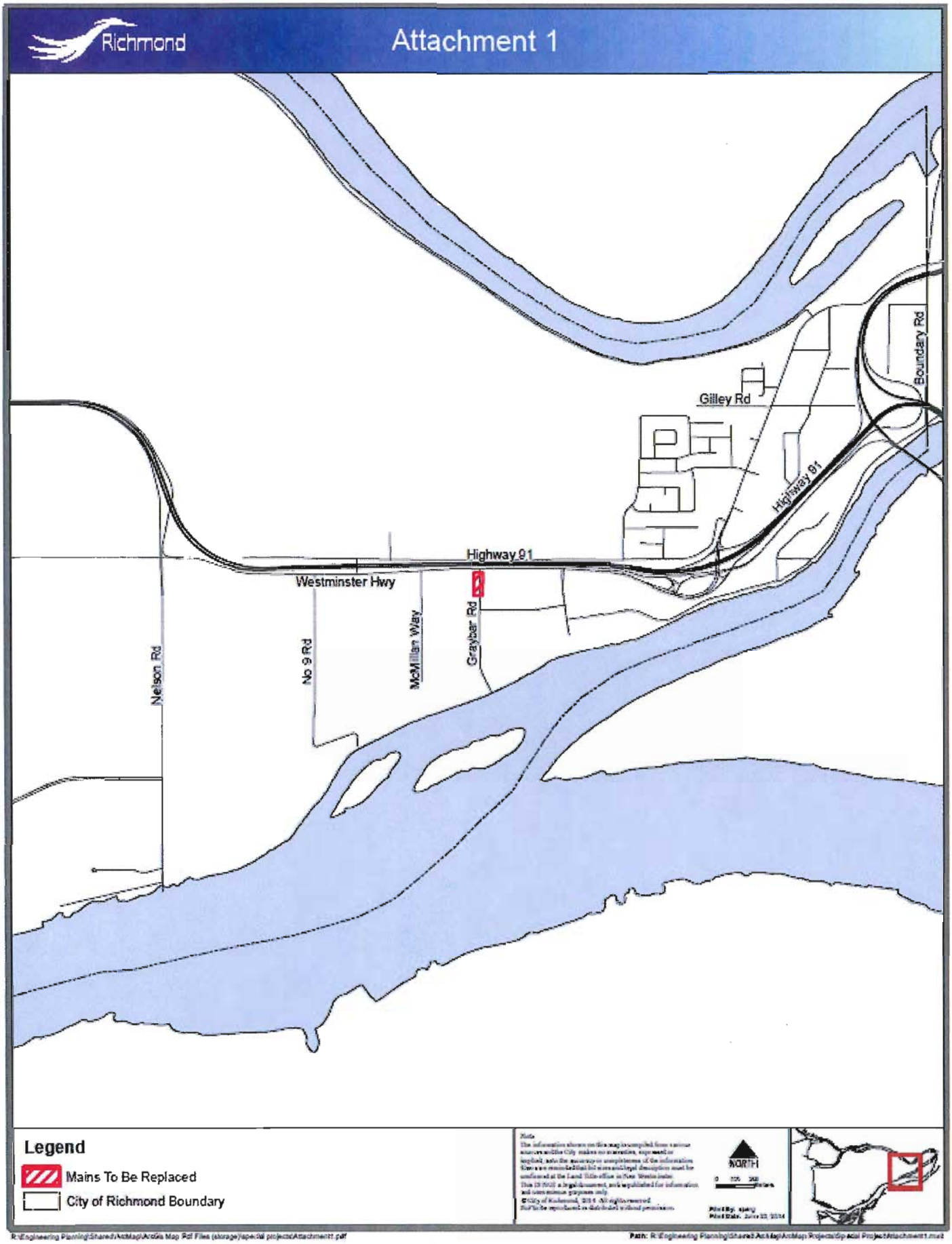
The 5 year Financial Plan (2014-2018) will be amended to reflect these changes.

Conclusion

The drainage and sanitary mains at the north end of Graybar Road have settled and there is infiltration into these pipes. It is necessary to replace these sections of sewer to prevent further ground settlement and damage to private property.

Milton Chan, P.Eng
Manager, Engineering Design & Construction
(604-276-4377)

MC:mc


Richmond
Attachment 1
Gilley Rd
Boundary Rd
Highway 91
Highway 91
Westminster Hwy
Nelson Rd
No 9 Rd
McMillan Way
Graybar Rd
Legend
Mains To Be Replaced
City of Richmond Boundary
NORTH

City of Richmond

Report to Committee

To:	Public Works and Transportation Committee	**Date:**	June 25, 2014
From:	John Irving, P.Eng, MPA Director, Engineering	**File:**	10-6000-01/2013-Vol 01
Re:	**2014 Corporate Energy Management Update**		

Staff Recommendation

That the staff report titled "2014 Corporate Energy Management Program Update" report from the Director of Engineering, dated June 25, 2014, be received for information.

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

Att. 2

REPORT CONCURRENCE	
CONCURRENCE OF GENERAL MANAGER	
REVIEWED BY STAFF REPORT / AGENDA REVIEW SUBCOMMITTEE	INITIALS:
APPROVED BY CAO	

Staff Report

Origin

The Corporate Energy Management Program (EMP) supports Council's Term Goal 8.1 Sustainability:

> *Continued implementation and significant progress towards achieving the City's Sustainability Framework, and associated targets.*

The EMP is a key contributing program towards achieving the Sustainability Framework Goals of a Sustainable Resource Use-Energy Smart City and Climate Prepared City. This report summarizes the recent achievements of the Corporate EMP and highlights upcoming initiatives. Attachment 1 includes a summary of key highlights of recent City energy initiatives.

Background

The City's EMP contributes to increased energy efficiency and is a major component of the City's "Towards Carbon Neutrality Implementation Strategy", adopted by Council in October 2013. The EMP achieves this by focusing on three main action areas:

1. Energy conservation – reduce the overall demand for energy (e.g., increased energy use awareness and improved operational control to reduce waste)
2. Energy efficiency – reduce the energy required for operations (e.g., lighting retrofits to more efficient technologies)
3. Renewable and clean energy – increase the use of renewable energy and reduce the carbon intensity of emissions (e.g., installation of solar thermal energy systems)

Similar to recent years, the City enters into a funding agreement with BC Hydro, with the commitment to reduce corporate electricity use by a target of 1.6% or 660,000 kWh by April 2015 (from 2013 levels), which is equal to the energy used by approximately 20 homes in BC per year. This target and the continued collaboration with BC Hydro helps to maximize the incentive funding the City receives and allows for the continued delivery of projects. Due to the City's continued focus on energy efficiency and collaboration with BC Hydro, the City of Richmond recently received three recognition awards for completed projects and has been nominated again as a BC Hydro PowerSmart Leader Award finalist for 2014. The final determination of this year's award recipients will be made in October 2014.

Findings of Fact

EMP Achievements – 2007-2012 EMP Highlights

Energy conservation work at the City and energy related projects have saved approximately 35.0 GWh of energy (equal to the energy consumption in 970 BC homes per year) since 2007. In this same period, the City has avoided approximately $1,750,000 in operational costs and over 5,000 tonnes of greenhouse gas emissions (equal to emissions from 1,500 Richmond cars). Since 2007, the City received approximately $1,000,000 in external funding which has supported

expanded EMP projects and increased the repayment of capital funding to the corporate Enterprise Fund, where funds are internally borrowed for funding many projects.

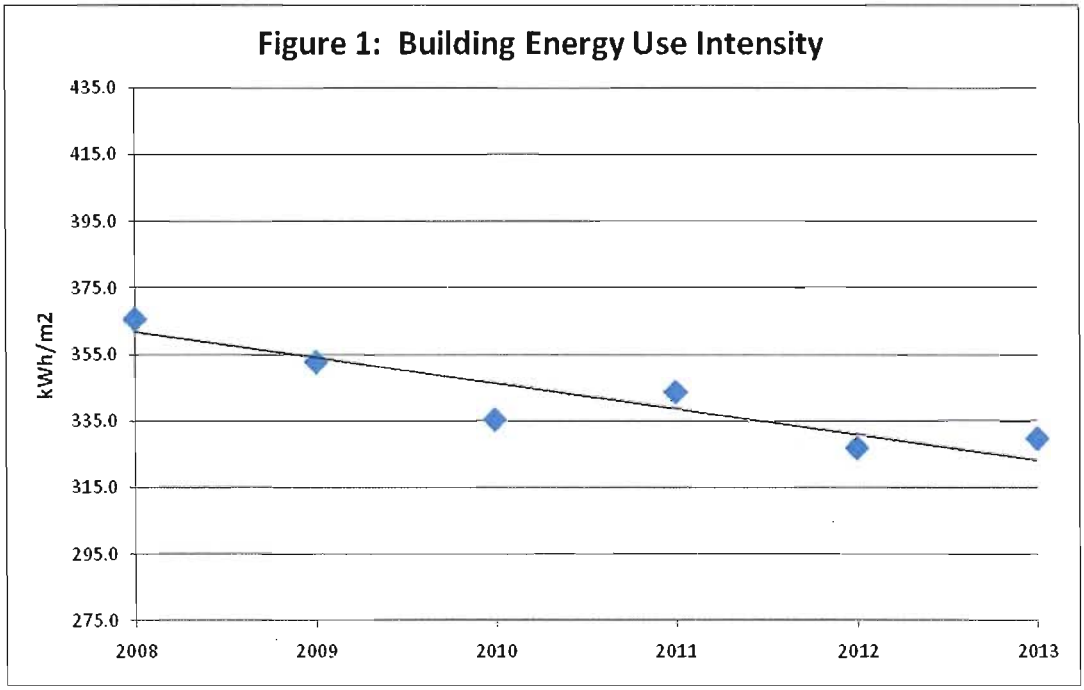
Corporate Energy Use Overview - 2013

Energy management best practices are the responsibility of all staff, and staff are encouraged to play an active role in identifying energy efficiency and reduction opportunities whenever possible. Through the City's workplace conservation awareness program, staff are further encouraged to look at behavioural-based ways to reduce energy use. Key staff in operational roles carry out more active roles in managing or coordinating energy use reporting, completing inventories, and implementing reduction programs for all civic buildings, lighting, and water/wastewater services.

In 2013, City assets, including the Richmond Oval, consumed approximately $6.0 million dollars of conventional energy[1] (electricity and natural gas), which equals 81.1 GWh (equivalent to the amount of energy used on average each year by approximately 2,300 homes in BC). This total does not include the energy used in the City's corporate fleet operations. Compared to the last three years, the corporate energy consumption for buildings, water/wastewater services, and lighting has relatively remained stable, while the City's infrastructure continues to increase to meet increasing demand.

Energy use at civic buildings accounts for a majority (approximately 83%) of total reported corporate energy use[2]. As shown in the following Figure 1, civic building energy use intensity has decreased from approximately 365 kWh/m^2 in 2008 to 329 kWh/m2 in 2013. Decreasing energy use intensity in civic buildings (improving energy use efficiency) demonstrates that corporate energy management remains an effective tool for managing costs over time.

Figure 1: Building Energy Use Intensity



[1] There are civic buildings that have renewable energy systems (e.g. solar thermal hot water heating at Minoru Aquatic Centre), which obtain "free" solar energy that is not accounted for in our total corporate energy use/cost amount.
[2] This total corporate energy use does not include Fleet services.

EMP Achievements - 2013 EMP Highlights

The City is on track to achieve a reduction of approximately 1.4 GWh of electrical and natural gas energy use (representing approximately 1.8% of its current use) from a variety of projects that began in 2013. Due to scheduling changes for two projects delaying them to a 2014 start, projects completed by the end of 2013 are anticipated to result in approximately 1.2 GWh of energy savings or 1.5% of corporate energy use. These savings are anticipated to be realized in the 2014 calendar year, and represent approximately $85,000 in operational cost avoidance and a reduction of approximately 150 tonnes of CO_2e (equal to removing approximately 45 Richmond cars from our roads each year). Based on the approximate $550,000 capital cost of the 2013 EMP projects, it is anticipated that these projects overall have a 6.5 year payback.

A detailed overview of EMP projects highlights in 2013 is provided in Attachment 2; highlights include:

- External Funding: $100,000 of external funding was leveraged to support the Corporate Energy Management Program and Sustainability Unit in 2013.
- Showcase projects: Achieved excellent results with sewage heat recovery at Gateway Theatre, with reductions of approximately 45% in natural gas use and approximately $15,000 annually in cost avoidance savings. Through the optimized refrigeration and mechanical upgrades at Richmond Ice Centre in 2014, it is anticipated that approximately 1.32 gigawatt hours (GWh) of energy consumption at the facility will be saved in 2015. This represents an approximate 20% reduction and approximately $80,000 annually in cost avoidance savings.
- Policy Review: Council adoption of the City's High Performance Building Policy, which retained LEED as a sustainable building construction measurement tool but included strategic revisions such as: acknowledging the importance of occupant comfort and functionality, establishing new energy performance targets for new and existing buildings, and embedding long term goals of constructing net zero energy and carbon neutral corporate buildings by 2030.
- New Technology: Working with BC Hydro, City staff will help deliver a pilot project that will install high efficient light-emitting diode (LED) street lighting fixtures on BC Hydro poles, improving the lighting on high priority roadways.

In addition to corporate energy management activities, the City is active in the development of community energy and emissions reduction actions through the advancement of district energy and new community programs. The City has one renewable district energy system in operation, the Alexandra District Energy Utility, and one in the design stages for City Centre. These investments will help the City transition from conventional energy sources to more sustainable and stable energy systems, reducing long term costs and greenhouse gas (GHG) emissions.

Through Council support, staff are also launching energy and carbon reduction initiatives in the Community, entitled Richmond Energy Challenge and Richmond Carbon Marketplace. The programs both aim to support energy efficiency and GHG emissions reductions in the community, and facilitate external funding for Richmond organizations. It is through these types of programs that the City strives to act as a catalyst within the community and encourage further energy efficiency and GHG emissions reductions.

EMP Goals for 2014 and Upcoming Projects

The following main focus areas remain in place for the EMP for 2014:

- Increase energy use awareness within the organization and show leadership in the community
- Pursue external funding and partnerships with outside agencies
- Maintain a leadership role in municipal energy systems and policy
- Improve the usability of energy use data at key facilities, to allow for more detailed analysis and the increased optimization of energy use
- Incorporate a more systematic approach to building energy use performance analysis and benchmarking in civic facilities, to allow for the continued improvement of facilities, and the extension of their usefulness
- Continue to ensure that energy use and GHG emission accounting (in relation to reduction goals) is a high priority during the designing of new facilities and developments

The following key energy initiatives are in various stages of implementation, and are scheduled to be completed in 2014:

- Major refrigeration plant and mechanical improvements at Richmond Ice Centre
- Completion of building automation system upgrades and improved energy monitoring capabilities at several civic facilities, including City Hall
- Lighting retrofits at various facilities, including Richmond Courthouse and the Minoru Park tennis courts
- Solar thermal pool heating system optimization at Steveston and South Arm facilities

Financial Impact

None at this time. Capital projects related to energy management are reviewed and approved by Council as part of the capital budget process.

Conclusion

It is through Council and staff's continued commitment to corporate energy efficiency that effective energy management and energy efficiency practices are becoming more embedded into the City's culture and decision making processes. Cumulatively since 2007, energy conservation projects in buildings at the City have saved approximately 35.0 GWh of energy (equal to the energy consumption in 970 BC homes per year), which amounts to approximately $1,750,000 in total operational cost avoidance and over 5,000 tonnes of greenhouse gas emissions reduced (equal to emissions from 1,500 Richmond cars). These efforts have allowed the City to add new facilities and infrastructure, without increasing overall energy use. This achievement is in line with the corporate target of maintaining building energy use and GHG emissions at 2012 levels while

incorporating new infrastructure and services. With continuing focus on reducing our corporate footprint through energy conservation, energy reduction, and increased integration or renewable energy sources, the corporation will be well positioned to limit its future operating cost and conventional energy use increases.

The City has made excellent progress in retrofitting buildings to minimize energy consumption and the staff will continue to develop similar retrofitting opportunities. Future success of the EMP program will increasingly depend on maximizing energy efficiency opportunities in new capital projects and replacement equipment, and increasing operational efficiencies through building automation systems and scheduling. As such, the City's updated High Performance Building Policy will become a critical tool for achieving future reductions.

Levi Higgs
Corporate Energy Manager
(604-244-1239)

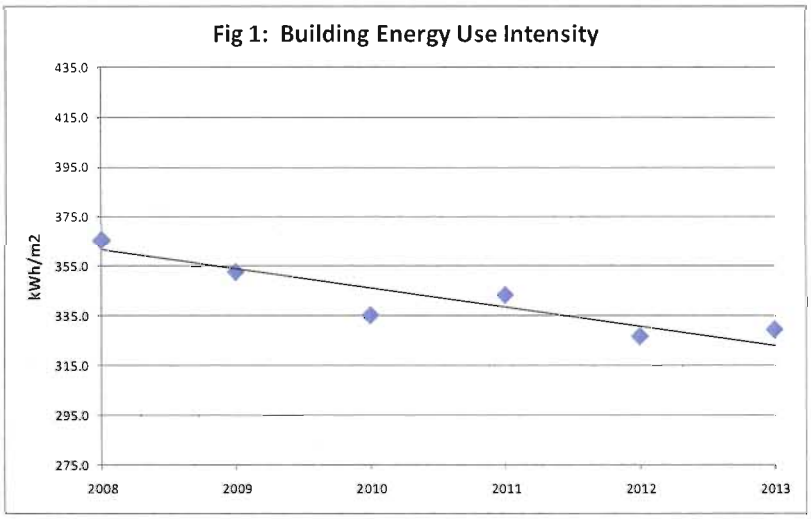
Att. 1	Energy Report Summary – 2013	REDMS# 4268878
Att. 2	City Energy Management Program 2013 Key Initiatives	REDMS# 4260178

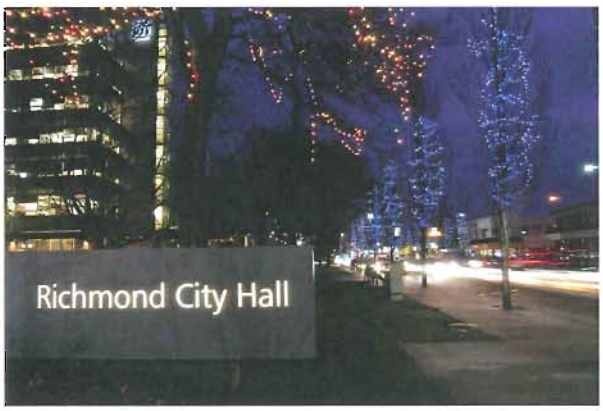
Energy Update Report

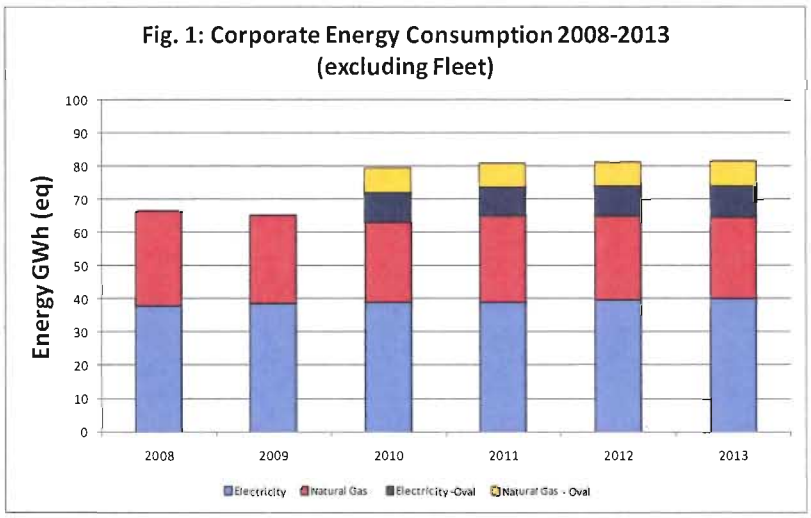
Summary 2013

Richmond

- Cost of energy in 2013 for the City of Richmond buildings, lighting, water and wastewater services = **$6.0 million dollars** or **81.1 GWh** (this is equal to the average power consumed in **~2,300** homes in BC in 1 year).
- As compared with the last three years, overall energy consumption for these civic assets has remained stable.
- Although overall energy use has not decreased as compared to the previous few years, our building energy use intensity (kWh/m2) has decreased. This indicates that corporate energy use efficiency is increasing.
- Cumulatively since 2007, energy conservation projects at the City have saved approximately **35.0 GWh** of energy (equal to the energy consumption in **~970 BC** homes per year), and over 5,000 tonnes of greenhouse gas emissions (equal to emissions from ~1,500 Richmond cars)







- In 2013, the majority of corporate energy use (excluding fleet services) was by buildings-83%, followed by lighting-11% and water/wastewater services-5%.
- Recreational pools and ice arenas are the City's highest energy consuming facilities - with Richmond Olympic Oval, Watermania, Richmond Ice Centre, Minoru Pools and Minoru Arenas accounting for approximately 57% of the energy used by civic buildings in 2013.
- Other larger energy consuming corporate buildings/complexes include Public Works Yard, City Hall, the Steveston Community Centre Complex, and the Community Safety Building.
- Planned upgrades to the building automation systems at select high consuming buildings and associated re-commissioning, is hoped to improve operational energy efficiency from between 10% to 20%.

Fig 3: Overall Energy Use by Asset Class 2013

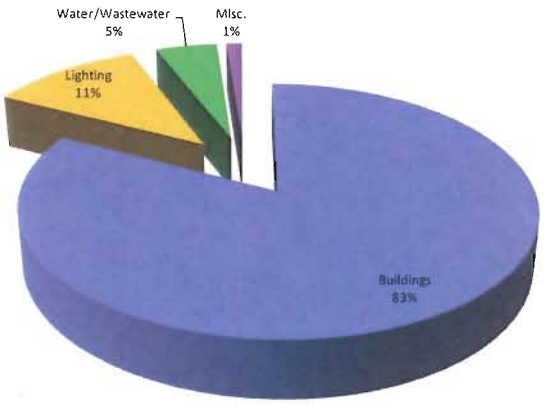
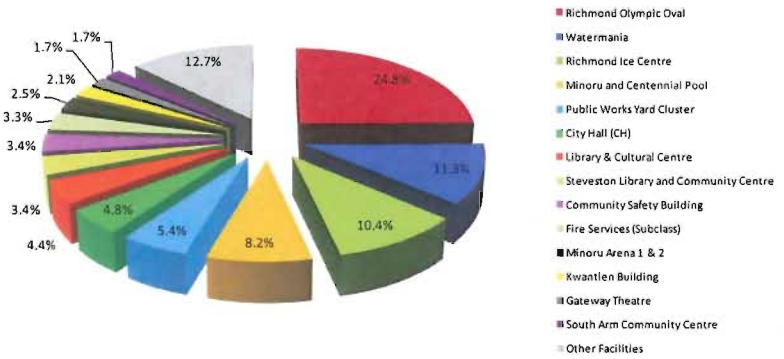


Fig 4: Building Energy Consumption Breakdown 2013



2013 Highlights:

- Secured over $100,000 of external funding to support the Energy Management Program.
- City of Richmond recently received three recognition awards for completed projects from BC Hydro, and has been nominated again as a BC Hydro PowerSmart Leader Award finalist for 2014.
- City achieved an estimated reduction of **1.2 GWh** in electrical and natural gas use and approximately **150 tonnes** of greenhouse gas emissions from a variety of projects in 2013.
- This energy reduction represents approximately **1.5%** of our current corporate annual energy use and the GHG emissions reduction is equal to removing approximately **45 vehicles** from Richmond roads each year.
- These energy reductions will result in approximately **$85,000** in operational cost avoidance savings.

2012 POWER SMART LEADER BC hydro powersmart


Minoru Aquatic Centre

Fire Hall No. 2

Showcase Projects:

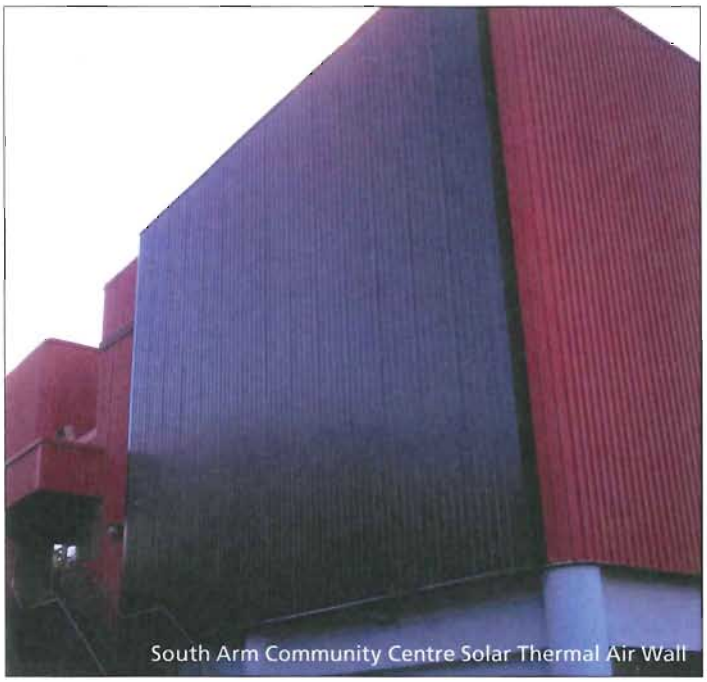
- Increased parking lot lighting levels at City Hall, with approximately 30% less energy usage.
- Solar thermal air wall in operation at South Arm Community Centre.
- Reductions of approximately 45% and 55% in natural gas use at Gateway Theatre and Minoru Arena respectively.

Policy Improvements:

- Council adopted the Corporate High Performance Building Policy, which targets LEED Gold construction for new buildings, improved energy performance for existing buildings, and long term goals of net zero energy and carbon neutral corporate buildings by 2030.

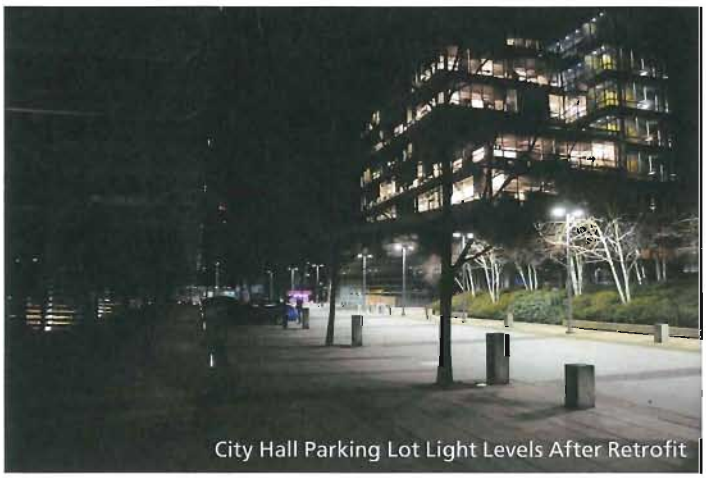
New Technology:

- Working with BC Hydro, City staff will help deliver a pilot project that will install high efficient light-emitting diode (LED) street lighting fixtures on BC Hydro poles, improving the lighting on high priority roadways.


South Arm Community Centre Solar Thermal Air Wall


Gateway Theatre Performance


City Hall Parking Lot Light Levels Before Retrofit

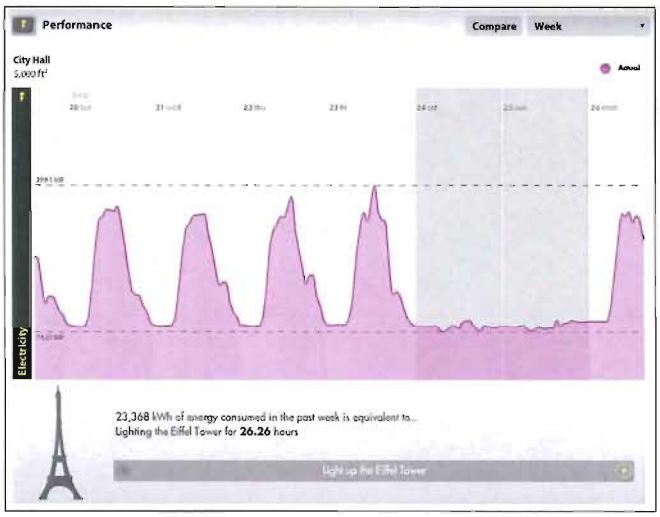

City Hall Parking Lot Light Levels After Retrofit

VIsion and Goals 2014

- Continue to support the City's Carbon Neutrality commitment, through corporate energy efficiency upgrades.
- Research and facilitate the maximizing of energy efficiency opportunities for new capital projects and replacement equipment, increasing operational efficiencies through building automation systems, and continuing to retrofit existing buildings for improved energy performance.
- Continue to increase energy use awareness within the organization and community.

2014 Action items:

- Major refrigeration plant and mechanical improvements at Richmond Ice Centre
- Completion of building automation system upgrades and improved energy monitoring capabilities at several civic facilities, including City Hall
- Lighting retrofits at various facilities, including Richmond Courthouse and the Minoru Park tennis courts
- Solar thermal pool heating system optimization at Steveston and South Arm facilities
- Launching of two community engagement programs to support energy efficiency and GHG emissions, entitled the Richmond Energy Challenge and Richmond Carbon Marketplace.



City Energy Management Program – 2013 Key Initiatives

	2013 Key Initiatives
Plan	***Energy Strategic Planning:*** • Secured over $100,000 in external funding for a variety of projects completed in 2013 • Secured over $175,000 in external funding in 2013 to support the infrastructure upgrades and replacements at Richmond Ice Centre in 2014 including; o Complete chiller replacement to more efficient refrigeration plant technology o Installation of heat recovery unit, to pre-heat ice resurfacing hot water o Replacing two hot water boilers to more efficient condensing units • Updated the Corporate High Performance Building Policy, which retained LEED as a sustainable building/space construction measurement tool and included the following strategic revisions; o Acknowledged that a "sustainable" building needs to ensure that occupant comfort and functionality o Established new energy performance targets for new and existing buildings o Referenced the need for sustainable operation and maintenance best practices to be followed o Included long term stretch goals of building net zero energy and carbon neutral buildings by 2030 • In collaboration with the Project Development Unit, currently undergoing a review of the energy production and delivery options for the new facilities in Minoru Park to ensure that these facilities are able to optimize energy use and incorporate renewable energy technologies where feasible.
Do	***Building Capacity*** • Workplace conservation Awareness program Year 3 completed in 2013(initiatives included What's Watt online challenge, lighting information workshop and a turn down the heat campaign). • Greater alignment of capital submissions for yearly building improvement and energy management related requests, to ensure that projects are delivered seamlessly (e.g. Coordinated Richmond Ice Centre mechanical upgrade planning to optimize the performance of the new system and maximize external funding support). ***Reducing Energy Use or Displacing conventional energy sources*** • Building controls upgrade and operational efficiency improvements at the Works Yard • Lighting retrofits and re-lamps at various facilities (e.g. Community Safety Building and City Hall) • Completion of natural gas use reduction projects at Gateway Theatre that included a major boiler and coupling replacement. • Building envelopment improvement and sealing at various facilities ***Increasing Financial Security & Stability*** • Over $80,000 in energy and maintenance cost avoidance savings

	2013 Key Initiatives
Monitor & Report	***Improving Energy Monitoring System*** • Building automation system upgrades have been completed at West Richmond and South Arm Community Centres, which will allow increased operational and energy use detail to enable greater energy system optimization. • The corporate energy use database is undergoing upgrades to allow of increased functionality (e.g. greater energy use reporting capabilities to stakeholders, and increased efficient reporting function for BC reporting requirements) ***Reporting Performance*** • Annual Corporate-wide Energy update report to Council • Semi-Annual reporting to Senior Management, on Energy Management Program status and work plan • Quarterly reporting to BC Hydro
Innovate & Improve	***Exploring New Approaches and Technologies*** • The following projects and feasibility of further evaluation will be assessed in the coming months o Steveston Community Centre and Richmond Courthouse energy upgrades o Further implementation of building automation system upgrades and energy monitoring improvements o Street lighting replacement plan and efficiency improvement ***Energy Management System Evaluation*** • BC Hydro energy management system assessment to be conducted in June 2014 will review current corporate practices and determine five action items/areas that the City's EMP should focus on to ensure continually improvement in corporate energy efficiency is maintained ***Improved Building Operational Guidelines*** • In collaboration with the Facilities Department, currently developing Sustainable Operation and Maintenance Guidelines for buildings that aim to include City Lighting standards and Building Automation System Integration Guidelines

City of Richmond

Report to Committee

To:	Public Works and Transportation Committee	**Date:**	June 16, 2014
From:	John Irving, P.Eng. MPA Director, Engineering	**File:**	10-6000-01/2014- Vol 01
Re:	**Electric Vehicle Promotion at Community Events**		

Staff Recommendation

That the City's participation in the Emotive electric vehicle initiative, as described in the attached report titled "Electric Vehicle Promotion at Community Events", dated June 16, 2014, from the Director, Engineering, be endorsed.

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

REPORT CONCURRENCE		
ROUTED TO:	**CONCURRENCE**	**CONCURRENCE OF GENERAL MANAGER**
Transportation	☑	
REVIEWED BY STAFF REPORT / AGENDA REVIEW SUBCOMMITTEE	**INITIALS:**	**APPROVED BY CAO**

Staff Report

Origin

Richmond's 2041 Official Community Plan (OCP) establishes community greenhouse gas (GHG) reduction targets of 33% by 2020, and 80% by 2050, below 2007 levels. Richmond's Community Energy and Emissions Plan (CEEP) identifies that vehicle transportation accounted for 53% of the community's GHG emissions in 2010. By increasing the use of electric vehicles (EVs) Richmond can more rapidly achieve the targeted GHG reductions.

Promoting EVs supports Council's Term Goal #8 Sustainability:

> #8.1 Continued implementation and significant progress towards achieving the City's Sustainability Framework.

Background

In January 2014, City Council adopted Richmond's Community Energy and Emissions Plan (CEEP), which sets strategies to manage energy use and reduce carbon emissions. A widespread shift to zero carbon vehicles is identified in the CEEP as a "Big Breakthrough" strategy necessary for Richmond to achieve its emissions targets in the coming decades. Strategy 7 in the CEEP identifies that the City will "promote low carbon personal vehicles".

The City has taken a variety of actions to facilitate the transition to EVs. In 2012, Council approved a cost sharing project with the Province that allowed the installation of EV charging stations at Steveston, Thompson, and Cambie Community Centres, as well as City Hall. The stations have been used 967 separate times in the first 9 months of their activation, helping to build consumer confidence in EVs. There are also two electrical charging stations at the Works Yard and City Hall for City vehicles to use, and the City has four EVs in its fleet.

The City has also supported EV charging stations in private development. The 2041 OCP requires that at least 45% of parking stalls in multi-family developments be constructed to accommodate future installation of EV charging equipment. Larger commercial developments such as the recent SmartCentres development have included provisions for EV charging infrastructure.

Analysis

Program Overview

"Emotive" is a new joint outreach campaign developed by Plug In BC, a collaborative initiative that works to promote EVs and related electric charging infrastructure in British Columbia. The Emotive campaign was developed with support from Metro Vancouver, some regional municipalities, the Fraser Basin Council, the Province of BC and BC Hydro.

The Emotive campaign is designed to raise awareness of EVs, and create more opportunities to experience driving an EV. A recent study by the World Wildlife Foundations found that 47% of Canadians had no awareness of EVs, while only 7% of the population report experience traveling

in or even seeing an EV. Such research suggests that building the public's awareness of EVs is crucial to facilitate their uptake.

Plug In BC conducted market research to identify likely "early adopter" populations that may purchase electric vehicles in the near term. This research suggests that higher income populations with an interest in technology and/or environmental values are appropriate target markets. This research also surveyed current owners on what they most appreciated about their EV. Interestingly, EV owners mostly cite vehicle performance as their favourite feature – 59% of owners cite power and speed, 30% that vehicles are quiet, and only 11% most appreciate vehicles' environmental attributes.

The Emotive campaign includes a branded identity (see Attachment 1) and various forms of media (website, billboards, etc.) that seek to increase peoples' knowledge of electric vehicles. The campaign includes "Community Event Kits", which can be deployed at major community events. The kits include usage of the Emotive identity, promotional materials (t-shirts, tattoos, and other collateral), and the participation of 1-2 volunteer EV owners who serve as "EV Ambassadors".

Promotion in Richmond

The City has the opportunity to deploy the Emotive campaign at major events, such as the Richmond Maritime Festival, Night Market, Summer Night Market, Steveston Dragon Boat Festival, and other events. City staff will attend these events, accompanying volunteer EV Ambassadors. Staff anticipate implementing Emotive engagements at a minimum of 5 events during 2014. Staff will also promote other sustainable energy opportunities, such as home energy improvement programs, during these events.

Financial Impact

None. Any minor costs related to Richmond-specific promotional materials and events can be accommodated within existing budgets.

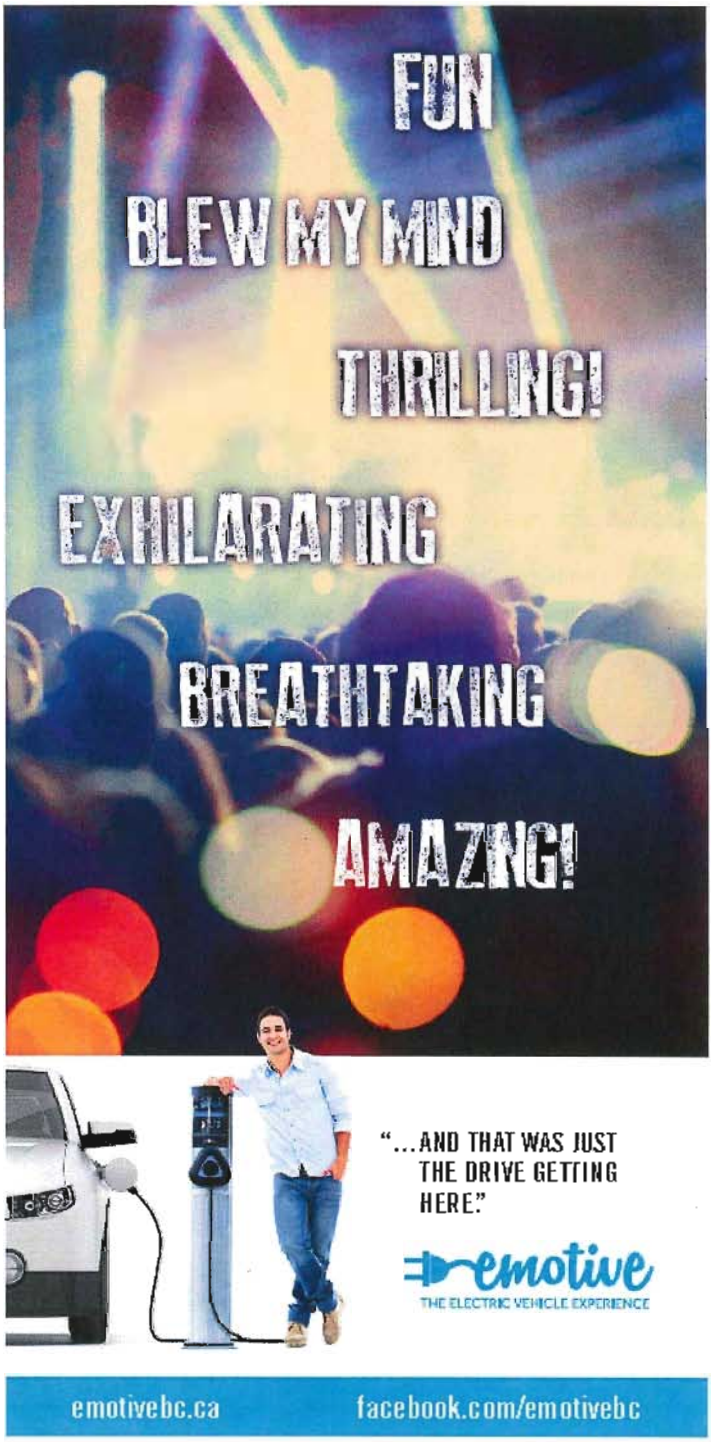
Conclusion

The Emotive campaign is an opportunity to encourage Richmond's residents to experience EVs, and will assist the City in meeting is energy and emissions goals. Staff will also use the opportunity to promote the City's actions and energy related programs.

Brendan McEwen
Manager, Sustainability
(604-247-4676)

Attachment 1

Emotive Campaign Branding & Promotions



City of Richmond

Report to Committee

To:	Public Works and Transportation Committee	**Date:**	July 3, 2014
From:	John Irving, P.Eng. MPA Director, Engineering	**File:**	10-6600-10-02/2014-Vol 01
Re:	**Alexandra District Energy Utility Expansion Phase 3**		

Staff Recommendation

That:

1. The expansion of the Alexandra District Energy Utility include additional geoexchange fields in the West Cambie Neighbourhood Park, with supplemental conventional energy systems for back up, as presented in the report titled "Alexandra District Energy Utility Expansion Phase 3", dated July 3, 2014, from the Director, Engineering, be endorsed; and

2. Capital submissions totalling $12.3M for design, construction and commissioning of the ADEU Phase 3 be submitted for Council's consideration as part of the City's Five Year Financial Plan (2015-2019).

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

Att. 2

REPORT CONCURRENCE		
ROUTED TO:	**CONCURRENCE**	**CONCURRENCE OF GENERAL MANAGER**
Finance Division	☑	
Parks Services	☑	
Development Applications	☑	
REVIEWED BY STAFF REPORT / AGENDA REVIEW SUBCOMMITTEE	**INITIALS:**	**APPROVED BY CAO**

Staff Report

Origin

At the December 10, 2012, Council meeting, Council supported the Alexandra District Energy Utility (ADEU) the following recommendations:

1. *Authorize staff to incorporate a wholly owned local government corporation including:*

    a. *naming the corporation Lulu Island Energy Company (pending name availability) (LIEC) with the City of Richmond as the sole share holder to own and operate the Alexandra District Energy Utility (ADEU);*

    b. *authorizing the Chief Administrative Officer and the General Manager, Engineering and Public Works to execute legal agreements and documentation related to the incorporation.*

2. *Authorize staff to explore the merits of external borrowing of up to $6M to finance phase 3 of the ADEU and report to Council through Committee on the budget impacts to future capital projects.*

3. *Re-classify the District Energy Manager position from Temporary Full Time (TFT) to Regular Full Time (RFT); and*

4. *Approve the creation of a Position Control Complement (PCC) for the District Energy Manager position.*

This report responds to item #2, a referral by Council for staff to explore the merits of external borrowing to finance Phase 3 of the ADEU expansion and its impacts to future capital projects, and includes a recommended plan for the ADEU Phase 3 expansion.

This initiative aligns with Council's Term Goal #8 Sustainability:

> *8.1 Continued implementation and significant progress towards achieving the City's Sustainability Framework, and associated targets.*

Background

Phases 1 and 2 of ADEU were established in partnership with Oris Geo Energy Ltd. The partnering agreement was limited to providing heating and cooling services to Oris Developments' two projects, Alexandra Gate and Remy.

Council subsequently adopted the Alexandra District Energy Utility Bylaw No. 8641 and Amendment Bylaw No. 8688 on January 24, 2011, which expanded the service area to include the western portion of the Alexandra neighbourhood. This gave ADEU the potential to encompass 3100 units and 1.1 million sq. ft. of commercial space at build out over an estimated 10 to 15 year period.

To date, Council approved $6M of borrowing from the City's Water Utility Reserve to fund the design and construction of ADEU Phases 1 and 2. These funds will be repaid with interest from customer service fees.

ADEU Phases 1 and 2 were commissioned in July 2012; the system currently provides energy to two developments (Mayfair Place and Remy) with over 600 residential units. The third development, Omega by Concord Pacific, is scheduled to be connected in mid 2014. It is estimated that the current ADEU system capacity is adequate to service this development as well. For its first year of operations and in the context of a small customer base, the financial, operational and environmental results show a better than expected performance of the ADEU system.

Lulu Island Energy Company

The Lulu Island Energy Company (LIEC) was established as a wholly-owned corporation of the City for the purposes of managing district energy utilities on the City's behalf. ADEU is currently not an asset of LIEC. Staff intend to bring forward a report with recommendations to transfer ADEU assets and operations to LIEC within the next year.

Analysis

ADEU Expansion Potential

The current system is estimated to be sufficient to service the two existing connected sites, Remy and Mayfair, and the Omega development which is scheduled to be connected in mid 2014. In order to service more buildings, both heating and cooling capacity and associated infrastructure will need to expand. The ADEU concept and design work completed to date identifies the highest return on energy efficiency and capital occurs with higher density development and high demand users.

Based on the most current construction schedules provided by developers, the City anticipates the need to expand ADEU to provide energy services within the next year. The most advanced project is Polygon's development, Alexandra Court, planned for the first occupancy in the summer of 2015. In addition, more developments, including SmartCentres, are projected to be completed in years 2016 to 2018. Timelines and building sizes are summarized in Table 1 and mapped in Attachment 1.

Table 1: Development Timing in the ADEU Service Area

	Floor Area (ft^2)	Use	Occupancy Date*
Alexandra Court	515,000	Residential	2015 Q2
Jamatkhana Temple	26,500	Institutional	2015
9500 Cambie	108,000	Residential	2015
Alexandra Gate	194,000	Residential	2015
SmartCentres	286,000	Commercial	2016
Jingon	132,000	Residential	2016
Polygon East	262,000	Residential	2018

* Note: Occupancy typically occurs over the course of several months after occupancy is issued.

Originally, it was estimated that Phase 3 will include three developments with 560,000 sq.ft. of floor area. The expanded Phase 3 includes seven developments with total of 1,530,000 sq.ft. of

floor area given the pace of development in the neighbourhood. This results in Phase 3 capital funding requirements greater than the originally estimated $6M. Including seven developments in Phase 3 results in overall greater efficiency, however, it would require capital investments sooner than expected.

ADEU Expansion Plan

ADEU was established on the concept that all capital and operating costs will be recovered through revenues from user fees. Council adopted an objective to provide end users with annual energy costs that are competitive with conventional system energy costs based on the same level of service. The primary strategy for construction phasing of ADEU is to match service capacity closely with demand at any given stage. In this way, capital expenditures that don't immediately generate revenue are minimized, and payback periods are reduced. Since the existing ADEU and the proposed expansion are located on City owned park land, no land costs have been included in the capital costs.

A load profiling analysis was completed for the expansion of the ADEU system based on the development schedule identified above. The analysis included a review of the following available local energy resources to best meet the project demand:

- open loop geoexchange in a West Cambie Neighbourhood Park,
- closed loop geoexchange in a West Cambie Neighbourhood Park, south greenway corridor, road right of ways, disturbed area of the Garden City Lands,
- sewer heat recovery from the sewer pump station on Odlin Road,
- solar thermal on the private building roof,
- natural gas fired boilers,
- cooling towers and fluid coolers; and
- air source heat pumps.

The analysis identified the following two viable options for Phase 3 that would supply the majority of energy for the ADEU system expansion, which are presented below for consideration by Council. Other energy technologies may be required to supplement the main energy sources.

Option 1 (Not recommended) – Delayed Implementation of Additional Geoexchange Field

Under this option, all energy required to service new customers connected up until year 2021 (except large format retail) would be supplied by natural gas fired boilers for space heating and domestic water heating, and cooling towers for space cooling. Large format retail buildings would receive heating and cooling services from air source heat pump system with excess heat delivered to buildings connected to ADEU.

Beginning in 2021 onwards, after the customer base has grown, additional renewable energy sources will be implemented including potentially geoexchange fields in the West Cambie Neighbourhood Park and south greenway corridor.

The existing energy centre, located in the West Cambie Neighbourhood Park on Odlin Rd east of Garden City Rd, will be expanded to accommodate all equipment necessary for the full build out of the ADEU system. A preliminary design for the building shows that the total area requirement

will be approximately 350 m^2 in the form of an addition to the existing building. This would approximately double the size of the existing energy centre building, which was designed and constructed to easily accommodate expansion. The addition will also be a taller building, approximately 8 m in height, as it will include cooling towers installed on the roof. The cooling towers will be screened to the maximum extent possible with visual and sound barriers. There will be opportunity to incorporate public art features into these barriers.

It is estimated that with this option, the total estimated greenhouse gas (GHG) emissions reduction by the ADEU system over the 12 years (until full build out) will be approximately 2500 tonnes (equal to 775 cars) with 671 tonnes (equal to 208 cars) reduction per annum at full build out.

This option is not recommended because the projected financial return is almost identical to Option 2 but the estimated GHG emissions reduction over the 12 years is one quarter of that for the Option 2 (Table 2).

Option 2 (Recommended) – Immediate Implementation of Geoexchange Fields

Under this option, the portion of the energy required to service new customers will be provided by an additional geoexchange field in the West Cambie Neighbourhood Park, with commencement of construction in 2015. This option includes additional natural gas boilers and cooling towers for supplement and back up. Similar to Option 1, large format retail customers would receive heating and cooling from an air source heat pump system with excess heat delivered to buildings connected to ADEU. In 2019, this option includes a potential plan to add an additional geoexchange field in the future south greenway corridor. At this time, additional natural gas boilers and cooling towers for top up and back up will be required.

The existing energy centre, located in the park, will be expanded to accommodate all equipment necessary for the full build out of the ADEU system. A preliminary design for the building shows that the total area requirement will be approximately 350 m^2 in the form of an addition to the existing building. This would approximately double the size of the existing energy centre building, which was designed and constructed to easily accommodate expansion. The addition will also be a taller building, approximately 8 m in height, as it will include cooling towers installed on the roof. The cooling towers will be screened to the maximum extent possible with visual and sound barriers. There will be opportunity to incorporate public art features into these barriers.

This option includes underground wells for the geoexchange field along the eastern edges of the West Cambie Neighbourhood Park. However, once the park design is completed, staff will explore opportunities to expand the geoexchange wells also under the other parts of the park where possible, without compromising the park's functionality.

The potential impacts to the West Cambie Neighbourhood Park and the future South Greenway will be minimized so as to ensure the function and use of them is not compromised. In the neighbourhood park, a few trees may need to be removed for the geoexchange field and several more for the addition to the energy centre. The expansion will be coordinated with the park and greenway designs to ensure good integration within the landscape.

It is estimated that with this approach, the total estimated GHG emissions reduction by the ADEU system over the 12 years (until full build out) will be over 9500 tonnes (equal to 2950 cars) with 671 tonnes (equal to 208 cars) reduction per annum after full build out. There exists the potential to increase these reductions with implementation of additional renewable/waste energy sources such as sewer heat recovery from Odlin Road sewer pump station. The best technology and configuration will be defined through analysis at future expansion phases.

Business Case[1]

The comparison of the business cases for the two options is summarized in the Table 2 below. Financial calculations for the payback periods are detailed in Attachment 2.

Table 2: Financial Summary

		Updated Business Case	
	Business Case as reported to Council Dec 10, 2012	**Option 1** (Delayed implementation of additional geoexchange fields)	**Option 2 (Recommended)** (Immediate implementation of additional geoexchange fields)
Capital Cost (Phase 3)	N/A	$11.0M	$12.3M
Capital Cost (full build-out)	$24.3M	$23.3M	$23.3M
NPV (discounted at 6.0%)	$1.35M	$4.82M	$4.76M
IRR	6.54%	8.2%	8.01%
Payback	21 years	19 years	19 years
Estimated GHG Savings		2500 tonnes over 12 years	9500 tonnes over 12 years

Note: No land costs have been attributed to the costs of the project since it is located on City owned park land or as part of private developments

Funding

It is estimated that $12.3 million (inclusive of design, project management and contingency) would be required for ADEU expansion, which will include:

- expansion of the energy centre (to accommodate equipment requirements for the full build out);
- extension of the distribution piping to service new customers south of Odlin Rd;

[1] The projections are based on prospective results based on assumptions about future conditions and courses of action.

- installation of heat pumps or natural gas boiler system to service new large format retail customers, with connection to ADEU such that energy sharing can occur;
- increasing the heating and cooling capacity to service new customers in the north and south loop via geoexchange field along the eastern edge of the West Cambie Neighbourhood Park; and
- increasing the heating and cooling capacity to service new customers in the north and south loop via boilers and cooling towers.

This funding will be needed over the next 3-5 years to complete the Phase 3 expansion (see Table 3 below). Funding for this expansion will provide infrastructure to service an additional seven developments and 1,530,000 square feet floor area. Once this expansion is completed, ADEU will be servicing 2,280,000 square feet floor area that represents 65% of the planned serviced floor area. Phase 1 and 2 funding of $4.8M provided infrastructure to service three developments and 750,000 square feet floor area.

Table 3: Funding Requirement Timing

	Estimated Occupancy Date	Estimated Capital Requirement	
Alexandra Court	2015	$7.2M	2015
Jamatkhana Temple	2015		
9500 Cambie	2015		
Alexandra Gate	2015		
SmartCentres	2016	$2.5M	2016
Jingon	2016	$2.6M	2016-2018
Polygon East	2018		

Financing Strategy

ADEU was approved on the basis that it would be financially self-sustaining. As a new system, the incremental cost to connect a new customer is high due to the need for new energy generation and distribution facilities. Over time, capital costs on a per building basis will decrease as the same infrastructure can be used to connect new buildings. The City has the option to fund capital costs internally or externally. Over the course of the full build out of ADEU, the City will have numerous decision points for optimizing financing strategies to achieve its objectives.

For the Phase 3 expansion, staff have considered the following financing alternatives:

- Alternative 1: Obtain external financing
- Alternative 2: Borrow internally from Utility Surplus

Alternative 1 (Not Recommended) – Obtain External Financing

The City may obtain external financing for capital purposes in accordance with 179(1)(a) of the *Community Charter*. Further, under Section 7 of the *Municipal Liabilities Regulation* states that, "Approval of the electors is not required under section 180(1) [loan authorization bylaws] of the *Community Charter* if: (a) at the time it proposes to incur the liability, (i) the annual cost of servicing the aggregate liabilities of the municipality for the year … does not exceed (ii) 5% of the annual calculation revenue of the municipality for the previous year … and (b) incurring the liability would not cause the annual cost referred to in paragraph (a) (i) to exceed the limit established by paragraph (a) (ii)."

External debt financing in the amount of $12.3M contributes to the total debt balance held by the City and the associated servicing costs are included when evaluating the requirement for elector approval for external borrowing. The following shows the calculation of the City's "approval-free liability zone" if borrowing takes place in 2014:

Calculation of the "approval-free liability zone"

2013 Annual Calculation Revenue	$350M
5% limit	5%
2014 Total Approval-Free Liability Zone	$17.5M
Existing 2014 Annual Liability Servicing Costs	$7M
Remaining Annual Liability Servicing for 2014	$10.5M
ADEU Phase 3 Expansion Annual Servicing Costs ($12.3M at 5% for 15 years)	**$1.2M**

The remaining annual liability servicing of $10.5M is the current available balance prior to any additional external debt related to the Phase 3 expansion or new commitments/agreements that the City may enter into that would increase the total liabilities serviced by the City.

Interest on external borrowing of $12.3M is estimated at $9.3M over the duration of the loan (based on 5% for 15 years). The interest rate can only be locked in for the first 10 years, the rate will be reset after the initial 10 year period to the applicable rate at the time.

External debt would also add additional complications for the process of transferring ADEU assets to LIEC.

Alternative 2 (Recommended) – Borrow internally from Utility General Surplus

The cost of the Phase 3 expansion may be funded by the City's existing Utility General Surplus which has a current balance of $24.4M. The Utility General Surplus balance is comprised of Water and Sanitary Sewer General Surplus balances of $15.2M and $9.2M respectively. The Utility General Surplus is not restricted in use (like Reserves) or directed for a specific purpose (like Appropriated Surplus). Any internal borrowing from existing surplus funds is required to be repaid with interest.

The timing of the internally borrowed funds can be adjusted to match the timing of construction over the next 3-5 years. The repayments will be funded by revenues generated from the customer rates. The repayment terms can be arranged to correspond to the timing of revenues received. The revenues will increase over the first three years of the Phase 3 expansion as the additional developments are completed. Table 4 summarizes both alternatives.

Table 4: Comparison of the Financing Alternatives

	Alternative 1: External Borrowing	**Alternative 2: Internal Borrowing**
Financing Threshold	No elector approval required: Up to an additional borrowing of $125M ("approval-free liability zone")	Up to $24.4M of Utility Surplus available for borrowing.
Advantages	Internal funds remain available for other initiatives First 10 years of borrowing can be locked in at low rates (approximately 3.3% July 2014), but the rate is unknown after 10 years	Internal borrowing does not require elector approval External interest charges will be avoided Internal funds are general and not directed for capital purposes Payment terms can be arranged to match timing of revenues from operations
Disadvantages	Reduction of the Approval-Free Liability Zone Elector approval required if Approval-Free Liability Zone limits are surpassed Payment terms are inflexible Timing of construction would require amounts to be borrowed in advance of capital construction Increased complexity for the ADEU assets transfer to LIEC	Opportunity cost of utilizing these funds
Costs	Total interest payment of $9.3M or approximately 75% of the amount borrowed (over a term of 15 years at 5 %)	None – all borrowing will be repaid with interest (current business model estimates 5%)

When compared to how DE is being funded for City Centre, Alexandra DEU and City Centre DEU have two very different business models. The difference is that the City finances, builds, operates and maintains the ADEU and collects all revenues. The City Centre DEU on the other hand, is built, maintained, operated and financed by City partner; City collects the revenue, but pays partner their portion. Also, estimated total capital investment at the full build out for the ADEU is $23.3M, while the total capital investment at the full build out for the City Centre DEU can be up to $142M. Due to the scale difference between ADEU and City Centre DEU, internal financing is the preferred option.

Based on the above analysis, staff recommend that up to $12.3M in funding be approved from the Water Utility General Surplus for the Phase 3 capital costs. All borrowed amounts will be repaid with interest and are incorporated into the financial model. Internal borrowing is recommended due to many variables including the time-span of construction, servicing requirements, and the availability of funding.

Financial Impact

Staff recommend that $12.3 million be submitted for Council consideration as part of the Five Year Financial Plan (2015-2019) with funding approved through borrowing from the Water Utility General Surplus. The cash flows scheduled for this borrowing and payback are detailed in Attachment 2.

Conclusion

Preliminary design concepts for the expansion of the Alexandra DEU system have been completed to service four new developments starting in 2015 and three more developments by 2018. It is recommended to include additional geoexchange fields in the West Cambie Neighbourhood Park for thermal energy, with supplemental conventional energy systems for back up. It is recommended that $12.3M in funding be provided from the Water Utility General Surplus for design, construction and commissioning of Phase 3 system expansion to service new ADEU customers.

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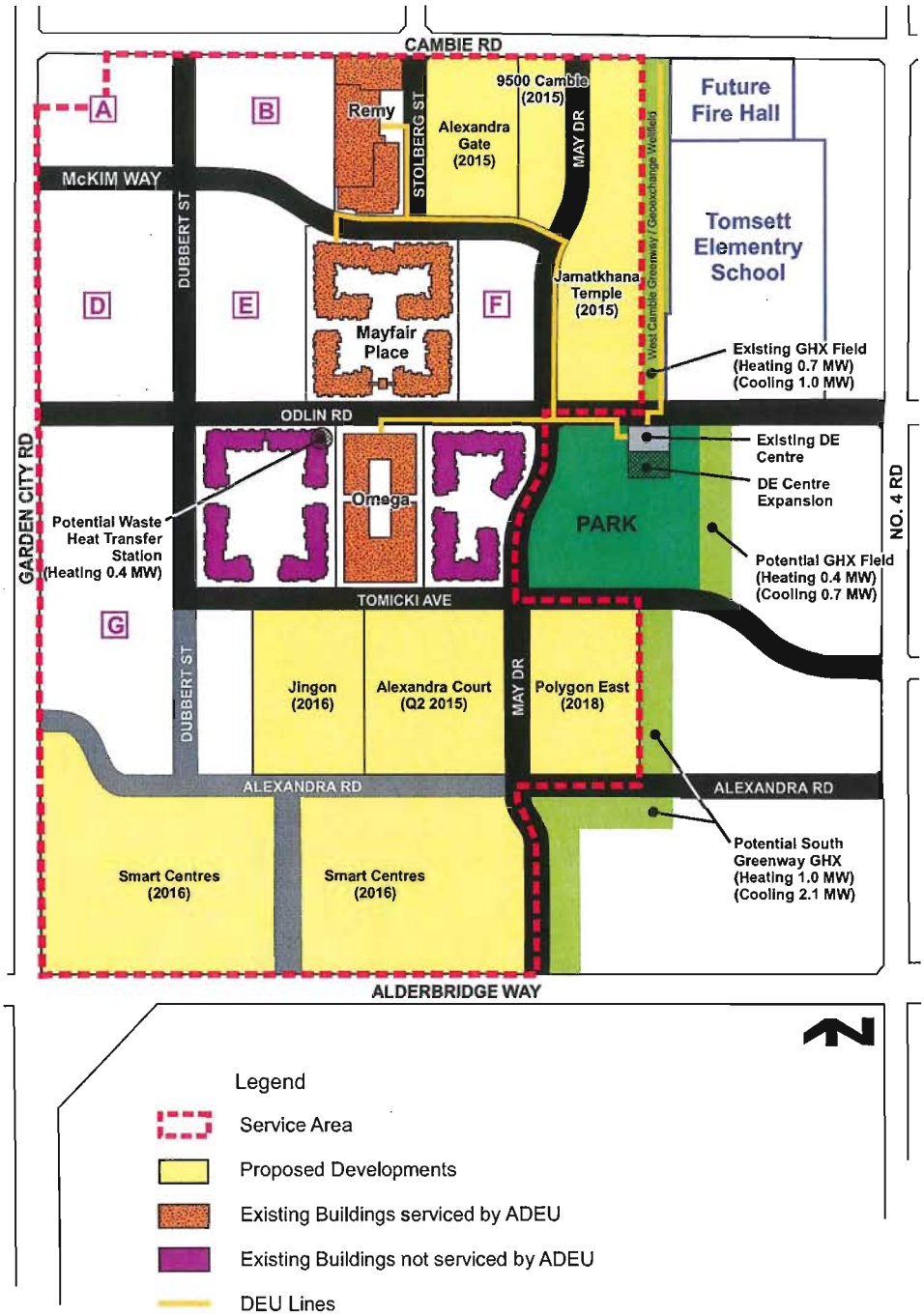
AP:ap

Att. 1: Alexandra Neighbourhood and ADEU Service Area Development
2: ADEU Financial Analysis Model

Attachment 1 – Alexandra Neighbourhood and ADEU Service Area Development



Attachment 2 – ADEU Financial Analysis Model (to build-out)

(Preliminary draft based on current assumptions. Financial Model is subject to change as these facts and assumptions change.)

	(All dollar figures are in thousands of dollars)									
	Year 1	Year 2	Year 3	Year 4	Year 5	Year 10	Year 15	Year 20	Year 25	Year 30
	2011	2012	2013	2014	2015	2020	2025	2030	2035	2040
TOTAL REVENUE	$ -	$ 72	$ 479	$ 817	$ 1,797	$ 3,548	$ 5,474	$ 6,660	$ 8,102	$ 9,858
TOTAL EXPENSES	$ -	$ 6	$ 181	$ 495	$ 791	$ 1,381	$ 2,068	$ 2,507	$ 3,094	$ 3,771
DEBT INTEREST EXPENSE	$ -	$ -	$ -	$ -	$ 535	$ 1,204	$ 1,169	$ 417	$ -	$ -
PROJECTED OPERATION INCOME (LOSS) BEFORE AMORTIZATION	$ -	$ 65	$ 298	$ 322	$ 471	$ 963	$ 2,236	$ 3,735	$ 5,008	$ 6,086
Principal Payment	$ -	$ -	$ -	$ -	$ 535	$ 1,341	$ 1,648	$ 1,331	$ -	$ -
PROJECTED CASHFLOW	$ -	$ 65	$ 298	$ 322	($ 63)	($ 379)	$ 588	$ 2,404	$ 5,008	$ 6,086
Cumulative Project Cashflow	$ -	$ 65	$ 363	$ 685	$ 622	$ 764	$ 2,055	$ 8,246	$ 28,939	$ 57,090
Internal Rate of Return (IRR) over 30 years:										
CAPITAL INVESTMENT*	($ 2,300)	($ 2,066)	$ -	($ 3,425)	($ 3,768)	$ -	$ -	$ -	($ 5,351)	$ -
Annual Cash Inflow from Operation	$ -	$ 65	$ 298	$ 322	$ 471	$ 963	$ 2,236	$ 3,735	$ 5,008	$ 6,086
Net Annual Cashflow of Investment	($ 2,300)	($ 2,001)	$ 298	($ 3,103)	($ 3,297)	$ 963	$ 2,236	$ 3,735	($ 342)	$ 13,012
CUMULATIVE DEBT LOAD	$ 2,518	$ 4,813	$ 5,054	$ 8,813	$ 12,377	$ 20,434	$ 12,392	$ 2,192	$ 10,561	$ 14,471
CUMULATIVE PROJECTED NET INCOME	($ 50)	($ 91)	$ 101	$ 177	$ 313	$ 1,081	$ 6,396	$ 17,123	$ 35,339	$ 58,076
IRR:	8.01%									
NPV:	$ 4,758									
Payback Period:	19 year	(time to recover original investment of $23.3 M from operation income)								

The projections are based on prospective results based on assumptions about future conditions and courses of action. The current model assumes internal borrowing for Phase 3 at an interest rate of 5% over 15 years.
*Includes an estimation of the remaining value of capital equipment.