Colliers International
200 Granville Street, 19th Floor
Vancouver, BC

April 4, 2014

University Endowment Lands
5495 Chancellor Boulevard
Vancouver, BC
V6T 1E2

Attention: Steve Butts, Deputy Manager

RE: Block F Rezoning/OCP Amendment Application Response to UEL Letter dated Feb 6, 2014

We are pleased to submit the attached response to your letter dated February 6, 2014 in which you identify some additional Development Approval Information requests regarding the rezoning application for Block F to amend the Land Use, Building and Community Administration By-law. Please find responses to the information requested in direct relationship to the identified issues. In some instances I have incorporated the Project Team's response directly into the text of this letter, in other instances, reference is made to attachments which document further clarifications.

1) Environmental Information

The following comments were provided directly by our environmental consultant Pottinger Gaherty Environmental Consultants (PGL) in response to the questions on this topic.

a) Wetland Setbacks

Our proposal of an average setback of 10.4m with a minimum setback of 3.0m (in very limited areas), planted with native riparian vegetation, is adequate in this case because the primary functions of this riparian area are to provide filtering of runoff, shade and a source of food for fish populations downstream of the site. The other functions of typical riparian areas adjacent to natural, fish bearing watercourses or ponds (provision of large woody debris (LWD) and bank stability) are not as important in this case, because:

- There are no fish present (therefore no requirement for LWD to provide cover from predators or habitat for young fish).
- There are no bank stability issues, because the wetland will be a man-made, engineered water feature.

b) Tree Retention (Response provided by PWL)

We have prepared a 1:1000 scale Tree Management Plan with Open Space Overlay 2.15.i (Arch D). It identifies the trees to be retained and removed. As per the arborist report prepared by Diamond Head Consulting (DHC) the trees required for a wind firm edge adjacent to the forest park are identified for retention. The tree tags placed by DHC are noted on the plan. There are many trees within the project area but have not been tagged or surveyed as per the methodology included in DHC's report. These trees are not indicated on the plan. Other trees were not tagged by DHC because of their location and value but were surveyed, these are identified with an 'na' number.

c) Wildlife Shelf

In our opinion there is not sufficient evidence to suggest a "wildlife shelf" should be built into the culvert under University Boulevard. Wildlife underpasses are typically installed to address an impact to wildlife from a roadway. For example, they are constructed under roads to prevent wildlife collisions and subsequent mortality. It is currently unknown whether University Boulevard is causing a wildlife issue, and whether the culvert would be a natural point of crossing to facilitate wildlife movement. Constructing effective wildlife underpasses requires research, planning and specific placement of structures to target an area of known impact. Verifying whether University Boulevard is creating a barrier to wildlife is not within the scope of the project since University Boulevard is an existing roadway (i.e., the Block F project is not creating a new barrier to wildlife).

d) Fish Habitat

As indicated in Table A of our Overview Environmental Impact Assessment, it is our opinion that construction will not likely have an impact on downstream fish habitat. Incorporation of construction best management practices (BMPs), including preparation of construction environmental management, spill contingency, erosion and sediment control and environmental monitoring plans will ensure that the potential for downstream impacts (including sediment deposition from the construction site) will be minimal or non-existent. In addition, had there been any potential for impacts to downstream fish habitat, senior regulatory agencies (Fisheries and Oceans Canada and the Ministry of Forests, Lands and Natural Resource Operations) would likely have raised concerns about this project.

e) Species at Risk

The wetlands and mature forest ecosystems on the site were identified in our assessment as key habitats for potentially occurring species at risk. Potential impacts to vegetation and wildlife, including species at risk have been outlined in our environmental assessment report. These impacts will be mitigated through project design, including the provision of setbacks from wetlands and watercourses. During construction, impacts will be further reduced through the implementation of environmental monitoring and Best Management Practices recommended in our report. Additional surveys may not confirm the presence of species at risk and are unlikely to lead to additional mitigation that has not already been outlined in our report.

f) Park Spaces (Response provided by PWL)

Drawing Sheet 2.15.i Tree Management plan (11x17) has been updated to include a more clearly defined line around the perimeter of the park and the constructed wetland, each with a specific line type. The retained and removed trees can be reviewed in relationship to these graphics. The Tree Management Plan with Open Space Overlay (Drawing Sheet 2.15.i) includes the various types of open and park space in relation to the trees to be retained.

2) Stormwater Management Plan

a) Wetland Storage Volumes

See R.F. Binnie Memorandum dated March 5/14 and calculations dated Feb 26/14 attached to this response and full size plans.

b) Wetland Design

See R.F. Binnie Memorandum dated March 5/14 and calculations dated Feb 26/14 attached to this response and full size plans.

c) Wetland Bed

See R.F. Binnie Memorandum dated March 5/14 and calculations dated Feb 26/14 attached to this response and full size plans.

d) Surface Area for Storm Water

See R.F. Binnie Memorandum dated March 5/14 and calculations dated Feb 26/14 attached to this response and full size plans.

e) Stormwater Treatment

See R.F. Binnie Memorandum dated March 5/14 and calculations dated Feb 26/14 attached to this response and full size plans.

3) Traffic and Transportation

a) Growth Projections

See Bunt & Assoc. memo dated March 26, 2014 attached.

b) Modal Split

See Bunt & Assoc. memo dated March 26, 2014 attached.

c) Peak Hours

See Bunt & Assoc. memo dated March 26, 2014 attached.

d) Parking

See Bunt & Assoc. memo dated March 26, 2014 attached.

e) University Blvd. and Acadia Rd. Intersections

See Bunt & Assoc. Memo dated March 26, 2014 attached.

f) Road Cross-sections

See Bunt & Assoc. memo dated March 26, 2014 attached as well as the full size PWL drawings (sheets 2.17 x 2) and the R.F. Binnie full size plans (CSP-XS). Coordination between landscape, civil and traffic disciplines have been undertaken with revised plans attached.

g) Road B

See Bunt & Assoc. memo dated March 26, 2014 attached.

h) Pass-by trips

See Bunt & Assoc. memo dated March 26, 2014 attached.

4) Utilities

a) Elevations

See R.F. Binnie Memorandum dated March 5/14 and calculations dated Feb 26/14 attached to this response and full size plans.

b) Sewers

See R.F. Binnie Memorandum dated March 5/14 and calculations dated Feb 26/14 attached to this response and full size plans.

c) Gravity Sanitary Sewer

As per this comment in this letter, see R.F. Binnie Memorandum dated March 5/14 and calculations dated Feb 26/14 attached to this response and full size plans.

5) Community Amenities

a) Population Needs

In developing the masterplan for the Block F site, the needs for the future residential community were considered in conjunction with the larger community needs. Due to the fact that it is impossible to dictate who the ultimate residents will be in the project, considerations were made for a wide range of residents' needs in developing the amenities for the project. Added to this complexity is the fact that the project will likely be constructed over a ten to twelve year period and residents will change continually over this timeframe and beyond.

In undertaking the three pre-application Open Houses, the project team heard very clearly the community's desire to retain the mature forest and trail connections that currently exist and build a new neighbourhood around these features. This community desire served as an organizing principle in preparing the Masterplan for the site and will offer a variety of open spaces including areas for quiet reflection, fitness and a variety of play spaces for children (see PWL Drawings sheet 2.23.i). Access to the community open space elements (anticipated to be utilized by residents, community members and the wider public), is completely unrestricted and as well, Block F residents would have the added feature of utilizing semi-private/private open space and indoor amenities provided as part of individual development sites. These opportunities would be created by the development partners as individual residential projects come on stream.

The proposed indoor amenities are to be comprised of two facilities, the first is the Block F resident's clubhouse as outlined below and the second is intended as a UEL community facility in the commercial village to be programmed jointly by UEL, Musqueam and the development partners and is intended to satisfy those needs as identified by the parties. The intent is for this building to be used for a wide variety of uses including a "living room" for the community, yoga classes, flexible meeting spaces etc.

The metrics for providing open space and indoor community spaces vary widely among municipalities and jurisdictions and are typically determined on an individual project basis rather than based on universal standards. In the case of determining an appropriate size of facility for the clubhouse a variety of methods were used. Firstly, interviews were carried out with 3 potential development partners with significant experience in building masterplanned communities. Their recommendations were that facilities ranging from 5,000 sq.ft. to 12,000 sq.ft. would be entirely appropriate for this type of communal facility and while each had a preference for programming they all believed tin providing a common facility in conjunction with individual building amenities. In this regard, the proposed clubhouse is at the upper end of this size range.

We also reviewed UBC's approach to providing community centre facilities as outlined on p.26 of the rezoning report where they determine need based on 15 s.m. per person. In the case of this project that demand would result in a facility of 375 s.m. well below that proposed. In fact if one took both the clubhouse and community amenity space in the commercial village, the provided amount of space (1,672 s.m.) is in excess of 4 x the demand.

b) Clubhouse

The primary purpose of the Clubhouse is to fulfill the recreation and amenity needs of the Block F residents through the provision of an "onsite" facility. Given the ownership and ongoing maintenance of this facility will rest with the individual strata's, its primary purpose is to serve the needs of the Block F project as the individual residents will be paying for the facility as part of their home ownership fees. However, in the case that programming of the space may have a wider appeal (e.g. yoga classes Saturday morning) it is possible that nonresidents of Block F could attend a drop-in session on a fee basis. Access to non-Block F residents will be assessed at a later date as programming and the ultimate ownership model has not been predetermined at this point. The challenge in moving forward is to ensure there is access for all Block F residents as they are essentially the owners of the facility, but access (assume pay as you go) to other UEL residents may be possible as long it is understood that on site residents are ensured first priority as they are paying for the facility.

c) Daycare

Calculating the number of childcare spaces demanded by new developments is a nuanced exercise that considers many factors, including the viability of childcare facilities, the number of units in the development and the labour force participation rate of the female population. Both UBC Campus and Community Planning and the City of Vancouver acknowledge that there are multiple bodies responsible for the provision of child care including the municipality, the province and the market and that it is not the responsibility of a new development to provide 100 percent of the childcare spaces demanded. Generally, there is no one metric that is used to calculate childcare spaces and in the City of Vancouver, the number of childcare spaces is typically determined on a case by case basis. To contextualize the 40 childcare spaces proposed at Block F, which equates to approximately 1 spot per 31

residential units, we researched the number of childcare spaces provided by several large master planned communities in the City of Vancouver. The Oakridge rezoning, recently approved by the City of Vancouver, proposed a Civic Centre with 69 childcare spaces. This equates to 1 spot per 42 residential units. The City of Vancouver's Southeast False Creek Official Development Plan, which prioritizes social equity and family accessibility, stipulates that 3, 69-space childcare facilities will be provided in the neighbourhood. At full build-out, this equates to approximately 1 childcare space per 30 units. Finally, the East Fraser Lands Official Development Plan which provides a framework for the creation of a complete and sustainable community with a variety of housing opportunities together with supporting facilities and amenities, stipulates that at full build-out, the neighbourhood will provide 256 childcare spaces in 4 facilities. The equates to approximately 1 spot per 29 residential units.

As such, when compared to recent master planned communities in the City of Vancouver, the 40 childcare spaces provided by Block F is consistent with the range of childcare spaces provided by other communities emphasizing sustainability, social equity and a range of housing typology.

d) Active Space

PWL drawing Sheet 2.13.i Active Outdoor Recreational Space indicates the proposed types and possible outdoor activities that the 5 main outdoor areas of Block F. We also indicate the offsite activities on the adjacent school as the availability of this space as per the agreement with the school is an important factor in reviewing the proposed development. We have attached a plan from UBC outlining additional opportunities for active play/recreation, many of which would be accessible by Block F residents.

6) Schools

As with any other development site located within or immediately adjacent to the City of Vancouver (UBC & UEL), the Vancouver School Board plans and provides for educational needs of school age children. In discussions with VSB planners, it is confirmed that the Block F site falls within the catchment of the Norma Rose Point School if students fall within the K to Gr 8 age group and the Block F site would be located in the catchment for the recently relocated University Hill Senior School at Wesbrook for grades 9 to 12.

Additional discussions with VSB planners will be required as they calculate school age demand separately utilizing metrics which the consultant team is not privy to. I have been exchanging calls with Anne Lee at VSB and will meet with her to provide an overview of the project and the review the development statistics. It is the responsibility of VSB to outline how and where the school age children would be accommodated, not the applicant; however, we are fully open to cooperating with VSB on this matter.

7) Amendments to the Official Community Plan (OCP) and the Land Use, Building and Community Administration By-law (the By-law)

a) Increased Density Condition

The request for an entire exclusion from this requirement was an oversight however we would like to have more dialogue with UEL on this matter. In particular we would wish to clarify further the definition of "below market housing". Specifically a market rental residential building component is being proposed which we believe should comply with this requirement.

Additionally, we believe the requirement as set out in the OCP should apply to the additional residential density only, as the commercial village has a much lower land value and is being proposed to create a complete neighbourhood and amenities to the residents of Block F and UEL.

We would welcome the opportunity to review this issue further with UEL.

b) Definitions

We confirm the request to modify several of the current definitions as these definitions do not respond to the current precedents set elsewhere in the lower mainland. The proposed definitions are aimed at creating superior urban form including interesting roofscapes and are based on similar jurisdictions zoning definitions where certain amenities and building components are excluded from density calculations due to the necessity to provide them but they do not result in marketable square footage. Our sense is that the current definitions relate to predominantly single family building forms and not multi-family forms. We would be pleased to discuss this issue in depth further with UEL.

While some new information has been developed for the graphics supporting the rezoning application, I have not as yet updated the booklets and will await your instructions as to when the timing is right for this to occur. I will be sending you full size prints of the plans requested under separate cover.

I trust the attached information is sufficient to provide responses to the issues raised in your February 6th letter. We look forward to continuing to work with the UEL in order to implement the requested land uses changes and would be pleased to meet at your convenience.

Sincerely,
COLLIERS INTERNATIONAL CONSULTING

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Managing Director
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Gordon.Easton@colliers.com

Colliers International
Gordon Easton
19th Floor, 200 Granville Street
Vancouver BC
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18 March 2014

Re: Block F Development Approval Response from UEL dated February 6, 2014

Dear Gordon,

PWL have reviewed the comments from the UEL letter as noted above. We have the following responses to the relevant issues pertaining to our scope of work:

1 Environmental Information

*b. **Tree Retention:** Please provide a larger, to scale version of Figure 2.15 that shows all trees with survey numbers in order to identify the trees that are proposed to be retained and removed. Currently the trees on Figure 2.15 cannot be related to the information provided in the tree survey. Please note that a tree protection and management plan will be required at the appropriate stage in the rezoning process.*
Response: We have prepared a 1:1000 scale Tree Management Plan with Open Space Overlay 2.15.i (Arch D). It identifies the trees to be retained and removed. As per the arborist report prepared by Diamond Head Consulting (DHC) the trees required for a wind firm edge adjacent to the forest park are identified for retention. The tree tags placed by DHC are noted on the plan. There are many trees within the project area but have not been tagged or surveyed as per the methodology included in DHC's report. These trees are not indicated on the plan. Other trees were not tagged by DHC because of their location and value but were surveyed, these are identified with an 'na' number.

***f. Park Space:** Please clearly define the boundaries of the proposed park space in relation to the proposed tree protection area and wetland.*
Response: Sheet 2 Tree Management plan (Tabloid) has been updated to include a more clearly defined line around the perimeter of the park and the constructed wetland, each with a specific line type. The retained and removed trees can be reviewed in relationship to these graphics. The Tree Management Plan with Open Space Overlay includes the various types of open and park space in relation to the trees to be retained.

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5 Community Amenities

*d. **Active Space:** Please identify the location, area and type of active outdoor recreational space provided on Block F*

Response: Sheet 2 Active Outdoor Recreational Space indicates the proposed types and possible outdoor activities that the 5 main outdoor areas of Block F. We also indicate the off site activities on the adjacent school as the availability of this space as per the agreement with the school is an important factor in reviewing the proposed development.

With regards to the road cross sections, our plans are primarily intended for character illustration, and as such only a few key locations are included. We have coordinated with Binnie Engineering to ensure the standard road cross sections are correct. We have corrected a few inconsistencies we noticed in the dimensions of our sections.

We trust that these responses will satisfy the UEL comments however if additional information is required please let us know and we will be happy to provide it.

Sincerely,
PWL Partnership Landscape Architects Inc

Jason Wegman
Principal

PWL Partnership Landscape Architects Inc

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1 Sport Fields (Off Site)

Active Outdoor Area: 1.45 ha

- Soccer field
- Baseball court -half and full
- Tennis Court
- Hard surface ball play

2 Forest Park

Active Outdoor Area: 1.22 ha

- Multi-use trails
- Integrated adventure / natureplay areas for a variety of age groups
- Flexible open free play areas
- Fitness circuit
- Dog walking
- Trail Hiking

3 Wetland

Active Outdoor Area: 0.11 ha

- Walking and running
- Casual cycling
- Fitness circuit
- Dog walking
- Trail Hiking

4 Green Buffers

Active Outdoor Area: 0.72 ha

- Walking and running
- Casual cycling
- Dog walking
- Trail Hiking

5 Community Green

Active Outdoor Area: 0.15 ha

- Open lawn area
- Outdoor Tai Chi or Yoga space
- Outdoor frisbee or catch

Toronto Blvd.

Road 'A'

Road 'B'

University Blvd.

Acadia Road

Ortona Ave.

Tree Retention Areas

Tree Retention Area.
Hazard trees to be assessed and Remediation Plan to be developed.
Not all trees are surveyed.

Tree to retain if possible.
Critical Root Zone (CRZ) to be re-assessed at the time of development to determine if possible and the driveway location.

LEGEND

- Existing Evergreen Trees to Remove (Surveyed)
- Existing Deciduous Trees to Remove (Surveyed)
- Existing Evergreen Trees to Remain (Surveyed)
- Existing Deciduous Trees to Remain (Surveyed)
- na — Surveyed Tree with No Tree Tag by DHC (na = not available)
- Tree Retention Area
- Constructed Wetland Area

Publically Accessible Open Space

- Green Buffers
- Community Green (Includes building area)
- Wetland
- Playfield - Off Site

Dedicated Park

- Forest Park

PWL partnership

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REVISIONS AND ISSUES

NO.	DATE	DESCRIPTION

PROJECT

BLOCK F –UNIVERSITY ENDOWMENT LANDS

DRAWING TITLE

TREE MANAGEMENT PLAN WITH OPEN SPACE OVERLAY

Copyright. All rights reserved. Reproduction in whole or in part is prohibited. This drawing as an instrument of service is the property of the Consultant and may not be used in any way without the written permission of this office.

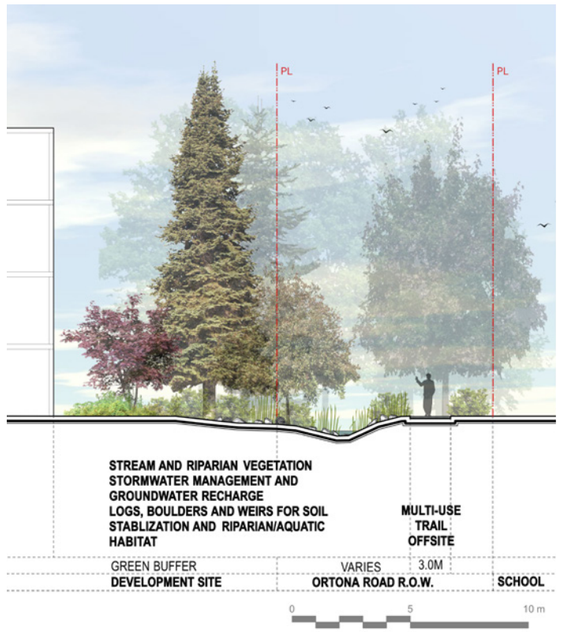
NORTH

SCALE 1:1000

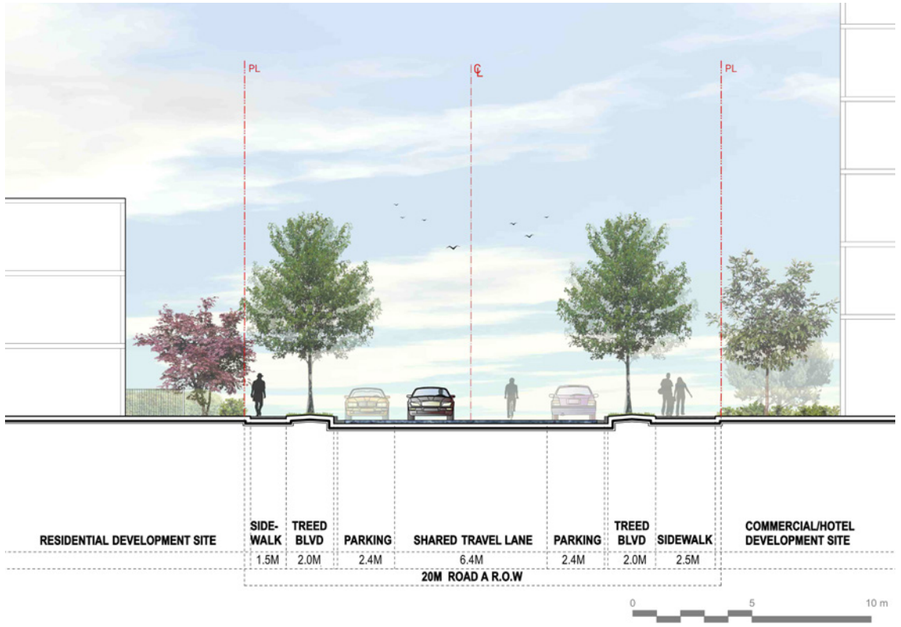
PROJECT NO.	1266		
DATE	MARCH 20, 2014		
FILE NAME	1266 PLAN.vwx		
PLOTTED	3/20/14 at 10:48:30 AM		
DRAWN	MW	REVIEWED	JW

DRAWING

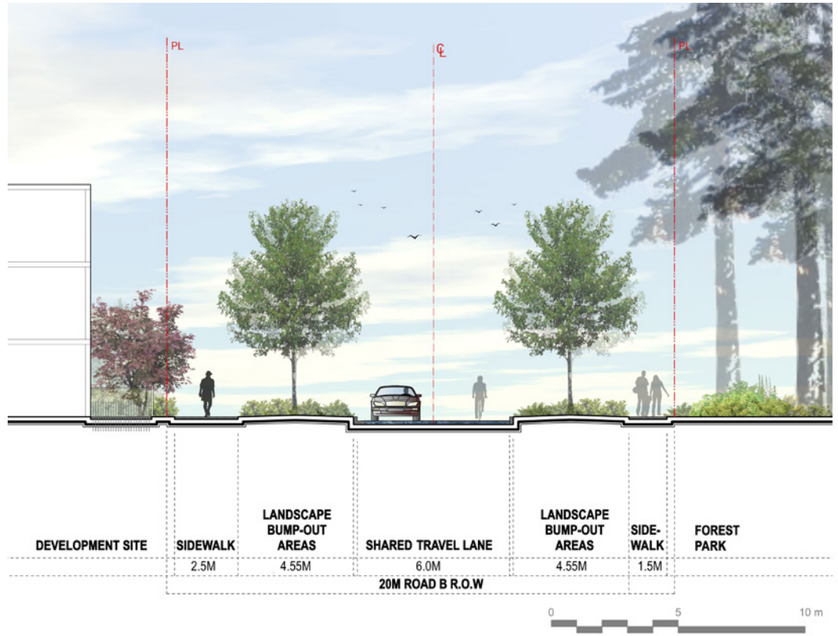
2.15.i



Section 1: Enhancement area at Ortona Ave R.O.W.

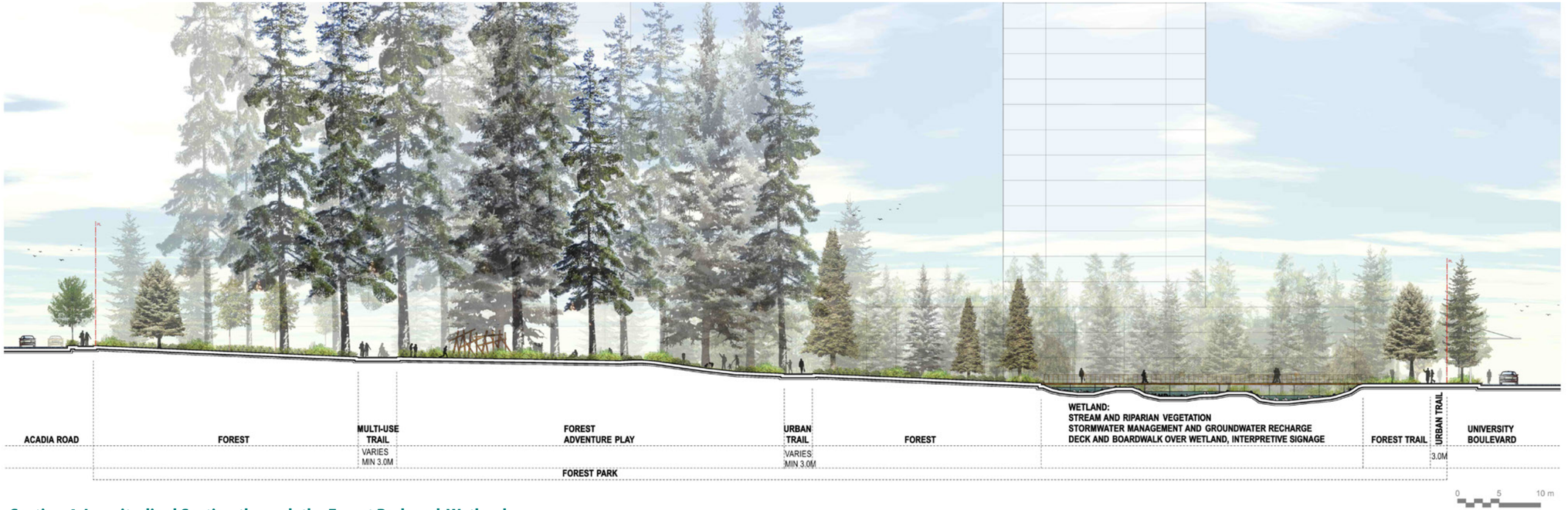


Section 2: Road A at Parking Aisles



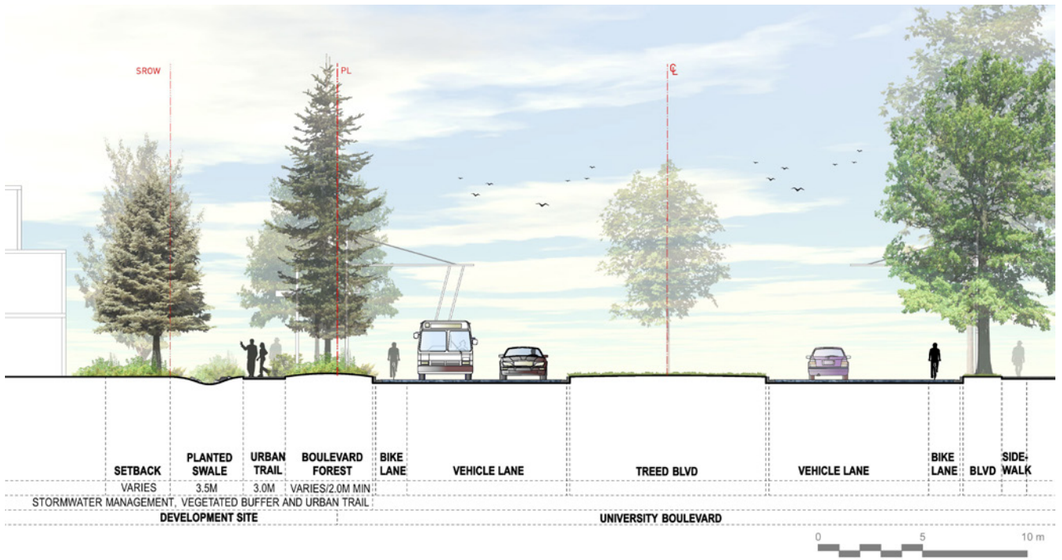
Section 3: Road B at Landscape Bump Outs

Key Plan

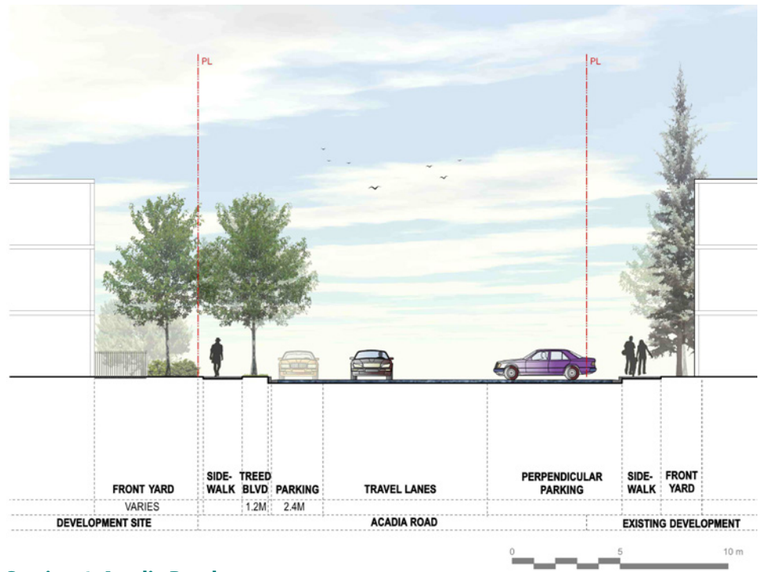


Section 4: Longitudinal Section through the Forest Park and Wetland

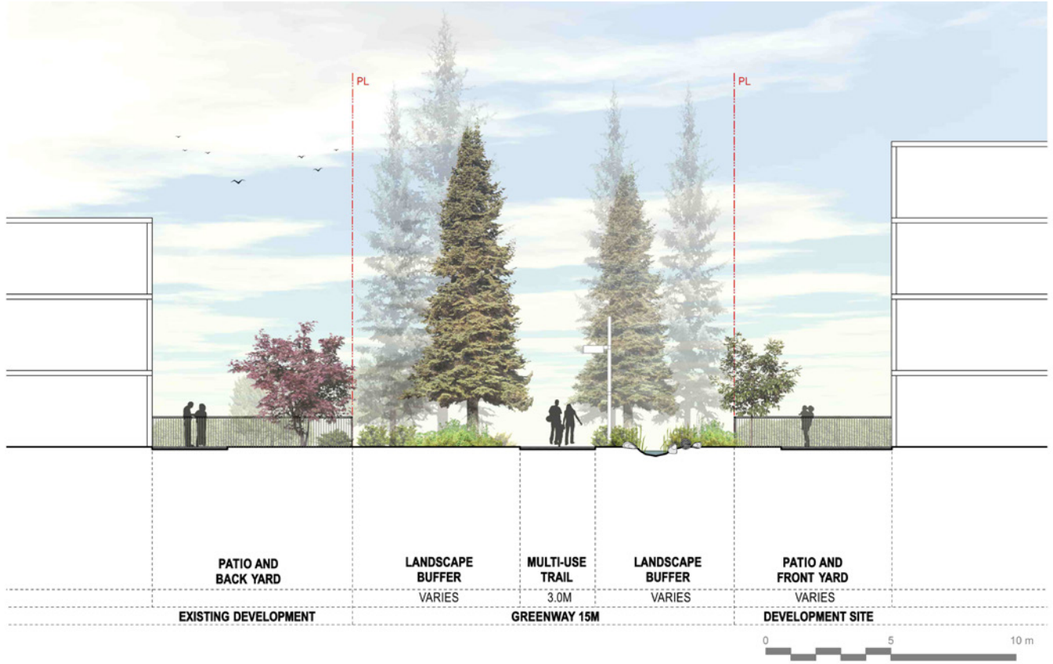
Key Plan



Section 5: University Boulevard



Section 6: Acadia Road



Section 7: Greenway North of Existing Townhouses

Section 8: Iva Mann Raised Pedestrian Crossing

BINNIE

R.F. Binnie & Associates Ltd.
205 – 4946 Canada Way
Burnaby, BC V5G 4H7
Tel: 604-420-1721 Fax: 604-420-4743

Memorandum

To:	Steve Butt	**From:**	Steve Jeffares
Cc:	Gordon Easton	**Date:**	March 5, 2014
Project #:	Block F, 545-40	**File:**	12-125-03
Re:	Musqueam Block F – Development Approval Information		

This memorandum was prepared in response to the additional information requested for the proposed Block F Development Approval. We received a letter dated February 6, 2014 from Steve Butt (UEL Manager) detailing the additional information and requirements needed in order to proceed with the full review of the rezoning application by UEL staff and its retained consultants.

R.F Binnie & Associates Ltd. (Binnie) has reviewed the comments attached in the Appendix and have prepared revised drawings to accompany the resubmission for Development Approval. The following sections outline the detailed revisions and responses to Section 2. Stormwater Management Plan and Section 4. Utility of the attachment.

1.0 STORMWATER MANAGEMENT PLAN

The following section outlines Binnie's responses to UEL's comments regarding the stormwater management plan. An extract of the requirements is outlined below:

> ***2. Stormwater Management Plan***
>
> *a.) Wetland Storage Volume: Show the proposed depth, profile and cross sectional area of the swales and wetland used to calculate the available storage volume.*
>
> *b.) Wetland Design: Pond inlets should not be adjacent to pond outlets as the water will "short-circuit" and not have sufficient retention time for treatment. Please show the water circulation pattern, and demonstrate that the water will not short-circuit.*
>
> *c.) Wetland Bed: Please confirm whether the proposed wetland is a "typical" wetland that retains water or whether it is would have a "porous" bottom for infiltrating stormwater.*
>
> *d.) Surface Area for Stormwater: Show the available surface area and assumed soil infiltration rate assumed for infiltrating stormwater. Please provide calculations showing the amount of stormwater to be infiltrated through the bioswales and retention pond.*
>
> *e.) Stormwater Treatment: The submission refers to stormwater being "treated" before reaching the wetland, but does not provide details as to how this will be achieved. Specifically the environmental report says that "there will be no direct runoff of dirty stormwater from future site development to the constructed wetland." Please provide details as to the level of stormwater treatment and how it will be achieved.*

1.1. DETENTION POND DESIGN

The stormwater management plan has been revised to include details requested from the letter. Cross sectional details of the pond and bioswales showing proposed depth and other details have been added to the SWMP-1 drawing. The outlet of the detention pond has been shifted south along University Boulevard, approximately 60m away from the inlet to allow water to flow through the detention pond prior to discharging to the culvert under University Boulevard. The detention pond is designed to allow infiltration of the captured runoff into the subsurface layers for groundwater recharge. In addition, open bottom lawn basins are proposed to further promote infiltration by directing the water directly through the soil layers to the more permeable subsurface layers. Detailed calculations and the preliminary geotechnical report are appended to this memo for reference.

1.2. STORMWATER TREATMENT

The proposed bioswale and detention pond will provide some treatment and allow particles to settle prior to discharging to the offsite storm system. Furthermore, treatment manholes are proposed on the two pond inlets to the detention pond for further treatment. Therefore, the future site development will not affect the water quality downstream of the development.

2.0 UTILITIES

The following section outlines our responses to UEL's comments regarding the utilities. An extract of the requirements is outlined below:

> ***4. Utilities***
>
> *a.) Elevations: Show elevations of the utilities and the ground ("rim elevations") at all manholes, tees and tie-ins with existing infrastructure.*
>
> *b.) Sewers: Show slopes of all proposed gravity sewers.*
>
> *c.) Gravity Sanitary Sewer: Show a gravity sanitary sewer system or demonstrate why a gravity system is not feasible. If a gravity sanitary sewer system is not feasible, please show a system that does not require UEL to take ownership and maintenance of a sanitary pump station (e.g a low pressure system or strata maintained pump station).*

2.1. STORM SEWER SYSTEM

A storm sewer concept plan (CSP-2) has been created showing more detailed information on the proposed storm system. The storm capacity analysis, inverts and rim elevations have been added to the drawing as requested in Item 4a and 4b.

2.2. SANITARY SEWER SYSTEM

To address Item 4c, three options for the sanitary system are proposed for UEL's review and comments.

2.2.1. Option A – Gravity Sanitary Sewer System

Drawing CSP-1A shows the option of installing a gravity sanitary sewer system for the entire development site. The tie-in location is just north of the intersection of Acadia Road and Toronto Blvd. This option is able to maintain a minimum 0.5% slope on all sections of the main, however, for approximately 280 meters of sewer along Acadia Road, the sewer will be greater than 6.5 meters deep and will require more difficult construction, installation and maintenance procedures.

2.2.2. Option B – Low Pressure Sanitary Sewer System

Drawing CSP-1B shows an option of installing a low pressure sanitary main along Road B. This will require each lot along Road B to connect to this main and install private grinder pumps prior to the clean-out at the sanitary connection for the lot. The proposed 100mm diameter low pressure system will be maintained by UEL and under this option.

2.2.3. Option C – UEL Sanitary Pump Station System

Drawing CSP-1C shows the option of installing a sanitary pump station and forcemain between manholes SAN 1-4 and SAN 1-6 along the western portion of Road B. The sanitary pump station will be in an easement and maintained by the development. The remaining sections of the sanitary sewer system will be a gravity system connecting to the same tie-in location at Acadia Road and Toronto Boulevard.

3.0 CONCLUSION

For this resubmission, we have revised the following drawings to support the rezoning application for Block F.

- CKP-1 – Conceptual Key Plan, Rev. 6
- CSP-1A – Conceptual Servicing Plan – Sanitary Option A, Rev. 1
- CSP-1B – Conceptual Servicing Plan – Sanitary Option B, Rev. 1
- CSP-1C – Conceptual Servicing Plan – Sanitary Option C, Rev. 1
- CSP-2 – Conceptual Servicing Plan – Storm, Rev. 1
- CGP-1 – Conceptual Grading Plan – Rev. 4
- CSP-XS – Conceptual Typical Sections – Rev. 1
- SWMP-1 – Conceptual Stormwater Management Plan, Rev. 4

We trust that the attached drawings and information has addressed the comments in the letter dated February 6, 2014. Should you require further clarifications or information, please do not hesitate to contact the undersigned.

Prepared by:

Geneve Lau, EIT
Land Development Engineer

Reviewed by:

Steve Jeffares, Associate
Project Manager, Land Development Division

BINNIE

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Tel: 604-420-1721 Fax: 604-420-4743

STORMWATER MANAGEMENT

(FLOW & DETENTION)

REQUIREMENTS

1- Restrict the 5 year post-development runoff rate to the pre-development rate as per the MMCD design guidelines.

2- Restrict the 100 year post-development runoff rate to the pre-development rate as required by the UEL (University Endowment Lands).

SITE INFO

AREA = 8.8 Ha

T_{c5} (Pre) = T_i + T_t

Where: T_i = Overland Flow Time

T_t = Concentrated Flow Time

$$Ti = \frac{(3.26(1.1-C)L^{0.5})}{S^{0.33}}$$

Where: C = 0.1 (Woodlands) [MMCD]

L = 300m

S ≈ 1.5%

$$T_i = \frac{(3.26(1.1-0.1)L^{0.5})}{1.5\%^{0.33}}$$

Ti = 49 min

Tt = 0 min

➔ Tc_5 (Pre) = 49 min + 0 min = 49 min

$$Tc_{100}\ (Pre) = \frac{(3.26(1.1-C)L^{0.5})}{S^{0.33}}$$

Where C = 0.3 [MMCD]

L = 300m

S ≈ 1.5%

Tc_{100} (Pre) = $\frac{(3.26(1.1-0.3)300m^{0.5})}{1.5\%^{0.33}}$

Tc_{100} (Pre) = 39 min

Tc_5 (Post) = $\frac{(3.26(1.1-C)L^{0.5})}{S^{0.33}}$

Where C = 0.8 (Commercial) [MMCD]

L = 300m

S ≈ 2.0%

Tc_5 (Post) = $\frac{(3.26(1.1-0.8)300m^{0.5})}{2.0\%^{0.33}}$

Tc_5 (Post) = 13 min

Tc_{100} (Post) = $\frac{(3.26(1.1-C)L^{0.5})}{S^{0.33}}$

Where C = 0.85 [MMCD]

L = 300m

S ≈ 2.0%

Tc_{100} (Post) = $\frac{(3.26(1.1-0.85)300m^{0.5})}{2.0\%^{0.33}}$

Tc_{100} (Post) = 11 min

I_5 (Pre) @ Tc_5 (Pre) = ATc_5^B [UBC IDF – See Attached]

Where: A = 13.5, Tc_5 = 49 min (0.82hr), B = -0.504

$= 13.5\ (0.82\ hr)^{-0.504}$

$\underline{I_5\ (Pre) = 14.9\ mm/hr}$

I_{100} (Pre) @ Tc_{100} (Pre) = ATc_{100}^{B}

Where: A = 22.1, Tc_{100} = 39 min (0.65hr), B = -0.541

$= 22.1\ (0.65\ hr)^{-0.541}$

$\underline{I_{100}\ (Pre) = 27.9\ mm/hr}$

I_5 (Post) @ Tc_5 (Post) = ATc_5^{B}

Where: A = 13.5, Tc_5 = 13 min (0.22hr), B = -0.504

$= 13.5\ (0.22\ hr)^{-0.504}$

$\underline{I_5\ (Post) = 29.0\ mm/hr}$

I_{100} (Post) @ Tc_{100} (Post) = ATc_{100}^{B}

Where: A = 22.1, Tc_{100} = 11 min (0.18hr), B = -0.541

$= 22.1\ (0.18\ hr)^{-0.541}$

$\underline{I_{100}\ (Post) = 55.9\ mm/hr}$

<u>RATIONAL METHOD</u>

Q_5 (Pre) = AIR

Where: A = 8.8 Ha, I = I_5 (Pre) 14.9mm/hr, R = 0.1 (Woodlands) [MMCD]

$= 88000m^2\ (0.0149\ m/hr)0.1$

Q_5(Pre) = 131.1 m^3/hr = <u>36.4 L/s</u>

Q_{100} (Pre) = AIR

Where: A = 8.8 Ha, I = I_{100} (Pre) 27.9mm/hr, R = 0.3

$= 88000m^2\ (0.0279\ m/hr)0.3$

Q_{100}(Pre) = 736.6 m^3/hr = <u>204.6 L/s</u>

Q_5 (Post) = AIR

Where: A = 8.8 Ha, I = I_5 (Post) 29.0mm/hr, R = 0.8 (Commercial) [MMCD]

= 88000m^2 (0.029 m/hr)0.8

Q_5(Post) = 2041.6 m^3/hr = 567.1 L/s

Q_{100} (Post) = AIR

Where: A = 8.8 Ha, I = I_{100} (Post) 55.9mm/hr, R = 0.85

= 88000m^2 (0.0559 m/hr)0.85

Q_{100}(Post) = 4181.3 m^3/hr = 1161.5 L/s

SEE SPREADSHEETS FOR DETENTION CALCULATION

Muqueam - Block F

PRELIMINARY STORM WATER STORAGE DESIGN CALCULATIONS

Using Environment Canada - Vancouver UBC IDF Curve Formula

100 Year Event

Catchment Area	8.80	ha.
Runoff Coefficient	0.85	
Time Of Concentration	11.0	minutes
Intensity (@ Tc)	56	mm/h
Storm Frequency	100	year storm
Maximum Release Rate	0.205	cu.m/s

Peak flow for storm of duration equal to Tc = 1.161 cu.m/s

Storage Volume = $T_r (Q_{p2} - Q_{rel}) + 0.5T_c (1/Q_{p2} - 1/Q_{p1}) Q_{rel}^2$

where Tr: storm duration, Qp2: peak flow where storm duration Tr>=Tc, Qrel: predevelopment flow, Tc: time of concentration, Qp1: peak flow where storm duration =Tc

Trial #	Rainfall Duration	Intensity	Inflow Rate	Inflow Volume	Outflow Rate	Outflow Vol	**Req'd Storage Volume**
	min.	mm/h	cu.m/s	cu.m	cu.m/s	cu.m	cu.m
1	5	84.77	1.761	528	0.205	62	463
2	10	58.26	1.211	726	0.205	123	603
3	15	46.79	0.972	875	0.205	185	693
4	27	34.04	0.707	1146	0.205	332	821
5	30	32.16	0.668	1203	0.205	369	842
6	45	25.82	0.537	1449	0.205	554	909
7	60	22.10	0.459	1653	0.205	738	**933**
8	75	19.59	0.407	1831	0.205	923	931
9	90	17.75	0.369	1991	0.205	1107	910
10	105	16.33	0.339	2137	0.205	1292	875
11	120	15.19	0.316	2272	0.205	1476	828
12	135	14.25	0.296	2399	0.205	1661	773
13	150	13.46	0.280	2517	0.205	1845	710
14	165	12.79	0.266	2630	0.205	2030	641
15	180	12.20	0.253	2737	0.205	2214	566
16	195	11.68	0.243	2840	0.205	2399	486
17	210	11.22	0.233	2938	0.205	2583	402
18	225	10.81	0.225	3032	0.205	2768	315
19	240	10.44	0.217	3123	0.205	2952	223
20	255	10.10	0.210	3212	0.205	3137	129
21	270	9.79	0.204	3297	0.205	3321	32
22	285	9.51	0.198	3380	0.205	3506	-67
23	300	9.25	0.192	3460	0.205	3690	-169
24	315	9.01	0.187	3539	0.205	3875	-274
25	330	8.79	0.183	3615	0.205	4059	-380
26	345	8.58	0.178	3690	0.205	4244	-488
27	360	8.38	0.174	3762	0.205	4428	-598
28	420	7.71	0.160	4038	0.205	5166	-1053
29	480	7.17	0.149	4294	0.205	5904	-1529
30	540	6.73	0.140	4532	0.205	6642	-2023
31	600	6.36	0.132	4757	0.205	7380	-2530
32	660	6.04	0.125	4969	0.205	8118	-3050
33	720	5.76	0.120	5172	0.205	8856	-3580
34	780	5.52	0.115	5365	0.205	9594	-4120
35	840	5.30	0.110	5551	0.205	10332	-4667
36	900	5.11	0.106	5730	0.205	11070	-5222
37	960	4.93	0.102	5902	0.205	11808	-5783
38	1020	4.77	0.099	6068	0.205	12546	-6350
39	1080	4.63	0.096	6230	0.205	13284	-6922
40	1140	4.49	0.093	6386	0.205	14022	-7499
41	1200	4.37	0.091	6538	0.205	14760	-8081
42	1260	4.26	0.088	6686	0.205	15498	-8667
43	1320	4.15	0.086	6831	0.205	16236	-9256
44	1380	4.05	0.084	6972	0.205	16974	-9850
45	1440	3.96	0.082	7109	0.205	17712	-10446

Muqueam - Block F

PRELIMINARY STORM WATER STORAGE DESIGN CALCULATIONS

Using Environment Canada - Vancouver UBC IDF Curve Formula

5 Year Event

Catchment Area	8.80	ha.
Runoff Coefficient	0.80	
Time Of Concentration	13.0	minutes
Intensity (@ Tc)	29	mm/h
Storm Frequency	5	year storm
Maximum Release Rate	0.036	cu.m/s

Peak flow for storm of duration equal to Tc = 0.567 cu.m/s

Storage Volume = $T_r (Q_{p2} - Q_{rel}) + 0.5T_c (1/Q_{p2} - 1/Q_{p1}) Q_{rel}^2$

where Tr: storm duration, Qp2: peak flow where storm duration Tr>=Tc, Qrel: predevelopment flow, Tc: time of concentration, Qp1: peak flow where storm duration =Tc

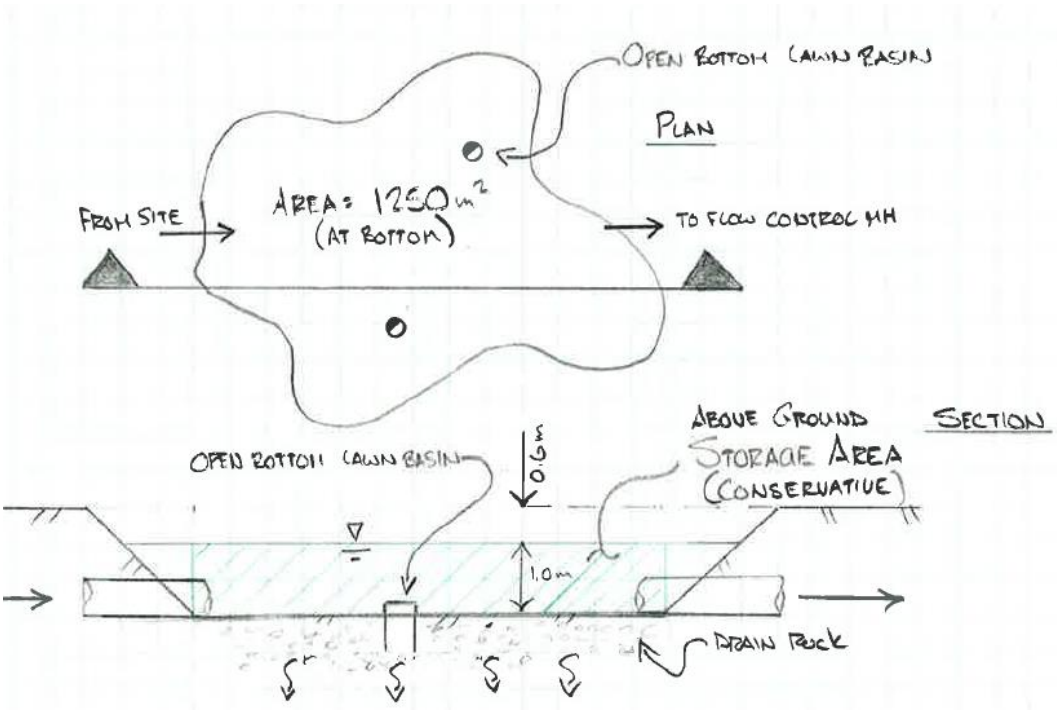
Trial #	Rainfall Duration	Intensity	Inflow Rate	Inflow Volume	Outflow Rate	Outflow Vol	**Req'd Storage Volume**
	min.	mm/h	cu.m/s	cu.m	cu.m/s	cu.m	cu.m
1	5	47.23	0.924	277	0.036	11	266
2	10	33.31	0.651	391	0.036	22	369
3	15	27.15	0.531	478	0.036	33	445
4	27	20.19	0.395	640	0.036	59	581
5	30	19.14	0.374	674	0.036	66	609
6	45	15.61	0.305	824	0.036	98	727
7	60	13.50	0.264	950	0.036	131	820
8	75	12.06	0.236	1062	0.036	164	899
9	90	11.00	0.215	1162	0.036	197	967
10	105	10.18	0.199	1254	0.036	229	1027
11	120	9.52	0.186	1340	0.036	262	1080
12	135	8.97	0.175	1421	0.036	295	1128
13	150	8.51	0.166	1497	0.036	328	1172
14	165	8.11	0.159	1570	0.036	360	1212
15	180	7.76	0.152	1639	0.036	393	1248
16	195	7.45	0.146	1705	0.036	426	1282
17	210	7.18	0.140	1769	0.036	459	1313
18	225	6.93	0.136	1831	0.036	491	1342
19	240	6.71	0.131	1890	0.036	524	1369
20	255	6.51	0.127	1948	0.036	557	1394
21	270	6.33	0.124	2004	0.036	590	1418
22	285	6.16	0.120	2058	0.036	622	1439
23	300	6.00	0.117	2112	0.036	655	1460
24	315	5.85	0.114	2163	0.036	688	1479
25	330	5.72	0.112	2214	0.036	721	1497
26	345	5.59	0.109	2263	0.036	753	1513
27	360	5.47	0.107	2311	0.036	786	1529
28	420	5.06	0.099	2495	0.036	917	1582
29	480	4.73	0.093	2666	0.036	1048	1622
30	540	4.46	0.087	2826	0.036	1179	1652
31	600	4.23	0.083	2978	0.036	1310	1673
32	660	4.03	0.079	3122	0.036	1441	1686
33	720	3.86	0.075	3260	0.036	1572	1693
34	780	3.71	0.072	3392	0.036	1704	**1694**
35	840	3.57	0.070	3519	0.036	1835	1691
36	900	3.45	0.067	3641	0.036	1966	1682
37	960	3.34	0.065	3760	0.036	2097	1670
38	1020	3.24	0.063	3874	0.036	2228	1654
39	1080	3.15	0.062	3986	0.036	2359	1635
40	1140	3.06	0.060	4094	0.036	2490	1612
41	1200	2.98	0.058	4200	0.036	2621	1587
42	1260	2.91	0.057	4303	0.036	2752	1559
43	1320	2.84	0.056	4403	0.036	2883	1528
44	1380	2.78	0.054	4501	0.036	3014	1496
45	1440	2.72	0.053	4597	0.036	3145	1461

STORMWATER MANAGEMENT

(INFILTRATION & DETENTION)

INFILTRATION

LARGE POND:



INFILTRATION RATE = 25mm/8.8 min (2.84 mm/min) [EXP. Ref # Van-00213751-A0]

INFILTRATION FLOW = 1250m^2 x 0.00284 m/mm

= 3.55 m^3/min = 59.2 L/s x 0.5 [FACTOR OF SAFETY] = 29.6 L/s

SEE ATTACHED SPREADSHEET

DETENTION

STORAGE VOLUME REQUIRED (ASSUMING INFILTRATION) = 938m^3

STORAGE VOLUME AVAILABLE:

IN DRAIN ROCK = 1250m^2 x 0.15m [DEPTH] X 0.3[VOUD RATIO] = 56m^3

IN POND = 1250m^2 x 1.0m = 1250m^3

TOTAL = 1250m^3 + 56m^3 = 1306m^3

$1306m^3 > 938m^3$ OK

NOTE: ADDITIONAL STORAGE IS AVAILABLE IN BIOSWALES & SMALL POND BUT IS CONSIDERED AS “EXTRA” DETENTION AS LARGE POND HAS SUFFICIENT CAPACITY TO MEET REQUIREMENTS.

ADDITIONAL CALCULATIONS ARE REQUIRED FOR FLOW CONTROL MANHOLE. THEY WILL BE PERFORMED DURING DETAILED DESIGN.

Muqueam - Block F

PRELIMINARY STORM WATER STORAGE DESIGN CALCULATIONS

Using Environment Canada - Vancouver UBC IDF Curve Formula

5 Year Event (With Infiltration Reduction)

Catchment Area	8.80	ha.
Runoff Coefficient	0.80	
Time Of Concentration	13.0	minutes
Intensity (@ Tc)	29	mm/h
Storm Frequency	5	year storm
Maximum Release Rate	0.036	cu.m/s

Peak flow for storm of duration equal to Tc = 0.567 cu.m/s
Infiltration flow within pond (See Calculations) = 0.030 cu.m/s
Peak flow - Infiltation flow = 0.537 cu.m/s

Storage Volume = $T_r (Q_{p2} - Q_{rel}) + 0.5T_c (1/Q_{p2} - 1/Q_{p1}) Q_{rel}^2$

where Tr: storm duration, Qp2: peak flow where storm duration Tr>=Tc, Qrel: predevelopment flow, Tc: time of concentration, Qp1: peak flow where storm duration =Tc

Trial #	Rainfall Duration	Intensity	Inflow Rate	Inflow Volume	Outflow Rate	Outflow Vol	**Req'd Storage Volume**
	min.	mm/h	cu.m/s	cu.m	cu.m/s	cu.m	cu.m
1	5	47.23	0.894	268	0.036	11	257
2	10	33.31	0.621	373	0.036	22	351
3	15	27.15	0.501	451	0.036	33	418
4	27	20.19	0.365	591	0.036	59	532
5	30	19.14	0.344	620	0.036	66	555
6	45	15.61	0.275	743	0.036	98	646
7	60	13.50	0.234	842	0.036	131	713
8	75	12.06	0.206	927	0.036	164	764
9	90	11.00	0.185	1000	0.036	197	805
10	105	10.18	0.169	1065	0.036	229	838
11	120	9.52	0.156	1124	0.036	262	865
12	135	8.97	0.145	1178	0.036	295	886
13	150	8.51	0.136	1227	0.036	328	902
14	165	8.11	0.129	1273	0.036	360	915
15	180	7.76	0.122	1315	0.036	393	925
16	195	7.45	0.116	1354	0.036	426	932
17	210	7.18	0.110	1391	0.036	459	936
18	225	6.93	0.106	1426	0.036	491	938
19	240	6.71	0.101	1458	0.036	524	**938**
20	255	6.51	0.097	1489	0.036	557	936
21	270	6.33	0.094	1518	0.036	590	933
22	285	6.16	0.090	1545	0.036	622	928
23	300	6.00	0.087	1572	0.036	655	921
24	315	5.85	0.084	1596	0.036	688	913
25	330	5.72	0.082	1620	0.036	721	904
26	345	5.59	0.079	1642	0.036	753	894
27	360	5.47	0.077	1663	0.036	786	883
28	420	5.06	0.069	1739	0.036	917	828
29	480	4.73	0.063	1802	0.036	1048	761
30	540	4.46	0.057	1854	0.036	1179	683
31	600	4.23	0.053	1898	0.036	1310	596
32	660	4.03	0.049	1934	0.036	1441	502
33	720	3.86	0.045	1964	0.036	1572	402
34	780	3.71	0.042	1988	0.036	1704	295
35	840	3.57	0.040	2007	0.036	1835	184
36	900	3.45	0.037	2021	0.036	1966	68
37	960	3.34	0.035	2032	0.036	2097	-51
38	1020	3.24	0.033	2038	0.036	2228	-175
39	1080	3.15	0.032	2042	0.036	2359	-301
40	1140	3.06	0.030	2042	0.036	2490	-431
41	1200	2.98	0.028	2040	0.036	2621	-564
42	1260	2.91	0.027	2035	0.036	2752	-699
43	1320	2.84	0.026	2027	0.036	2883	-837
44	1380	2.78	0.024	2017	0.036	3014	-977
45	1440	2.72	0.023	2005	0.036	3145	-1118

Muqueam - Block F

PRELIMINARY STORM WATER STORAGE DESIGN CALCULATIONS

Using Environment Canada - Vancouver UBC IDF Curve Formula

100 Year Event (With Infiltration Reduction)

Catchment Area	8.80	ha.
Runoff Coefficient	0.85	
Time Of Concentration	11.0	minutes
Intensity (@ Tc)	56	mm/h
Storm Frequency	100	year storm
Maximum Release Rate	0.205	cu.m/s

Peak flow for storm of duration equal to Tc = 1.161 cu.m/s
Infiltration flow within pond (See Calculations) = 0.030 cu.m/s
Peak flow - Infiltation flow = 1.131 cu.m/s

Storage Volume = $T_r (Q_{p2} - Q_{rel}) + 0.5T_c (1/Q_{p2} - 1/Q_{p1}) Q_{rel}^2$

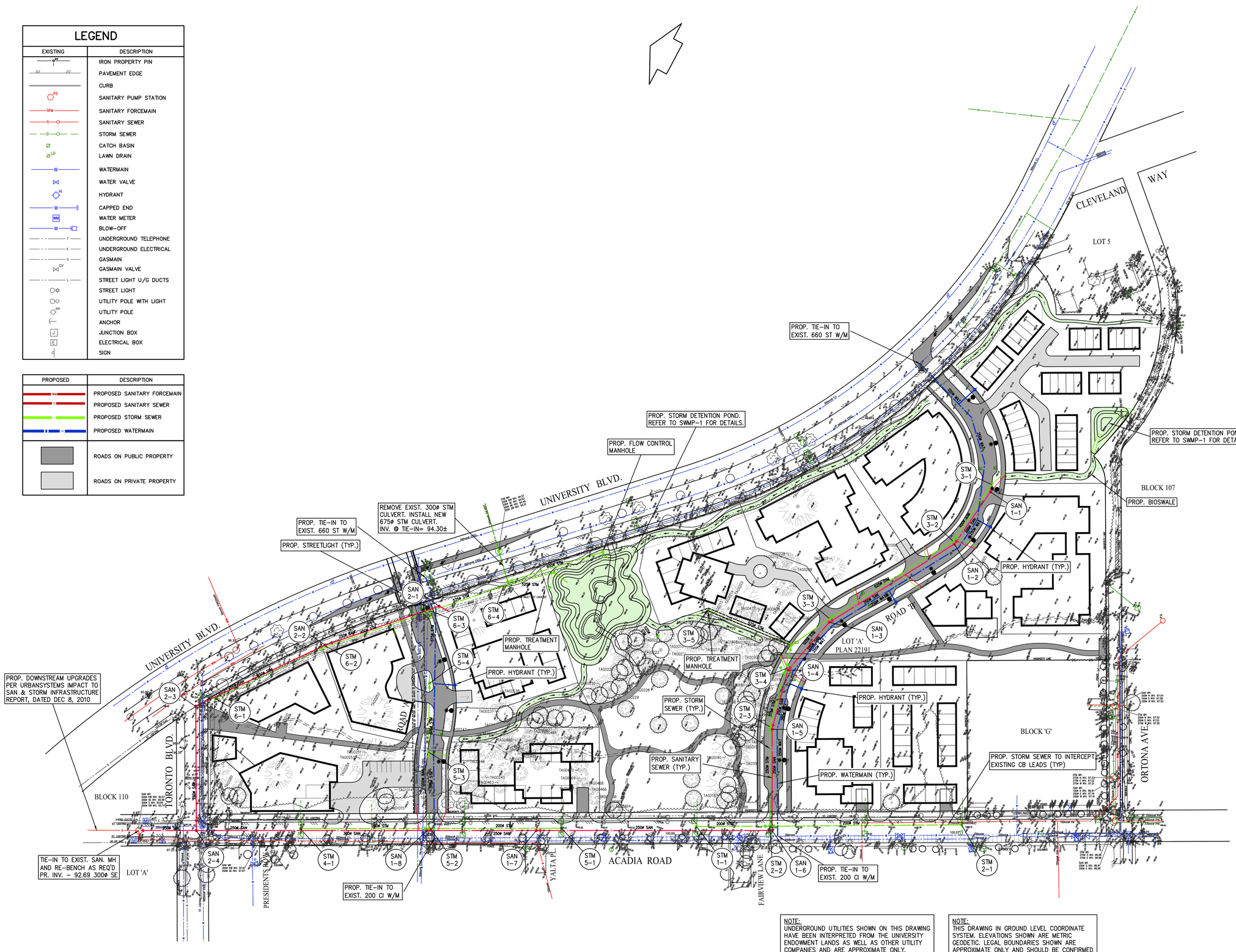
where Tr: storm duration, Qp2: peak flow where storm duration Tr>=Tc, Qrel: predevelopment flow, Tc: time of concentration, Qp1: peak flow where storm duration =Tc

Trial #	Rainfall Duration	Intensity	Inflow Rate	Inflow Volume	Outflow Rate	Outflow Vol	**Req'd Storage Volume**
	min.	mm/h	cu.m/s	cu.m	cu.m/s	cu.m	cu.m
1	5	84.77	1.731	519	0.205	62	454
2	10	58.26	1.181	708	0.205	123	585
3	15	46.79	0.942	848	0.205	185	666
4	27	34.04	0.677	1097	0.205	332	774
5	30	32.16	0.638	1149	0.205	369	789
6	45	25.82	0.507	1368	0.205	554	**830**
7	60	22.10	0.429	1545	0.205	738	827
8	75	19.59	0.377	1696	0.205	923	799
9	90	17.75	0.339	1829	0.205	1107	751
10	105	16.33	0.309	1948	0.205	1292	690
11	120	15.19	0.286	2056	0.205	1476	617
12	135	14.25	0.266	2156	0.205	1661	535
13	150	13.46	0.250	2247	0.205	1845	446
14	165	12.79	0.236	2333	0.205	2030	350
15	180	12.20	0.223	2413	0.205	2214	249
16	195	11.68	0.213	2489	0.205	2399	143
17	210	11.22	0.203	2560	0.205	2583	33
18	225	10.81	0.195	2627	0.205	2768	-81
19	240	10.44	0.187	2691	0.205	2952	-198
20	255	10.10	0.180	2753	0.205	3137	-319
21	270	9.79	0.174	2811	0.205	3321	-442
22	285	9.51	0.168	2867	0.205	3506	-568
23	300	9.25	0.162	2920	0.205	3690	-696
24	315	9.01	0.157	2972	0.205	3875	-827
25	330	8.79	0.153	3021	0.205	4059	-959
26	345	8.58	0.148	3069	0.205	4244	-1093
27	360	8.38	0.144	3114	0.205	4428	-1229
28	420	7.71	0.130	3282	0.205	5166	-1789
29	480	7.17	0.119	3430	0.205	5904	-2370
30	540	6.73	0.110	3560	0.205	6642	-2968
31	600	6.36	0.102	3677	0.205	7380	-3580
32	660	6.04	0.095	3781	0.205	8118	-4203
33	720	5.76	0.090	3876	0.205	8856	-4838
34	780	5.52	0.085	3961	0.205	9594	-5481
35	840	5.30	0.080	4039	0.205	10332	-6132
36	900	5.11	0.076	4110	0.205	11070	-6790
37	960	4.93	0.072	4174	0.205	11808	-7455
38	1020	4.77	0.069	4232	0.205	12546	-8125
39	1080	4.63	0.066	4286	0.205	13284	-8801
40	1140	4.49	0.063	4334	0.205	14022	-9481
41	1200	4.37	0.061	4378	0.205	14760	-10166
42	1260	4.26	0.058	4418	0.205	15498	-10854
43	1320	4.15	0.056	4455	0.205	16236	-11547
44	1380	4.05	0.054	4488	0.205	16974	-12243
45	1440	3.96	0.052	4517	0.205	17712	-12942

LEGEND

EXISTING	DESCRIPTION
IP	IRON PROPERTY PIN
	PAVEMENT EDGE
	CURB
PS	SANITARY PUMP STATION
SFM	SANITARY FORCEMAIN
S	SANITARY SEWER
D	STORM SEWER
	CATCH BASIN
LD	LAWN DRAIN
W	WATERMAIN
	WATER VALVE
H	HYDRANT
W	CAPPED END
WM	WATER METER
W	BLOW-OFF
T	UNDERGROUND TELEPHONE
E	UNDERGROUND ELECTRICAL
G	GASMAIN
GV	GASMAIN VALVE
L	STREET LIGHT U/G DUCTS
	STREET LIGHT
	UTILITY POLE WITH LIGHT
PP	UTILITY POLE
	ANCHOR
J	JUNCTION BOX
E	ELECTRICAL BOX
	SIGN

PROPOSED	DESCRIPTION
FM	PROPOSED SANITARY FORCEMAIN
S	PROPOSED SANITARY SEWER
D	PROPOSED STORM SEWER
W	PROPOSED WATERMAIN
	ROADS ON PUBLIC PROPERTY
	ROADS ON PRIVATE PROPERTY



NOTE:
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NOTE:
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BENCHMARK:
MONUMENT UEL #28 EL.91.709m CVD28GVRD DATUM

SITE SCALE FACTOR: 0.9996

SURVEYED BY:
R.F. BINNIE & ASSOCIATES LTD

CIVIC ADDRESS:

LEGAL DESCRIPTION:
LOT 'A'
PLAN 22191
DL 140
NEW WESTMINSTER DISTRICT

SCALE:
0 1:1000 50m

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ISSUED: M/D/Y	REVISION	DESCRIPTION
02/28/14	6	RE-ISSUED FOR REZONING SUBMISSION
10/24/13	5	RE-ISSUED FOR REZONING SUBMISSION
10/02/13	4	RE-ISSUED FOR REZONING SUBMISSION
08/26/13	3	ISSUED FOR REZONING SUBMISSION
06/20/13	2	ISSUED FOR COORDINATION
04/22/13	1	ADDED BUNT LEFT TURN DESIGNS

PROJECT:
MUSQUEAM DEVELOPMENT

CLIENT:
COLLIERS INTERNATIONAL CONSULTANTS

CONSULTANT:
BINNIE
Engineering ▪ Project Management ▪ Geomatics
R.F. Binnie & Associates Ltd.
205 - 4946 Canada Way
Burnaby, BC V5G 4H7
P: 604-420-1721
F: 604-420-4743
www.binnie.com
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DATE: 3/27/13
DRAWN: SJ
DESIGN: JS
CHECKED: TC
SCALE: 1:1000m
SEAL:

SHEET TITLE:
CONCEPTUAL KEY PLAN

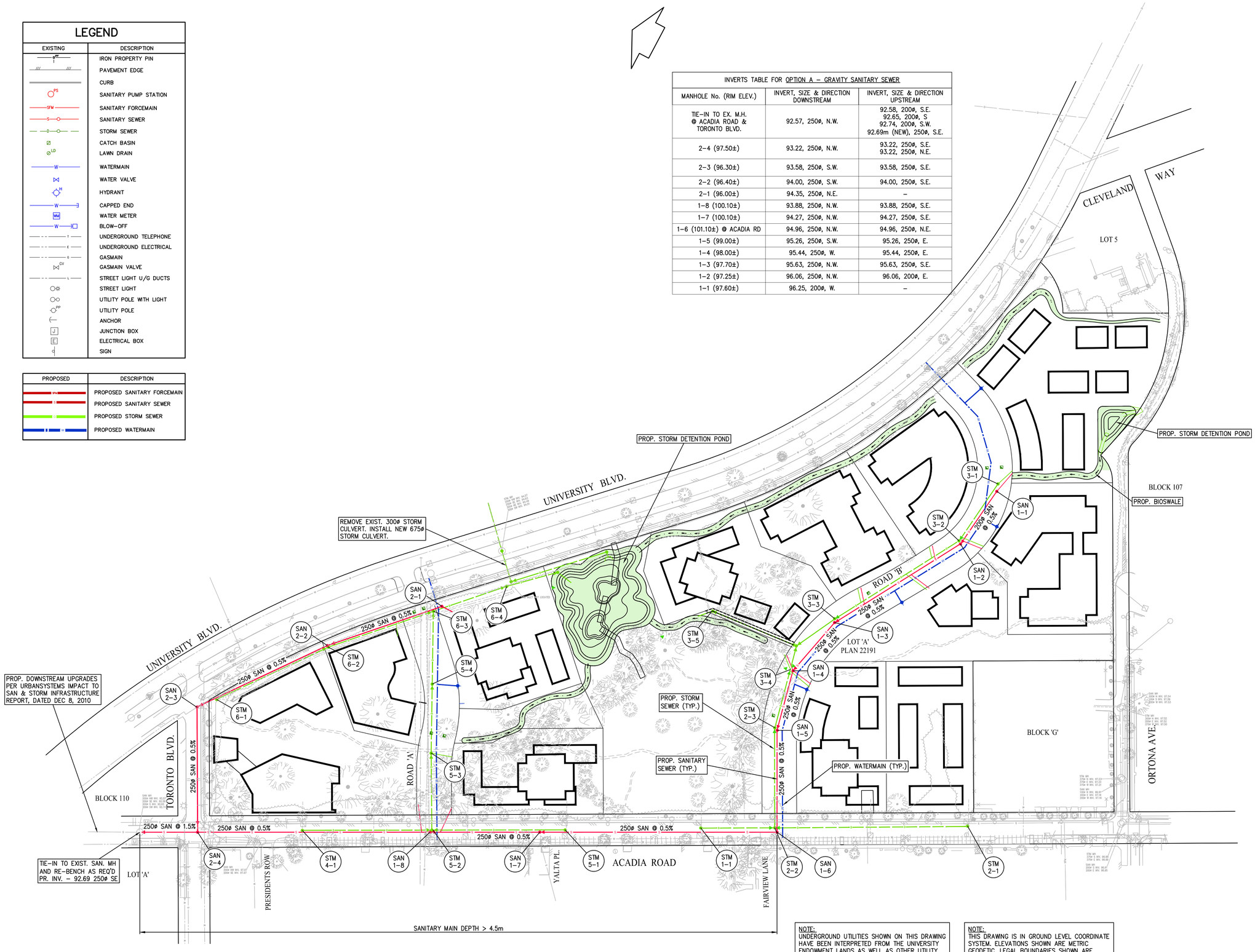
DRAWING NO.: CKP-1
REV.: 6
RFB JOB No. 12-125
SHEET 1 OF 8

LEGEND

EXISTING	DESCRIPTION
IP	IRON PROPERTY PIN
/// ///	PAVEMENT EDGE
	CURB
PS	SANITARY PUMP STATION
SFM	SANITARY FORCEMAIN
S	SANITARY SEWER
D	STORM SEWER
	CATCH BASIN
LD	LAWN DRAIN
W	WATERMAIN
	WATER VALVE
H	HYDRANT
W	CAPPED END
WM	WATER METER
W	BLOW-OFF
T	UNDERGROUND TELEPHONE
E	UNDERGROUND ELECTRICAL
G	GASMAIN
GV	GASMAIN VALVE
L	STREET LIGHT U/G DUCTS
	STREET LIGHT
	UTILITY POLE WITH LIGHT
PP	UTILITY POLE
	ANCHOR
J	JUNCTION BOX
E	ELECTRICAL BOX
	SIGN

PROPOSED	DESCRIPTION
FM	PROPOSED SANITARY FORCEMAIN
S	PROPOSED SANITARY SEWER
D	PROPOSED STORM SEWER
W	PROPOSED WATERMAIN

INVERTS TABLE FOR OPTION A – GRAVITY SANITARY SEWER		
MANHOLE No. (RIM ELEV.)	INVERT, SIZE & DIRECTION DOWNSTREAM	INVERT, SIZE & DIRECTION UPSTREAM
TIE–IN TO EX. M.H. @ ACADIA ROAD & TORONTO BLVD.	92.57, 250ø, N.W.	92.58, 200ø, S.E. 92.65, 200ø, S 92.74, 200ø, S.W. 92.69m (NEW), 250ø, S.E.
2–4 (97.50±)	93.22, 250ø, N.W.	93.22, 250ø, S.E. 93.22, 250ø, N.E.
2–3 (96.30±)	93.58, 250ø, S.W.	93.58, 250ø, S.E.
2–2 (96.40±)	94.00, 250ø, S.W.	94.00, 250ø, S.E.
2–1 (96.00±)	94.35, 250ø, N.E.	–
1–8 (100.10±)	93.88, 250ø, N.W.	93.88, 250ø, S.E.
1–7 (100.10±)	94.27, 250ø, N.W.	94.27, 250ø, S.E.
1–6 (101.10±) @ ACADIA RD	94.96, 250ø, N.W.	94.96, 250ø, N.E.
1–5 (99.00±)	95.26, 250ø, S.W.	95.26, 250ø, E.
1–4 (98.00±)	95.44, 250ø, W.	95.44, 250ø, E.
1–3 (97.70±)	95.63, 250ø, N.W.	95.63, 250ø, S.E.
1–2 (97.25±)	96.06, 250ø, N.W.	96.06, 200ø, E.
1–1 (97.60±)	96.25, 200ø, W.	–



NOTE:
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NOTE:
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BENCHMARK:
MONUMENT UEL #28 EL.91.709m CVD28GVRD DATUM

SITE SCALE FACTOR: 0.9996

SURVEYED BY:
R.F. BINNIE & ASSOCIATES LTD

CIVIC ADDRESS:

LEGAL DESCRIPTION:
LOT 'A'
PLAN 22191
DL 140
NEW WESTMINSTER DISTRICT

SCALE:
0 1:1000 50m

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ISSUED: M/D/Y	REVISION	DESCRIPTION
02/28/14	1	RE–ISSUED FOR REZONING SUBMISSION

PROJECT:
MUSQUEAM DEVELOPMENT

CLIENT:
COLLIERS INTERNATIONAL CONSULTANTS

CONSULTANT:
BINNIE
Engineering • Project Management • Geomatics
R.F. Binnie & Associates Ltd.
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P: 604-420-1721
F: 604-420-4743
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DATE:	3/27/13
DRAWN:	SJ
DESIGN:	JS
CHECKED:	TC
SCALE:	1:1000m

SEAL:

SHEET TITLE:
CONCEPTUAL SERVICING PLAN SANITARY OPTION A (GRAVITY)

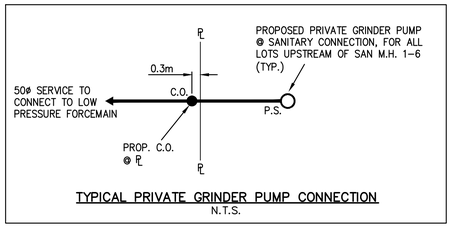
DRAWING NO.: CSP-1A
REV.: 1
RFB JOB No. 12–125
SHEET 2 OF 8

LEGEND

EXISTING	DESCRIPTION
	IRON PROPERTY PIN
	PAVEMENT EDGE
	CURB
PS	SANITARY PUMP STATION
SFM	SANITARY FORCEMAIN
S	SANITARY SEWER
D	STORM SEWER
	CATCH BASIN
LD	LAWN DRAIN
W	WATERMAIN
	WATER VALVE
H	HYDRANT
	CAPPED END
WM	WATER METER
	BLOW-OFF
T	UNDERGROUND TELEPHONE
E	UNDERGROUND ELECTRICAL
G	GASMAIN
GV	GASMAIN VALVE
L	STREET LIGHT U/G DUCTS
	STREET LIGHT
	UTILITY POLE WITH LIGHT
PP	UTILITY POLE
	ANCHOR
J	JUNCTION BOX
E	ELECTRICAL BOX
	SIGN

PROPOSED	DESCRIPTION
PFM	PROPOSED SANITARY FORCEMAIN
	PROPOSED SANITARY SEWER
	PROPOSED STORM SEWER
W	PROPOSED WATERMAIN

INVERTS TABLE FOR OPTION B – LOW PRESSURE SANITARY SYSTEM		
MANHOLE No. (RIM ELEV.)	INVERT, SIZE & DIRECTION DOWNSTREAM	INVERT, SIZE & DIRECTION UPSTREAM
TIE–IN TO EX. M.H. @ ACADIA ROAD & TORONTO BLVD.	92.57, 300ø, N.W.	92.58, 200ø, S.E. 92.65, 200ø, S 92.74, 200ø, S.W. 92.69m (NEW), 300ø, S.E.
2–4 (97.50±)	93.22, 250ø, N.W.	93.22, 250ø, S.E. 93.22, 250ø, N.E.
2–3 (96.30±)	93.58, 250ø, S.W.	93.58, 250ø, S.E.
2–2 (96.40±)	94.00, 250ø, S.W.	94.00, 250ø, S.E.
2–1 (98.60)	94.35, 250ø, N.E.	–
1–8 (100.10±)	96.88, 250ø, N.W.	96.88, 250ø, S.E.
1–7 (100.10)	98.60, 250ø, N.W.	98.60, 250ø, S.E.
1–6 (101.10) @ ACADIA RD	99.60±, 250ø, N.W.	99.75±, 100ø, N.E.



TYPICAL PRIVATE GRINDER PUMP CONNECTION
N.T.S.

NOTE:
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BENCHMARK:
MONUMENT UEL #28 EL.91.709m CVD28GVRD DATUM

SITE SCALE FACTOR: 0.9996

SURVEYED BY:
R.F. BINNIE & ASSOCIATES LTD

CIVIC ADDRESS:

LEGAL DESCRIPTION:
LOT 'A'
PLAN 22191
DL 140
NEW WESTMINSTER DISTRICT

SCALE:
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ISSUED: M/D/Y	REVISION	DESCRIPTION
02/28/14	1	ISSUED FOR RE–ZONING SUBMISSION

PROJECT:
MUSQUEAM DEVELOPMENT

CLIENT:
COLLIERS INTERNATIONAL CONSULTANTS

CONSULTANT:
BINNIE
Engineering ▪ Project Management ▪ Geomatics
R.F. Binnie & Associates Ltd.
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F: 604-420-4743
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DATE: 3/27/13	SEAL:
DRAWN: SJ	
DESIGN: JS	
CHECKED: TC	
SCALE: 1:1000m	

SHEET TITLE:
CONCEPTUAL SERVICING PLAN SANITARY OPTION B (LOW PRESSURE)

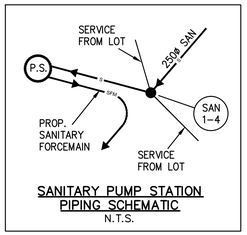
DRAWING NO.:	REV.
CSP-1B	1
RFB JOB No. 12–125	SHEET 3 OF 8

LEGEND

EXISTING	DESCRIPTION
IP	IRON PROPERTY PIN
	PAVEMENT EDGE
	CURB
PS	SANITARY PUMP STATION
SFM	SANITARY FORCEMAIN
S	SANITARY SEWER
D	STORM SEWER
	CATCH BASIN
LD	LAWN DRAIN
W	WATERMAIN
	WATER VALVE
H	HYDRANT
W	CAPPED END
WM	WATER METER
W	BLOW-OFF
T	UNDERGROUND TELEPHONE
E	UNDERGROUND ELECTRICAL
G	GASMAIN
GV	GASMAIN VALVE
L	STREET LIGHT U/G DUCTS
	STREET LIGHT
	UTILITY POLE WITH LIGHT
PP	UTILITY POLE
	ANCHOR
J	JUNCTION BOX
E	ELECTRICAL BOX
	SIGN

PROPOSED	DESCRIPTION
PFM	PROPOSED SANITARY FORCEMAIN
S	PROPOSED SANITARY SEWER
D	PROPOSED STORM SEWER
W	PROPOSED WATERMAIN

INVERTS TABLE FOR OPTION C – SANITARY FORCEMAIN & PUMP STATION		
MANHOLE No. (RIM ELEV.)	INVERT, SIZE & DIRECTION DOWNSTREAM	INVERT, SIZE & DIRECTION UPSTREAM
TIE-IN TO EX. M.H. @ ACADIA ROAD & TORONTO BLVD.	92.57, 300ø, N.W.	92.58, 200ø, S.E. 92.65, 200ø, S 92.74, 200ø, S.W. 92.69m (NEW), 300ø, S.E.
2–4 (100.00±)	93.11, 300ø, N.W.	96.13, 300ø, S.E.
1–8 (100.00±)	96.54, 300ø, N.W.	97.00, 250ø, S.E. 96.59, 200ø, N.E.
2–1 (98.60)	96.85, 200ø, S.W.	–
1–7 (100.10)	98.60, 250ø, N.W.	98.60, 250ø, S.E.
1–6 (101.10) @ ACADIA RD	99.60±, 250ø, N.W.	99.60, 250ø, N.E.
BETWEEN 1–6 AND 1–4	PUMP	PUMP
1–4 (98.00±)	95.39, 250ø, W.	95.39, 250ø, E.
1–3 (97.70±)	95.58, 250ø, N.W.	95.54, 250ø, S.E.
1–2 (97.25±)	95.97, 250ø, N.W.	96.02, 200ø, E.
1–1 (97.60±)	96.20±, 200ø, W.	–



SANITARY PUMP STATION PIPING SCHEMATIC
N.T.S.

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BENCHMARK:
MONUMENT UEL #28 EL.91.709m CVD28GVRD DATUM

SITE SCALE FACTOR: 0.9996

SURVEYED BY:
R.F. BINNIE & ASSOCIATES LTD

CIVIC ADDRESS:

LEGAL DESCRIPTION:
LOT 'A'
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DL 140
NEW WESTMINSTER DISTRICT

SCALE:
0 1:1000 50m

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ISSUED: M/D/Y	REVISION	DESCRIPTION
02/28/14	1	RE–ISSUED FOR REZONING SUBMISSION

PROJECT:
MUSQUEAM DEVELOPMENT

CLIENT:
COLLIERS INTERNATIONAL CONSULTANTS

CONSULTANT:
BINNIE
Engineering • Project Management • Geomatics
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DATE:	3/27/13
DRAWN:	SJ
DESIGN:	JS
CHECKED:	TC
SCALE:	1:1000m

SEAL:

SHEET TITLE:
CONCEPTUAL SERVICING PLAN SANITARY OPTION C (FORCEMAIN)

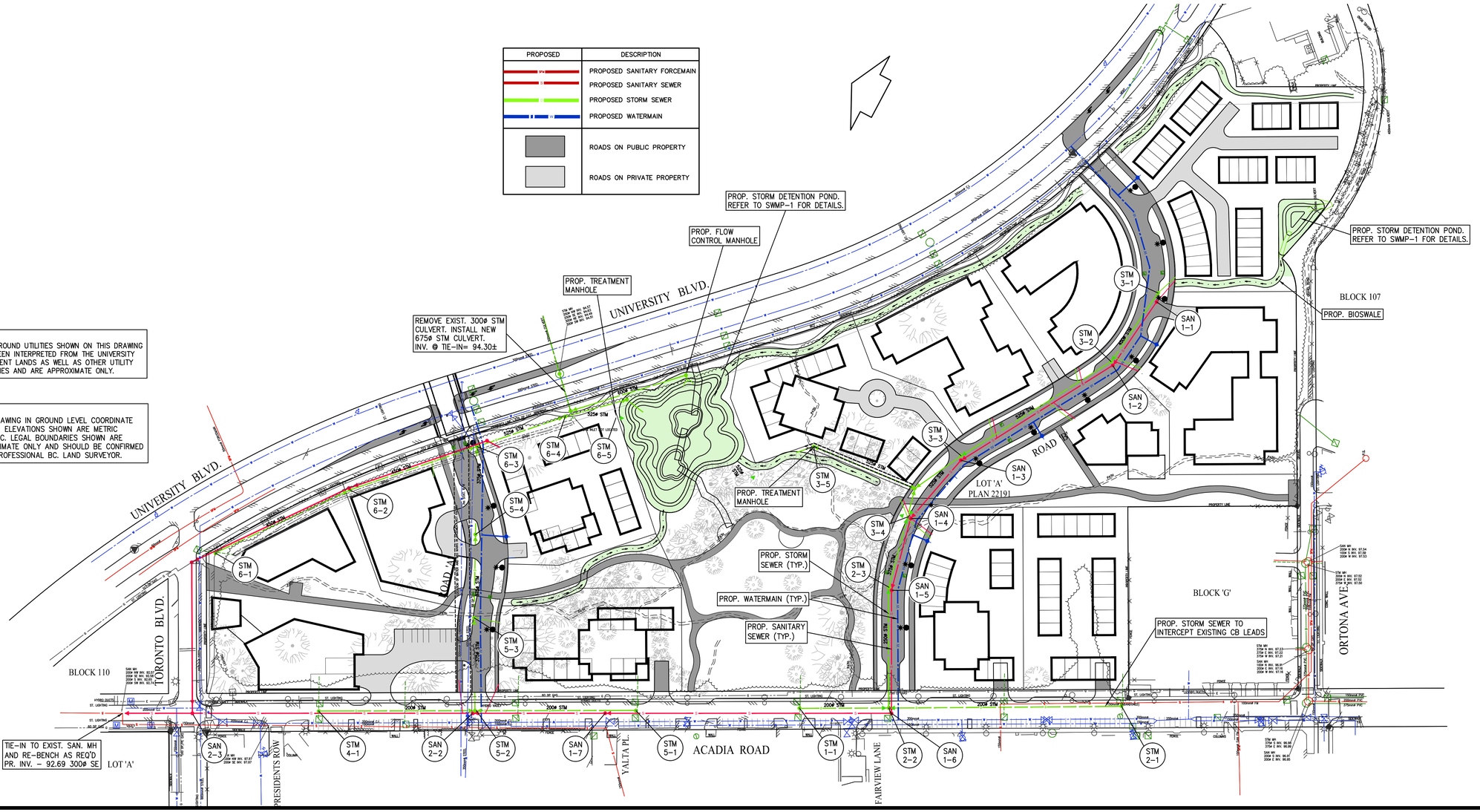
DRAWING NO.:	REV.
CSP-1C	1
RFB JOB No. 12–125	SHEET 4 OF 8

Storm Sewer Analysis - Rational Method

Consultant:	RF Binnie & Associates Ltd.	Storm Sewer Design Criteria:	*DESIGN RETURN PERIOD*	*10 YEAR / 100 YEAR*	Sheet: 1 of 1
Project No.:	12-125	Minor Rainfall Intensity (10-year storm)	*MANNING "n"*	*0.013 (PVC)*	File Name: 12-125-04
Project Description:	Block F Musqueum Development	Major Rainfall Intensity (100-year storm)	*Q 10 / Q 100 = RAIN*	*0.003 = N*	Completed by: GL
		Q = RAIN	*RUNOFF COEFF 10 YEAR*	*0.9 = R*	Date: February 2014
Project Location:	University Endowment Lands	Q = C*I*A	*RUNOFF COEFF 100 YEAR*	*0.9 = R*	Checked by: TC
		Rainfall Data Location: Confederation Park IDF			Date:
		$R = AT^{B}$ (10 YR: A = 15.628 B = -0.517)			
		(100 YR: A = 22.134 B = -0.542)	Manning's 'n' = 0.013 (PVC); 0.014 (VCP); 0.012 (CONC)		

Location of Drainage Area	Manhole		Area (ha)	Runoff Coefficient (R)		R*A (ha)		Total R*A (ha)		Time of Concentration	Total Time	Intensity I(10)	Intensity I(100)	Flow Q(10)	Flow Q(100)	Sewer Design Slope	Sewer Design Pipe Dia.	Sewer Design Mannings "n"	Sewer Design Q Cap.	Sewer Design V Cap.	Sewer Design Length	Inc. Travel Time to Downstream Manhole	Ratio Q(10)/ Q Cap.	Ratio Q(100)/ Q Cap.	Comments Major Flow Route		100 Year Hydraulic Grade Line Information PROP. INVERT AT U/S MANHOLE	PROP. INVERT AT D/S MANHOLE	APPROX RIM ELEV PIPE AT U/S MH
	From	To	A	10 Yr	100 Yr	10 Yr	100 Yr	10 Yr	100 Yr	(min)	(min)	(mm/hr)	(mm/hr)	m^3/s	(m/s)	%	(mm)		(m3/s)	(m/s)	(m)	(min)	%	%					
A1	DMH 1-1	DMH 2-2	0.21	0.90	0.90	0.19	0.19	0.19	0.19	15.00	16.78	30.20	44.2	0.016	0.023	1.00	200	0.013	0.033	1.04	111.3	1.78	49	71	SURCHARGE,	BELOW SURFACE	99.362	98.249	100.6
A2	DMH 2-1	DMH 2-2	0.15	0.90	0.90	0.13	0.13	0.13	0.13	16.78	17.46	29.59	43.2	0.011	0.016	1.00	200	0.013	0.033	1.04	42.6	0.68	34	50	SURCHARGE,	BELOW SURFACE	98.675	98.249	99.9
A3	DMH 2-2	DMH 2-3	0.05	0.90	0.90	0.04	0.04	0.36	0.36	17.46	17.83	29.27	42.7	0.030	0.044	2.50	250	0.013	0.094	1.92	42.6	0.37	32	46	SURCHARGE,	BELOW SURFACE	98.199	97.133	101.0
A4	DMH 2-3	DMH 3-4	0.95	0.70	0.75	0.66	0.71	1.03	1.08	17.83	17.99	29.13	42.5	0.084	0.128	5.00	375	0.013	0.392	3.55	34.8	0.16	21	33	SURCHARGE,	BELOW SURFACE	97.008	95.267	98.5
A5	DMH 3-1	DMH 3-2	1.62	0.60	0.65	0.97	1.06	1.06	1.06	15.00	15.68	31.28	45.8	0.092	0.135	0.30	450	0.013	0.156	0.98	39.8	0.68	59	87	SURCHARGE,	BELOW SURFACE	95.760	95.641	97.0
A6	DMH 3-2	DMH 3-3	1.59	0.60	0.65	0.95	1.03	2.01	2.09	15.68	16.97	30.02	43.9	0.169	0.256	0.30	525	0.013	0.236	1.09	84.9	1.30	72	109	SURCHARGE,	BELOW SURFACE	95.566	95.312	96.9
A7	DMH 3-3	DMH 3-4	0.60	0.70	0.75	0.42	0.45	2.43	2.54	16.97	17.44	29.61	43.2	0.201	0.307	0.50	525	0.013	0.304	1.41	38.9	0.46	66	101	SURCHARGE,	BELOW SURFACE	95.312	95.117	96.7
A8	DMH 3-4	DMH 3-5	1.33	0.10	0.30	0.13	0.40	3.59	4.01	17.99	18.93	28.38	41.4	0.285	0.465	0.50	525	0.013	0.304	1.41	78.9	0.94	94	153	SURCHARGE,	BELOW SURFACE	95.117	94.723	96.9
Outfall	DMH 3-5	Pond	0.00	0.00	0.00	0.00	0.00	3.59	4.01	18.93	19.04	28.29	41.2	0.284	0.463	0.50	525	0.013	0.304	1.41	9.5	0.11	94	152	SURCHARGE,	BELOW SURFACE	94.723	94.675	96.4
B1	DMH 4-1	DMH 5-2	0.24	0.90	0.90	0.21	0.21	0.19	0.21	15.00	16.20	30.75	45.0	0.016	0.027	1.00	200	0.013	0.033	1.04	75.3	1.20	50	82	SURCHARGE,	BELOW SURFACE	98.888	98.135	100.0
B2	DMH 5-1	DMH 5-2	0.21	0.90	0.90	0.19	0.19	0.17	0.19	15.00	16.22	30.74	45.0	0.015	0.024	1.00	200	0.013	0.033	1.04	76.3	1.22	45	73	SURCHARGE,	BELOW SURFACE	98.898	98.135	100.2
B3	DMH 5-2	DMH 5-3	1.05	0.76	0.81	0.80	0.85	1.16	1.25	16.22	16.49	30.48	44.6	0.099	0.156	3.00	375	0.013	0.304	2.75	44.4	0.27	32	51	SURCHARGE,	BELOW SURFACE	97.960	96.629	100.1
B4	DMH 5-3	DMH 5-4	0.04	0.90	0.90	0.04	0.04	1.19	1.29	16.49	16.78	30.20	44.2	0.101	0.159	2.00	375	0.013	0.248	2.25	39.9	0.30	41	64	SURCHARGE,	BELOW SURFACE	96.629	95.830	98.9
B5	DMH 5-4	DMH 6-3	0.04	0.90	0.90	0.04	0.04	1.23	1.33	16.78	17.09	29.92	43.7	0.103	0.162	2.00	375	0.013	0.248	2.25	40.9	0.30	42	65	SURCHARGE,	BELOW SURFACE	95.830	95.012	97.4
B6	DMH 6-1	DMH 6-2	0.26	0.80	0.85	0.21	0.22	0.17	0.22	15.00	16.71	30.27	44.3	0.014	0.028	0.15	450	0.013	0.110	0.69	71.1	1.71	13	25	SURCHARGE,	BELOW SURFACE	95.126	95.019	96.4
B7	DMH 6-2	DMH 6-3	0.38	0.80	0.85	0.30	0.32	0.47	0.54	16.71	18.01	29.11	42.5	0.038	0.065	0.15	450	0.013	0.110	0.69	54.5	1.31	35	58	SURCHARGE,	BELOW SURFACE	95.019	94.937	96.4
B8	DMH 6-3	DMH 6-4	0.76	0.70	0.75	0.53	0.57	2.23	2.44	18.01	19.03	28.29	41.2	0.177	0.281	0.20	525	0.013	0.192	0.89	54.3	1.02	92	146	SURCHARGE,	BELOW SURFACE	94.862	94.754	96.0
Outfall	DMH 6-4	Pond	0.00	0.00	0.00	0.00	0.00	2.23	2.44	18.01	18.75	28.51	41.6	0.178	0.283	0.20	525	0.013	0.192	0.89	39.3	0.74	93	147	SURCHARGE,	BELOW SURFACE	94.754	94.675	96.1
Outlet	Pond	Outlet	0.00	0.00	0.00	0.00	0.00	5.82	6.45	19.04	19.69	27.80	40.5	0.453	0.731	0.50	600	0.013	0.434	1.54	60.0	0.65	104	168	SURCHARGE,	BELOW SURFACE	94.600	94.300	96.0
		Total Area	*1.35*	ha		5.82	6.45	0.00	0.00																				

PROPOSED	DESCRIPTION
FM	PROPOSED SANITARY FORCEMAIN
S	PROPOSED SANITARY SEWER
D	PROPOSED STORM SEWER
D W	PROPOSED WATERMAIN
	ROADS ON PUBLIC PROPERTY
	ROADS ON PRIVATE PROPERTY



NOTE:
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NOTE:
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BENCHMARK:
MONUMENT UEL #28 EL.91.709m CVD28GVRD DATUM

SITE SCALE FACTOR: 0.9996

SURVEYED BY:
R.F. BINNIE & ASSOCIATES LTD

CIVIC ADDRESS:

LEGAL DESCRIPTION:
LOT 'A'
PLAN 22191
DL 140
NEW WESTMINSTER DISTRICT

SCALE:
0 1:1000 50m

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ISSUED: M/D/Y	REVISION	DESCRIPTION
02/28/14	1	RE-ISSUED FOR REZONING SUBMISSION

PROJECT:
MUSQUEAM DEVELOPMENT

CLIENT:
COLLIERS INTERNATIONAL CONSULTANTS

CONSULTANT:
BINNIE
Engineering ▪ Project Management ▪ Geomatics
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DATE: 3/27/13	SEAL:
DRAWN: SJ	
DESIGN: JS	
CHECKED: TC	
SCALE: 1:1000m	

SHEET TITLE:
CONCEPTUAL SERVICING PLAN

STORM

DRAWING NO.:	REV.
CSP-2	1
RFB JOB No. 12-125	SHEET 5 OF 8

LEGEND

EXISTING	DESCRIPTION
IP	IRON PROPERTY PIN
/// ///	PAVEMENT EDGE
	CURB
PS	SANITARY PUMP STATION
SFM	SANITARY FORCEMAIN
S	SANITARY SEWER
D	STORM SEWER
	CATCH BASIN
LD	LAWN DRAIN
W	WATERMAIN
	WATER VALVE
H	HYDRANT
W	CAPPED END
WM	WATER METER
W	BLOW-OFF
T	UNDERGROUND TELEPHONE
E	UNDERGROUND ELECTRICAL
G	GASMAIN
GV	GASMAIN VALVE
L	STREET LIGHT U/G DUCTS
	STREET LIGHT
PP	UTILITY POLE WITH LIGHT
PP	UTILITY POLE
	ANCHOR
J	JUNCTION BOX
E	ELECTRICAL BOX
	SIGN

PROPOSED	DESCRIPTION
FM	PROPOSED SANITARY FORCEMAIN
S	PROPOSED SANITARY SEWER
D	PROPOSED STORM SEWER
W	PROPOSED WATERMAIN
	ROADS ON PUBLIC PROPERTY
	ROADS ON PRIVATE PROPERTY

NOTE:
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BENCHMARK:
MONUMENT UEL #28 EL.91.709m CVD28GVRD DATUM

SITE SCALE FACTOR: 0.9996

SURVEYED BY:
R.F. BINNIE & ASSOCIATES LTD

CIVIC ADDRESS:

LEGAL DESCRIPTION:
LOT 'A'
PLAN 22191
DL 140
NEW WESTMINSTER DISTRICT

SCALE:
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ISSUED: M/D/Y	REVISION	DESCRIPTION
05/03/14	4	RE-ISSUED FOR REZONING SUBMISSION
10/02/13	3	RE-ISSUED FOR REZONING SUBMISSION
08/26/13	2	ISSUED FOR REZONING SUBMISSION
06/20/13	1	ISSUED FOR COORDINATION

PROJECT:
MUSQUEAM DEVELOPMENT

CLIENT:
COLLIERS INTERNATIONAL CONSULTANTS

CONSULTANT:
BINNIE
Engineering • Project Management • Geomatics

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DATE: 6/7/13	SEAL:
DRAWN: SB	
DESIGN: JS	
CHECKED: TC	
SCALE: 1:1000m	

SHEET TITLE:
CONCEPTUAL GRADING PLAN

DRAWING NO.:	REV.
CGP-1	4
RFB JOB No. 12-125	SHEET 6 OF 8

LEGEND

EXISTING	DESCRIPTION
	IRON PROPERTY PIN
	PAVEMENT EDGE
	CURB
PS	SANITARY PUMP STATION
SFM	SANITARY FORCEMAIN
S	SANITARY SEWER
D	STORM SEWER
	CATCH BASIN
LD	LAWN DRAIN
W	WATERMAIN
	WATER VALVE
H	HYDRANT
W	CAPPED END
WM	WATER METER
W	BLOW-OFF
T	UNDERGROUND TELEPHONE
E	UNDERGROUND ELECTRICAL
G	GASMAIN
GV	GASMAIN VALVE
L	STREET LIGHT U/G DUCTS
	STREET LIGHT
PP	UTILITY POLE WITH LIGHT
PP	UTILITY POLE
	ANCHOR
J	JUNCTION BOX
E	ELECTRICAL BOX
	SIGN

- PROPOSED BUILDING
- ASPHALT PAVEMENT
- STORMWATER DETENTION POND
- LANDSCAPING

Muqueam - Block F
PRELIMINARY STORM WATER STORAGE DESIGN CALCULATIONS

Using Environment Canada - Vancouver UBC IDF Curve Formula
5 Year Event (With Infiltration Reduction)

Catchment Area	8.80	ha.
Runoff Coefficient	0.80	
Time Of Concentration	13.0	minutes
Intensity (@ Tc)	29	mm/h
Storm Frequency	5	year storm
Maximum Release Rate	0.036	cu.m/s

Peak flow for storm of duration equal to Tc = 0.567 cu.m/s
Infiltration flow within pond (See Calculations) = 0.030 cu.m/s
Peak flow - Infiltation flow = 0.537 cu.m/s

Storage Volume = $T_r (Q_{p2} - Q_{rel}) + 0.5T_c (1/Q_{p2} - 1/Q_{p1}) Q_{rel}^2$
where Tr: storm duration, Qp2: peak flow where storm duration Tr>=Tc, Qrel: predevelopment flow,
Tc: time of concentration, Qp1: peak flow where storm duration =Tc

Trial #	Rainfall Duration	Intensity	Inflow Rate	Inflow Volume	Outflow Rate	Outflow Vol	Req'd Storage Volume
	min.	mm/h	cu.m/s	cu.m	cu.m/s	cu.m	cu.m
1	5	47.23	0.894	268	0.036	11	257
2	10	33.31	0.621	373	0.036	22	351
3	15	27.15	0.501	451	0.036	33	418
4	27	20.19	0.365	591	0.036	59	532
5	30	19.14	0.344	620	0.036	66	555
6	45	15.61	0.275	743	0.036	98	646
7	60	13.50	0.234	842	0.036	131	713
8	75	12.06	0.206	927	0.036	164	764
9	90	11.00	0.185	1000	0.036	197	805
10	105	10.18	0.169	1065	0.036	229	838
11	120	9.52	0.156	1124	0.036	262	865
12	135	8.97	0.145	1178	0.036	295	886
13	150	8.51	0.136	1227	0.036	328	902
14	165	8.11	0.129	1273	0.036	360	915
15	180	7.76	0.122	1315	0.036	393	925
16	195	7.45	0.116	1354	0.036	426	932
17	210	7.18	0.110	1391	0.036	459	936
18	225	6.93	0.106	1426	0.036	491	938
19	240	6.71	0.101	1458	0.036	524	938
20	255	6.51	0.097	1489	0.036	557	936
21	270	6.33	0.094	1518	0.036	590	933
22	285	6.16	0.090	1545	0.036	622	928
23	300	6.00	0.087	1572	0.036	655	921
24	315	5.85	0.084	1596	0.036	688	913
25	330	5.72	0.082	1620	0.036	721	904
26	345	5.59	0.079	1642	0.036	753	894
27	360	5.47	0.077	1663	0.036	786	883
28	420	5.06	0.069	1739	0.036	917	828
29	480	4.73	0.063	1802	0.036	1048	761
30	540	4.46	0.057	1854	0.036	1179	683
31	600	4.23	0.053	1898	0.036	1310	596

Muqueam - Block F
PRELIMINARY STORM WATER STORAGE DESIGN CALCULATIONS

Using Environment Canada - Vancouver UBC IDF Curve Formula
100 Year Event (With Infiltration Reduction)

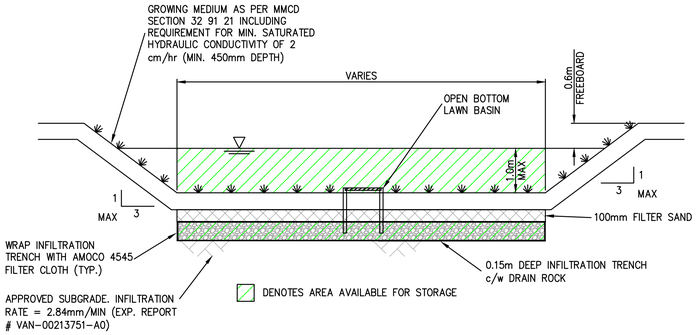
Catchment Area	8.80	ha.
Runoff Coefficient	0.85	
Time Of Concentration	11.0	minutes
Intensity (@ Tc)	56	mm/h
Storm Frequency	100	year storm
Maximum Release Rate	0.205	cu.m/s

Peak flow for storm of duration equal to Tc = 1.161 cu.m/s
Infiltration flow within pond (See Calculations) = 0.030 cu.m/s
Peak flow - Infiltation flow = 1.131 cu.m/s

Storage Volume = $T_r (Q_{p2} - Q_{rel}) + 0.5T_c (1/Q_{p2} - 1/Q_{p1}) Q_{rel}^2$
where Tr: storm duration, Qp2: peak flow where storm duration Tr>=Tc, Qrel: predevelopment flow,
Tc: time of concentration, Qp1: peak flow where storm duration =Tc

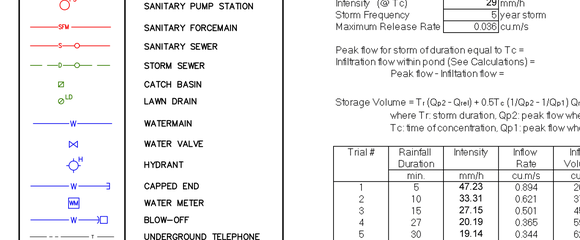
Trial #	Rainfall Duration	Intensity	Inflow Rate	Inflow Volume	Outflow Rate	Outflow Vol	Req'd Storage Volume
	min.	mm/h	cu.m/s	cu.m	cu.m/s	cu.m	cu.m
1	5	84.77	1.731	519	0.205	62	454
2	10	58.26	1.181	708	0.205	123	585
3	15	46.79	0.942	848	0.205	185	666
4	27	34.04	0.677	1097	0.205	332	774
5	30	32.16	0.638	1149	0.205	359	789
6	45	25.82	0.507	1368	0.205	554	830
7	60	22.10	0.429	1545	0.205	738	827
8	75	19.59	0.377	1696	0.205	923	799
9	90	17.75	0.339	1829	0.205	1107	751
10	105	16.33	0.309	1948	0.205	1292	690
11	120	15.19	0.288	2056	0.205	1476	617
12	135	14.25	0.266	2156	0.205	1661	535
13	150	13.46	0.250	2247	0.205	1845	446
14	165	12.79	0.236	2333	0.205	2030	350
15	180	12.20	0.223	2413	0.205	2214	249
16	195	11.68	0.213	2489	0.205	2399	143
17	210	11.22	0.203	2560	0.205	2583	33
18	225	10.81	0.195	2627	0.205	2768	-81
19	240	10.44	0.187	2691	0.205	2952	-198
20	255	10.10	0.180	2753	0.205	3137	-319
21	270	9.79	0.174	2811	0.205	3321	-442
22	285	9.51	0.168	2867	0.205	3506	-568
23	300	9.25	0.162	2920	0.205	3690	-696
24	315	9.01	0.157	2972	0.205	3875	-827
25	330	8.79	0.153	3021	0.205	4059	-959
26	345	8.58	0.148	3069	0.205	4244	-1093
27	360	8.38	0.144	3114	0.205	4428	-1229
28	420	7.71	0.130	3282	0.205	5166	-1789
29	480	7.17	0.119	3430	0.205	5904	-2370
30	540	6.73	0.110	3560	0.205	6642	-2968
31	600	6.36	0.102	3677	0.205	7380	-3580

STORMWATER MANAGEMENT NOTES:
- THE LARGE DETENTION POND HAS SUFFICIENT STORAGE TO MEET THE REQUIREMENTS OF THE PROPOSED DEVELOPMENT. ADDITIONAL STORAGE AVAILABLE FROM BIO-SWALES AND THE SMALL DETENTION POND WILL BE CONSIDERED AS CONTINGENCY
- HARD SURFACE RUNOFF (EG. ROADS) WILL BE ROUTED THROUGH A TREATMENT MANHOLE PRIOR TO ENTERING THE DETENTION POND



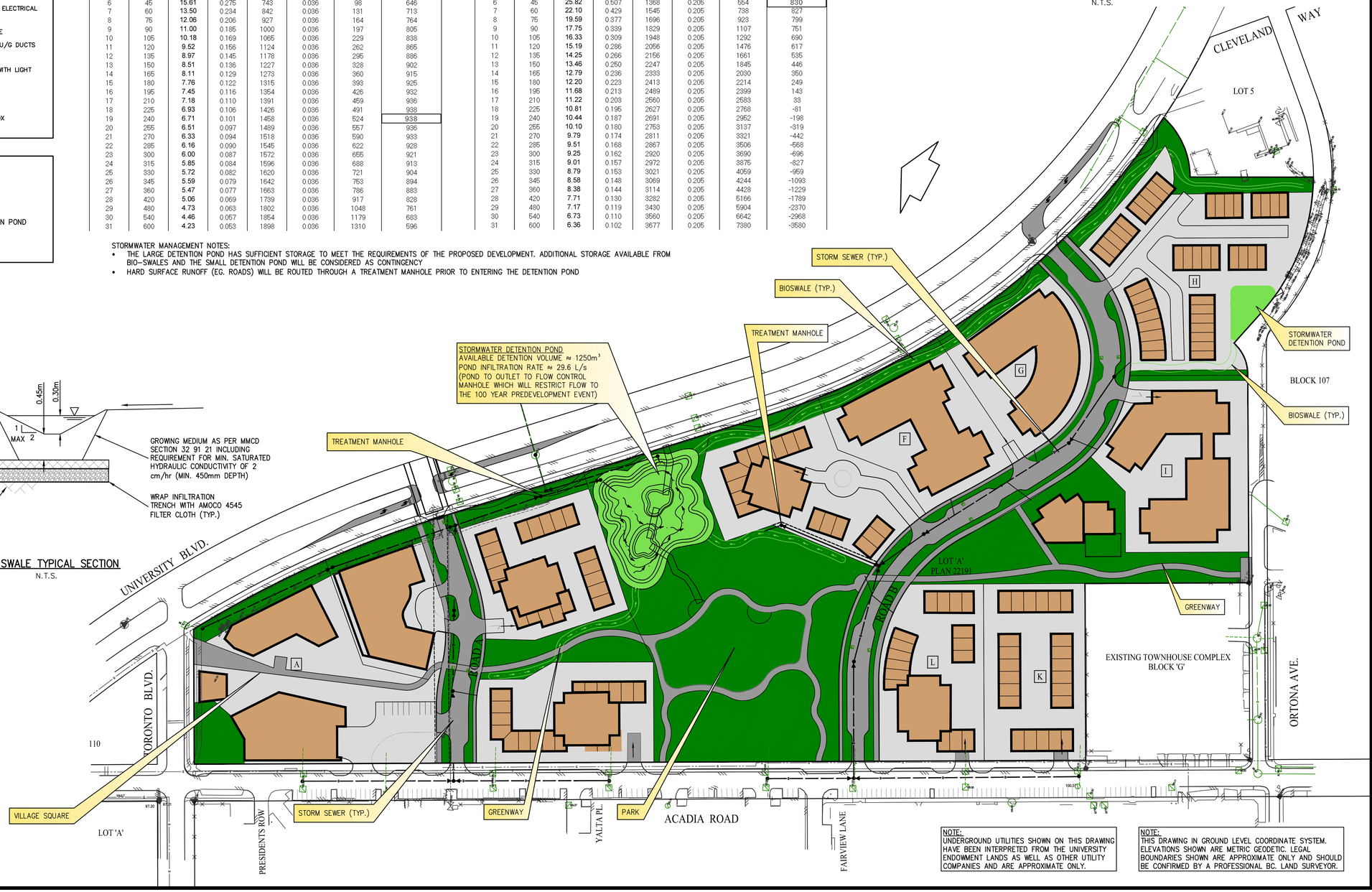
DETENTION POND TYPICAL SECTION

N.T.S.



BIO-SWALE TYPICAL SECTION

N.T.S.



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BENCHMARK:
MONUMENT UEL #28 EL.91.709m CVD28GVRD DATUM

SITE SCALE FACTOR: 0.9996

SURVEYED BY:
R.F. BINNIE & ASSOCIATES LTD

CIVIC ADDRESS:

LEGAL DESCRIPTION:
LOT 'A'
PLAN 22191
DL 140
NEW WESTMINSTER DISTRICT

SCALE: 0 1:1000 50m

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ISSUED: M/D/Y	REVISION	DESCRIPTION
02/28/14	4	RE-ISSUED FOR REZONING SUBMISSION
10/02/13	3	RE-ISSUED FOR REZONING SUBMISSION
08/26/13	2	ISSUED FOR REZONING SUBMISSION
06/25/13	1	ISSUED FOR INFORMATION ONLY

PROJECT:
MUSQUEAM DEVELOPMENT

CLIENT:
COLLIERS INTERNATIONAL CONSULTANTS

CONSULTANT:
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Engineering ▪ Project Management ▪ Geomatics
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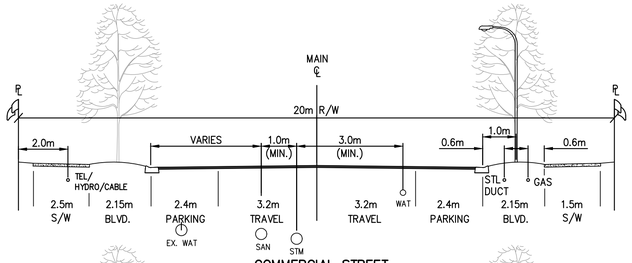
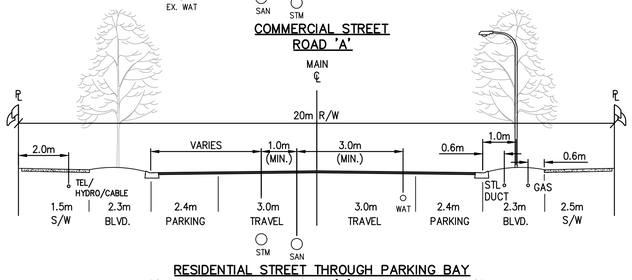
DATE: 6/20/13	SEAL:
DRAWN: SB	
DESIGN: JS	
CHECKED: TC	
SCALE: 1:1000m	

SHEET TITLE:
CONCEPTUAL STORMWATER MANAGEMENT PLAN

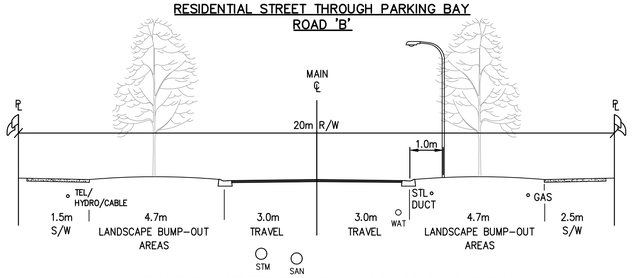
DRAWING NO.:	REV.
SWMP-1	4
RFB JOB No. 12-125	SHEET 8 OF 8



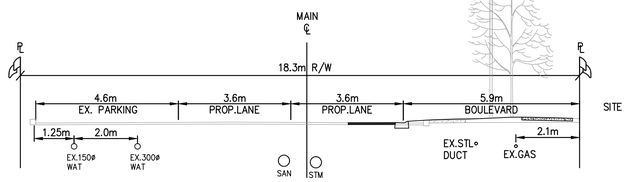
COMMERCIAL STREET
ROAD 'A'



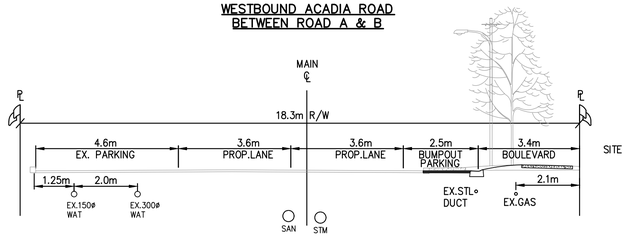
RESIDENTIAL STREET THROUGH PARKING BAY
ROAD 'B'



RESIDENTIAL STREET THROUGH LANDSCAPE BUMP-OUTS
ROAD 'B'



WESTBOUND ACADIA ROAD
BETWEEN ROAD A & B



WESTBOUND ACADIA ROAD
BETWEEN ROAD A & B

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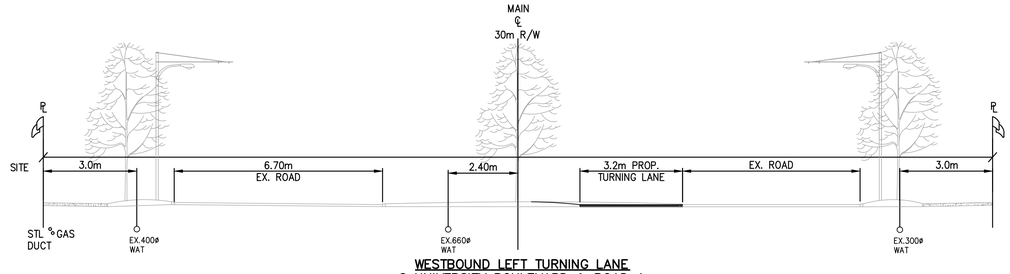
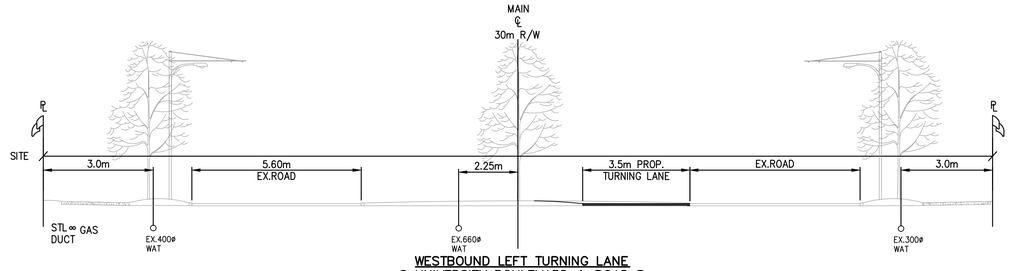
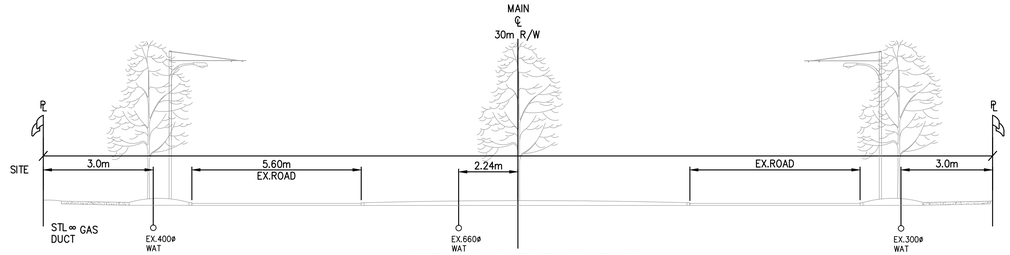


WESTBOUND LEFT TURNING LANE
@ UNIVERSITY BOULEVARD & ROAD A



WESTBOUND LEFT TURNING LANE
@ UNIVERSITY BOULEVARD & ROAD B



WESTBOUND UNIVERSITY BOULEVARD
BETWEEN ROAD A & B INTERSECTION

BENCHMARK:
MONUMENT UEL #28 EL.91.709m CVD28GVRD DATUM

SITE SCALE FACTOR: 0.9996

SURVEYED BY:
R.F. BINNIE & ASSOCIATES LTD

CIVIC ADDRESS:

LEGAL DESCRIPTION:
LOT 'A'
PLAN 22191
DL 140
NEW WESTMINSTER DISTRICT

SCALE:
AS SHOWN

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ISSUED: M/D/Y	REVISION	DESCRIPTION
02/28/14	1	RE-ISSUED FOR REZONING SUBMISSION

PROJECT:
MUSQUEAM
DEVELOPMENT

CLIENT:
COLLIERS INTERNATIONAL
CONSULTANTS

CONSULTANT:
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DATE: 3/27/13	SEAL:
DRAWN: SJ	
DESIGN: JS	
CHECKED: TC	
SCALE: AS SHOWN	

SHEET TITLE:
CONCEPTUAL
TYPICAL SECTIONS

DRAWING NO.:	REV.
CSP-XS	1
RFB JOB No. 12-125	SHEET 7 OF 8

MEMO

DATE: March 26, 2014
PROJECT NO: 4912-01
PROJECT: Block F Development, University Endowment Lands
SUBJECT: Response to UEL Staff Comments Regarding the Transportation Assessment Report

TO: Gordan Easton, Colliers International
FROM: Chris Cheng & Peter Joyce, Bunt & Associates

The following memorandum provides our response to the Traffic and Transportation comments received from the *University Endowment Lands (UEL)* dated February 6, 2014 regarding the proposed development of Block F in the University Endowment Lands (attached for reference).

3a. Growth Projections: Please identify the assumptions underlying the 1% growth projection used for modeling.

As described in Section 5.2 of our Transportation Assessment Report for Block F dated August 23, 2013, automobile traffic volumes crossing the road screen line for the UBC Point Grey campus have decreased by 10,000 vehicles per day over the period from 1997 to 2011 even with a 43% increase in the student, staff and faculty population at UBC over this period, and the transformation of the Wesbrook Village neighbourhood at the south end of the campus to become a community with hundreds of new multifamily residential units and supporting commercial shops and services.

While vehicle traffic volumes are downward trending, as a conservative measure our traffic impact assessment assumes growth in area traffic generally with the Block F anticipated site generated traffic added as a further layer of increased traffic.

The assumption of the assumed 1% growth rate in area traffic is based on the following considerations:

- *2030 student housing goals* identified in the *UBC Vancouver Campus Plan (June 2010)*, resulting in an additional 8,000 beds on campus.
- Assuming these additional beds will be constructed over the next 17 years at a consistent rate, applying a *Student Housing trip rate (trips per bed)* of 0.03 (inbound) and 0.02 (outbound) during the AM Peak and 0.08 (inbound and outbound) for the PM Peak Hour, a yearly increase of vehicle trips was determined.

- Based on the volume split along University Boulevard reported in the *UBC Fall 2011 Transportation Status Report (Figure 2.7)*, it is estimated that 23% of all of the new trips from these beds would travel along University Boulevard.
- This works out to an equivalent of 1% growth per year of the existing traffic volumes along University Boulevard.

3b. Modal Split: State the exact modal split assumed for Block F development. Reference is made to UBC's modal split but it is unclear whether this was the modal split used for the Block F analysis.

The residential vehicle trip rates that were used in the study were based on data collected by Bunt from UBC South Campus Area. It is anticipated that the residential component of the Block F development would be similar to the conditions observed for existing residential development in the South Campus Area.

The trip rates for the Daycare, Grocery Store, Restaurant/Cafe, Office and Hotel were taken from Institute of Transportation Engineers (ITE) Trip Generation data and reduced by an assumed 30% to account for the availability of transit, pedestrian and cycling options as is the case for the Block F development and also the availability of a significant on-site residential population. ITE vehicle trip generation information is largely based on data collected at standalone, suburban locations in the United States over the past 20-30 years with typically over 90% automobile based travel splits.

3c. Peak Hours: Determine when the PM peak hour will occur and use this for the analysis. It is likely with the proximity of the school that the PM peak hour may actually be earlier than proposed.

The PM peak hour for the approximately 1,050 trips (650 EB, 400 WB) along University Boulevard is between 4:30 and 5:30 PM.

The school is anticipated to have a PM peak hour between 2:45 and 3:45 pm, with approximately 100 trips (60 EB/40 WB) adding onto University Boulevard. Vehicle volumes along University Boulevard at the school peak hour period is to just under 1,000 trips (600 EB, 400 WB). These volumes are very close, but considering the peak hour for the site land uses, the later peak hour provides a more conservative analysis.

3d. Parking: Identify the research that indicates that the proposed parking standards are appropriate for the site, and provide evidence that parking will not impact the neighbourhood.

Parking requirements for the proposed Block F development have been carefully planned, taking into consideration relevant planning policies, current trend on vehicle ownership levels, as well as anticipated built-form and expected parking demand for the proposed Master Plan.

Residential Parking

As noted in our August 23/13 Transportation Assessment Report, the proposed residential parking supply rates for the Block F development range from 1.0 resident spaces per apartment unit for buildings greater than 6 storeys, 1.1 resident spaces per apartment unit for low rise buildings up to 6 storeys, and 1.4 spaces per dwelling unit for townhomes. An additional 0.1 parking spaces per unit are identified for residential visitor parking.

As a comparison, parking policy at the UBC South Neighbourhood has no minimum parking requirement for the residential uses. In fact, the parking policy at the South Neighbourhood stipulates parking maximums for both condominiums (1 for each 70 sq m of GFA, or 1.8 per unit, whichever is less) and townhomes (2.0 spaces per unit). The parking rates are also inclusive of visitor and handicap parking at 0.1 space per unit for each category.

Auto-ownership data obtained from ICBC for comparable buildings in the UBC area also suggested vehicle ownership are generally lower than 1.0 space per unit, as shown in the following table.

Building	Year Built	Tenure	Address	No. of Units	Vehicle Count as of June 30, 2013	Vehicles Per Unit	Calculated Auto Ownership Ratio (added 10%)
The Chatham	1995	Leasehold Prepaid-Strata	5775 HAMPTON PL	97	112	1.15	1.27
The Wesbrook	2009	Leasehold Prepaid-Strata	5838 BERTON AVE	65	67	1.03	1.13
Keats Hall	2005	Leasehold Prepaid-Strata	2280 WESBROOK MALL	92	53	0.58	0.64
Westcott Commons	2005	Leasehold Prepaid-Strata	2388 WESTERN PKY	72	48	0.67	0.74
Winslow Commons	2001	Leasehold Prepaid-Strata	2338 WESTERN PKY	64	37	0.58	0.64
			TOTAL	**390**	**317**	**0.81**	**0.89**

The average auto ownership for the buildings studied were is found to be less than *0.90 spaces per unit*. The planned parking minimums are considered appropriate for the residential use.

Commercial Parking

The following parking ratios are being proposed for the commercial uses at Block F. The current parking ratios from the UEL By-law are included for comparison:

Use	UEL Land Use, Building and Community Administrative By-Law (1999)	Proposed Parking Supply Ratio (Minimum)
Office	1 for every 1,000 sq ft	1.5 to 2 per 1,000 sq ft
Retail	None	2.5 per 1,000 sq ft GFA
Restaurants	None	6 to 8 per 1,000 sq ft.
Hotels	1 for every two sleeping units	1 for every two sleeping units
Daycare (Staff Parking)	Not Specified	1 per 15 students

The proposed commercial parking ratios are based on research and industry best practices as outlined in Industry Guidelines such as the *ITE Parking Generation*, along with input from commercial real estate leasing agents.

3e. University Blvd. And Acadia Rd. Intersection: The study indicates that the University Blvd. And Acadia Rd. Intersection will operate with a level-of-service 'F' under full build-out conditions. Please explicitly state what upgrades are proposed for this intersection.

The traffic control at the intersection of University Boulevard & Acadia Road is presently minor street (two way) stop sign control on the Acadia Road approaches. Our analysis of this type of control at the full build out condition does indeed result in a predicted Level of Service (LOS) 'F' traffic operation on the northbound approach.

The presence of a pedestrian actuated signal at this intersection does however provide additional breaks in University Boulevard traffic when pedestrians are present, improving delay along Acadia Road. To more accurately model this “pedestrian signal assist” traffic operation, Bunt provided analysis for this intersection operating as a two way stop and as a traffic signal controlled intersection. With the current intersection design, the predicted performance will be somewhere between the two, i.e., more pressured than a signalized intersection, but better than a two way stop. It is our opinion that the intersection will operate with better than LOS 'F' for the full build out traffic condition.

3f. Road Cross-sections: Please provide detailed cross-sections with complete measurements for both University Blvd. and Acadia Rd. To demonstrate that here is sufficient width for what is proposed. Please show the "worst case scenario" (e.g. where there is the least amount of available setback). Please provide a larger, to-scale version of Figure 2.17 that shows conceptually sufficient measurements to assess the feasibility of this plan.

The Landscape Plan has been updated. Also, for detailed measurements, please refer to the updated Civil Plan. Based on the Landscape and Civil plans, it is confirmed that there is sufficient width to accommodate the proposed cross-sections.

3g. Road B: Please have your transportation consultant review and comment on the proposed "off-set" intersection of Road B and Acadia Rd. with Fairview Lane, and comment on any safety or traffic flow concerns with this off-set intersection.

While there is an offset at the intersection of Road B & Acadia Road with Fairview Lane, the expected left-turn volumes at these locations are quite low with less than 1 vehicle every 10 minutes and therefore are not expected to result in any operational issue. With the redevelopment of the UBC student housing in the future, it is desirable to have the future connection opposing Block F to align with the proposed Road B in the site Master Plan.

3h. Pass-by Trips: Provide rationale for by-pass trip assumptions.

The ITE Trip Generation Handbook (2nd Edition) identifies weekday pm peak hour pass-by for a supermarket between 25 and 45%. Considering this and the isolation of the site from Vancouver, the 50% pass-by rate is considered appropriate.

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STREET BLOCK #S
N-S
E-W
UBC
VANCOUVER CAMPUS
UNIVERSITY ENDOWMENT LANDS (U.E.L.)
Acadia Park Commons Block
East Campus
Doug Mitchell Thunderbird Sports Centre
Hampton Place
Tapestry
UNA Community Place
Nobel Softball Diamond & Park
Student Rec Centre
UBC Birdcoop
Chancellor Place
Osborne Centre
Outdoor Basketball Court
Tennis Centre
Spencer Field
Rashpal Dhillon Track and Oval Field
UNA Office
Wesbrook Place
Iona Green Park
Aquatic Centre
Skate Park
Hawthorn Place
UNA Community Field
UBC Ropes Course
UBC Botanical Garden
The Old Barn Community Centre
WESBROOK MALL
EAST MALL
WEST MALL
Main Mall
WEST 16TH AVENUE
Museum of Anthropology (MOA)
UBC Farm
Centre for Sustainable Food Systems
UBC Botanical Garden & Centre for Plant Research
NW MARINE DRIVE
SW MARINE DRIVE
Pacific Spirit Regional Park
POINT GREY
Tower Beach
Wreck Beach
Fraser River North Arm