City of Richmond

Report to Committee

To:	General Purposes Committee	**Date:**	December 20, 2022
From:	Mark Corrado Director, Community Bylaws and Licencing	**File:**	12-8080-12-01/Vol 01
Re:	**Soil or Fill Use Application for the Property at 8251 No. 5 Road (Garcha)**		

Staff Recommendation

That the 'Soil or Fill Use' application, submitted by Harbinder (Harry) Garcha (Applicant), proposing to retain soil for the purpose of improving the agricultural capability of the property located at 8251 No. 5 Road, be authorized for referral to the Agricultural Land Commission (ALC) for the ALC to review and determine the merits of the proposal from an agricultural perspective as the Applicant has satisfied all of the City's current reporting requirements.

Mark Corrado
Director, Community Bylaws & Licencing
(604-204-8673)

Att. 2

REPORT CONCURRENCE		
ROUTED TO:	**CONCURRENCE**	**CONCURRENCE OF GENERAL MANAGER**
Engineering	☑	
Finance	☑	
Policy Planning	☑	
Transportation	☑	
SENIOR STAFF REPORT REVIEW	**INITIALS:**	**APPROVED BY CAO**

Staff Report

Origin

The City of Richmond has received a 'Soil or Fill Use' application for the property located at 8251 No. 5 Road (Property). The Applicant is proposing to retain 1,100 cubic metres of soil to improve the agricultural capability of the Property to develop a blueberry farm.

The Property is situated within the Agricultural Land Reserve (ALR) and is subject to provisions of the *Agricultural Land Commission Act* and its regulations, and the City's Soil Deposit and Removal Bylaw No. 10200 (Soil Bylaw).

Pursuant to applicable Provincial regulations, a 'Soil or Fill Use' application requires authorization from local government in order to be referred to the Agricultural Land Commission (ALC) for their review and approval. As such, this application must be submitted to the City for review and a decision from Council. Should the application be referred to the ALC and should it subsequently be approved by the ALC, the Applicant is required to satisfy the City's requirements outlined in the Soil Bylaw before a soil deposit permit would be issued by the City.

The Applicant has satisfied all of the City's referral requirements for submission to the ALC.

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

> *Environmentally conscious decision-making that demonstrates leadership in implementing innovative, sustainable practices and supports the City's unique biodiversity and island ecology.*
>
> *2.1 Continued leadership in addressing climate change and promoting circular economic principles.*
>
> *2.3 Increase emphasis on local food systems, urban agriculture and organic farming.*

Analysis

The Property is zoned AG1 (Agriculture). The current zoning permits a wide range of farming and compatible uses consistent with the provisions of the *ALCA* and Regulations and the City's Official Community Plan and Zoning Bylaw. The Applicant is proposing to retain 1,100 cubic metres of soil over a portion of the Property at an average depth of 0.75m. The primary objective is to improve the agricultural capability of the Property.

Uses on Adjacent Lots

- To the North: ALR – Land is in agricultural production
- To the East: ALR – Land is in agricultural production
- To the South: ALR – Land is in agricultural production
- To the West: ALR – Land is in agricultural production

Table 1: Existing Information and Proposed Changes for the Property

Item	**Existing**
Owners	Harbinder & Jaspreet Garcha
Applicant	Harbinder (Harry) Garcha
Consultant	Darrell Zbeetnoff, MSc, MA, MRNM, PAg, CAC
Consultant	Dr. Stephen Ramsay, P.Eng.
Lot Size	0.5 hectares (1.23 acres)
Current Land Uses	The Property is currently not being farmed
Proposed Land Uses	The Applicant intends to continue farming the Property following completion of the proposed project
Zoning	AG1
Official Community Plan Designation	Agriculture
ALR Designation	The Property is within the ALR
Riparian Management Area (RMA)	No
Environmental Sensitive Area (ESA)	No

Project Overview

The Applicant is proposing to retain approximately 1,100 cubic metres of unauthorized soil placed at an average depth of 0.75m over a portion of the Property. The primary objectives of the proposal are to remediate the Property to an appropriate agricultural standard and develop a blueberry farm under the guidance of a qualified agrologist and other associated professionals.

The estimated duration to remediate the Property and plant the blueberries is six months.

Staff Comments

The proposal aligns with the following Council endorsed strategy:

- The proposal to raise the Property to improve the agricultural viability is consistent with the City's current Flood Protection Management Strategy, which identifies raising land levels within all areas of the City as a key overall long-term objective.

Richmond Food Security and Agricultural Advisory Committee (FSAAC) Consultation

The proposal was presented to the FSAAC on October 27, 2022[1]. The FSAAC unanimously supported the proposal passing the following motion:

[1] FSAAC will table the minutes for official adoption at the next meeting.

That the Food Security and Agricultural Advisory Committee support the ALR Soil Use for Placement of Fill Application at 8251 No. 5 Road (CD 130242) and that consideration be given to not disturbing peat soil in Area 5, while supporting the addition of organic matter to Area 5 and remediation in Areas 3 and 4 as recommended in the consultant reports.

Carried Unanimously

Agricultural Considerations

The Applicant has retained Darrell Zbeetnoff MSc, MA, MRNM, PAg, CAC to review and assess the soil and provide recommendations to remediate the area of disturbance within the Property to an appropriate agricultural standard.

The Applicant has provided the following reports (Attachment 1):

- Plan to Reclaim the Soil & Develop a Blueberry Field (Reclamation Plan) – prepared by Darrell Zbeetnoff (MSc, MA, MRNM, PAg, CAC)
- Agrologist's Report – prepared by Geoff Hughes-Games (PAg. Soil Specialist/Sr. Agrologist)
- Water Management report – prepared by Dr. Stephen Ramsay, P.Eng.
- Geotechnical Assessment – prepared by Dr. Stephen Ramsay, P.Eng.

The Reclamation Plan provides an overview of the soil that has been placed on the Property including current site conditions and a proposed Farm Plan in addition to identifying the process required to both retain the soil and remediate the Property. The Reclamation Plan also outlines the Applicant's intensions to grow blueberries following completion of the remediation work and has provided the costs associated with creating the blueberry farm.

As per the assessment of two professional agrologists, following the placement of the soil, it has been concluded that should the City and ALC permit the soil to be retained, the proposed area to be farmed within the Property (identified in the associated reports) can be improved from the current unimproved soils (Classes 5 to 7), "to Classes 2 to 4 with limitations related to wetness, undesirable soil structure, and low nutrient content."

As noted above, the Applicant has retained two qualified agrologists, Mr. Zbeetnoff and Mr. Hughes-Games who are employed by McTavish Resource & Management Consultants Ltd. Given that both agrologists are employed by Mr. Bruce McTavish (MSc, MBA, PAg, RPBio), staff have not recommended an external qualified agrologist review. In particular, staff considered that the review of the imported soil has already been conducted by two agrologists. In addition to the aforesaid review and staff review, the ALC has conducted a preliminary inspection and review of the imported soil. Should Council authorize that the proposal be forwarded to the ALC, it will also be subject to a final comprehensive ALC review and decision, which typically includes a review from an ALC staff agrologist.

Should Council not authorize that this application be referred to the ALC or should the ALC deny the application (if referred by the City), the Applicant shall be required to remove the soil

and remediate the Property. The cost of remediation would be substantial and would require traffic management.

Staff have reviewed the Reclamation Plan and Agrologist's Report and are satisfied that the information provided within each report achieves the City's Farm Plan requirements.

Drainage & Geotechnical Considerations

The Applicant has provided the City a Water Management report and Geotechnical Assessment prepared by Dr. Stephen Ramsay. Dr. Ramsay has concluded that the soil placement and plans to remediate the Property "will have no adverse effects on the [Property] or on adjacent properties".

Staff have reviewed the Geotechnical Assessment, Drainage Plan and associated Drainage addendum (Attachment 2) and have no concerns at this time relative to the conclusions of the Applicant's qualified professional.

Environmental Considerations

The Property contains no designated Environmentally Sensitive Area or any Riparian Management Area.

No trees were removed prior to importation of the soil and no tree removal will be required to complete the project.

Financial Costs and Considerations for the Applicant

Due to the low volume of soil deposited on the Property, it is the opinion of staff that the financial costs of implementing the Reclamation Plan and Farm Plan will likely exceed the monies that have been generated, if any, from the importation of the soil.

As per the Soil Bylaw, should the proposal receive approval, the City will require payment from the Applicant of a non-refundable volume fee in the amount of $1,100.

Road & Traffic Considerations

As no additional soil or other material is proposed to be imported, the City will not require a traffic management plan.

Soil Deposit Permit Requirements, City Inspection and Project Oversight Protocols

The City's permit document will establish requirements to ensure the Property is remediated and Farm Plan implemented as per the recommendations of the agrologist-of-record and other associated qualified professionals.

The City would not be undertaking the typical inspection protocols as the soil has already been imported/deposited.

The agrologist-of-record will be required to provide oversight of the remediation work and provide a final report to the City indicating that the Property has been remediated to appropriate agricultural standard and that the Farm Plan has been implemented.

Security Bond

Should the proposal receive approval, the City would require that the Applicant provide a refundable security deposit in the amount of $15,000. The security deposit would be returned once the Property has been remediated and the Farm Plan implemented.

In addition to the City's security deposit, the ALC has the authority to require a performance bond to ensure that all ALC requirements are completed. The ALC bond is intended to ensure the rehabilitation of the Property in the event the project is not completed. ALC performance bonds and approved volumes from previous approvals for projects within the City are as follows:

- $25,000 – 12,000m3 (Sahota - approved August 2022)
- $41,000 – 30,300m^3 (Jiang - approved Nov 2021)
- $60,000 – 23,673m3 (Gosal - approved October 2020)
- $70,000 – 17,500m3 (Athwal - approved May 2020)
- $160,000 – 48,000m3 (City of Richmond - approved June 2017)
- $290,000 – 140,000m3 (Sixwest Holdings - approved January 2017)
- $500,000 – 102,080m3 (Sunshine Cranberry Farms - approved January 2014)

Alternatives to Council Approval

Should Council not authorize staff to refer the proposal to the ALC for their review and decision; the application will be considered to be rejected. Council may add additional recommendations for ALC consideration within a referral to the ALC.

Financial Impact

If the proposal is approved, the City will receive $1,100 in non-refundable soil volume fee revenue from the Applicant.

Conclusion

Staff recommends that the soil deposit application for 8251 No. 5 Road be authorized for referral to the ALC for the ALC to review and determine the merits of the proposal from an agricultural perspective as the Applicant has satisfied all of the City's current reporting requirements.

Mark Corrado
Director, Community Bylaws & Licencing
(604-204-8673)

Att. 1: Reclamation Plan and associated reports (rec. June 2022)
2: Drainage addendum (November 2022)

Garcha Property
8251 No. 5 Road
Richmond, BC, V6Y 2V5

A Plan to Reclaim the Soil and Develop a Blueberry Field

Prepared for:
Mr. Harry Garcha

Prepared by:

Darrell Zbeetnoff MSc, MA, MRNM, PAg, CAC

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May 22, 2022

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1.0 Introduction

Zbeetnoff Agro-Environmental Inc. was contracted by Harry Garcha , owner of 8152 No. 5 Road, Richmond, BC, V6Y 2V5, to assist in resolving the City of Richmond/BC Agricultural Land Commission (ALC) concerns related to the unauthorized placement of fill. The work has involved:

- Soils Investigation
- Hydrological investigation
- Geotechnical investigation
- Preparation of a farm plan showing how the fill may be used to promote farming on the property.

1.1 Summary of the Soils Investigation

The soils investigation was undertaken by Geoff Hughes-Games, P.Ag. The investigation noted:

- Area 1: 1720 m2 utilized by the house and driveway
- Area 2: 795 m2 overlain with imported mineral soil used for lawn and septic
- Area 3: 975 m2 of fine textured mineral fill, underlain by native peat soil
- Area 4: 790 m2 of disturbed peat and mineral fill
- Area 5: 715 m2 of native peat soil.

Overall, the soil fill used in the Areas 3 and 4 contains no appreciable amounts of foreign matter. Areas 1 and 2 comprise house and yard and are unlikely to be used for crop production. Areas 3, 4 and 5 have potential for crop production, given improvements are undertaken to provide fertility, manage water, and increase soil organic matter.

The unimproved soils are in Classes 5 to 7, improvable to Classes 2 to 4 with limitations related to wetness, undesirable soil structure, and low nutrient content (see Appendix A).

1.2 Summary of the Hydrological Investigation

This investigation was undertaken by Dr. Stephen Ramsey of Inform Pipeline Services Ltd. The hydrological investigation indicates that the inherent hydrologic concerns in the area are related to storm water and irrigation water management. At the site, however, there is no evidence of any adverse erosion or hydrological issues related to stormwater management and "… it can be concluded that the existing and proposed fill has a negligible effect on regional drainage and that infiltration can continue to be the operative process for storm water management. In summary, the paced soil … will have no adverse effects on the subject property on adjacent properties." (see Appendix B).

1.3 Summary of the Geotechnical Investigation

This investigation was undertaken by Dr. Stephen Ramsey of Inform Pipeline Services Ltd. The geotechnical investigation indicates that the inherent geotechnical concerns in the area are related to effect of the fill on load bearing. The report notes that "(T)here will be some limited settlement of the placed soil layer due to consolidation of the underlying silty clay layer however, this will have no effect beyond the area of the placed soil and a narrow region at the edges extending less than 1m. A 1.5 m buffer surrounding the placed soil will provide adequate

spatial separation from any settlement effects. In summary, the placed soil … will have no adverse effects on the subject property on adjacent properties." (see Appendix C).

1.4 Implications for the Farm Plan

Based on the soils, hydrological and geotechnical findings, it is anticipated that soils remedial work needs to occur on site to optimize the potential for field agriculture. In particular, these remediations include:

- Excavating 30 cm of native soil out Field 5, moving the native soil to Area 3, and refilling with mineral soil from Areas 3 and 4, as required to meet grade
- Leaving a 3.5 m wide filled farm access road along the south boundary of the property in Area 3 and extending the farm road to the SW corner of the property, then along the west boundary to the NW corner, to provide all-weather access to a shed to be built in the NW corner for farm tractor, tools, and equipment.
- Salvage the peat soil in Area 4 prior to moving a portion of the mineral soil in Area 4 as base for Areas 4 and 5.
- Re-applying native and peat soils salvaged from Areas 4 and 5 to Areas 3, 4, and 5 to create a homogeneous field for crop production.

2.0 Reclamation of the Field

Remediation of the field for agriculture is anticipated to require the following:

- Relocation of previously imported mineral soil.
- Relocation of native topsoil on site.
- Drainage under the farm road to the south boundary drain, connected to the No. 5 Road ditch.

3.0 The Farm Plan

Discussions with the property owner indicated that he wants to establish agricultural production on the property. In terms of the suitability of the field for crops, it is noted:

- Creating suitable growing conditions for any crop is going to require attention to drainage, irrigation, and fertility management.
- Annual vegetable crops are likely to require more management than the owner is presently able to offer.
- A perennial crop would reduce the management component and also provide a more compatible agricultural land use with adjacent property owners.
- Blueberry crops do well under similar conditions in adjacent fields, i.e., high water table.

3.1 Land Use on the Property

The total area of the property is 4,994 m^2 (53,735 sq. ft. or 1.234 acre)

- Area 1: residence, front landscaping, and driveway = 1,719 m^2.
- Area 2: backyard and lawn = 795 m^2.
- Area 3: fill site = 975 m^2.
- Area 4: fill site with some topsoil = 790 m^2.
- Area 5: native soil = 715 m^2.

Areas 1 and 2 (2,514 m^2) will remain as non-farming uses. Areas 3, 4 and 5 (will be reclaimed for field agriculture (2,480 m^2).

3.2 Areas Required for Setbacks, Roads, and Shed

The owner has indicated that a farm access road will be required along the south boundary of the property and extending along the west boundary. The road will be set back 1.5 m from the property line and a swale will be created along the south property line to direct surface drainage to No. 5 Road. A shed for farm equipment will be erected in the NW corner of the property having a pad print of 82 m2 (including 4.5 m setback from the north property boundary).

- The total area required for setbacks, road and shed in Areas 3, 4, and 5 is estimated at 935 m2.
- The net area available for crop production is 1,545 m2 (16,621 sq. ft. or 0.382 ac).

3.3 Reclamation of Areas for Farming

The net area available for crop production is not currently field ready and filled areas need to be reclaimed. Areas 3, 4 and 5 each exhibit substantial existing soil variability that would make field management difficult if remediation is not undertaken. Moreover, a portion of the farmable area possesses no topsoil at present and would not be arable without soil remediation. Essentially, the reclamation plan would create a similar subsoil and topsoil profile in all areas of the field.

Specifically, the soil reclamation plan should consist of the following:

- Salvage the topsoil in Area 4 and 30 cm of peaty topsoil in Area 5 and stockpile on Area 2.
- Area 4 is slightly higher in elevation than Area 3 and 10 cm will be scooped off to be used to fill the depression created by peat soil salvage in Area 5 and to provide the base for the farm road in Area 5.
- Area 3 does not have topsoil and 20 cm of mineral soil should be scooped off to replace the salvaged peat in Area 5, fill depressions in Area 3, and provide the base for the farm road in Area 5.
- The above steps will result in a mineral base on which 20 cm of topsoil will be applied.
- Poultry manure and/or compost should be applied and worked into the soil after the topsoil is spread out to provide organic matter and increase fertility.

Table 1 indicates the estimated volume of material involved in the salvage, stripping, and spreading operations.

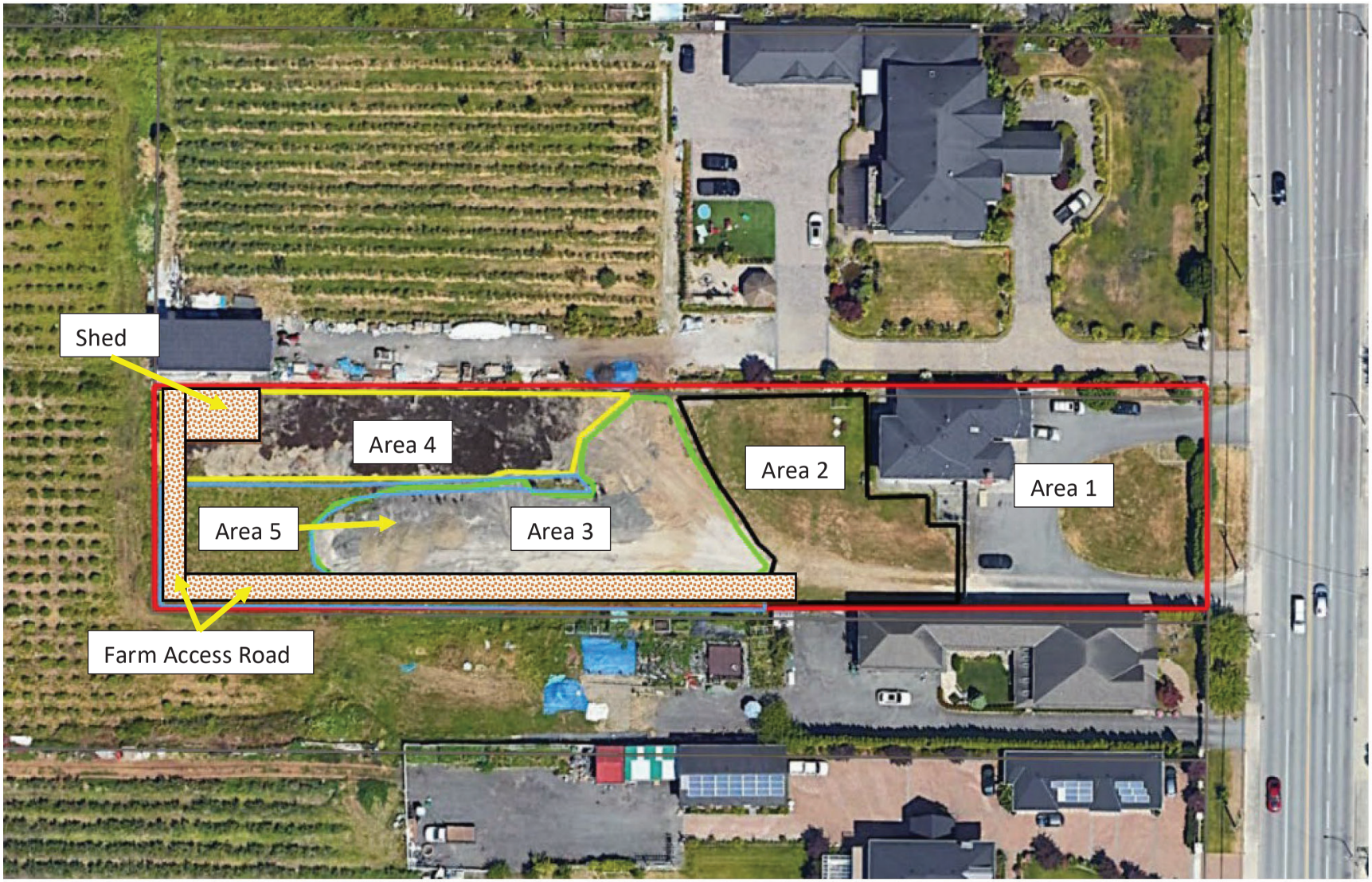


Figure 1: Location of Farm Access Road, Shed, and Areas Referred to in the Report

3.4 Field Preparation

An estimate was made of the quantity of materials needing to be moved on the property in order to create the field of production. Table 1 indicates that a total of 1,307 m3 would have to be moved:

- The amount of stripped mineral soil matches the amount needing to be spread.
- The amount of salvaged peat and topsoil matches the amount salvaged on site.

Table 1: Volume of Soil Associated with Soil Remediation for Farming

Operation	Area 3	Area 4	Area 5	Total
	Cubic meters			
Strip mineral soil	145	127	0	272
Spread mineral soil	41	0	236	277
Salvage topsoil/peat	30	158	193	381
Spread topsoil/peat	165	127	85	377
Total				1,307
Spread gravel	29	14	22	65

At a rate of $10/m3, the total cost of field reclamation including farm access road construction and a 0.1 m topping of gravel on the farm access road and shed site is estimated at about $13,000.

3.5 Blueberry Budget

3.5.1 Blueberry Establishment

The costs of blueberry establishment have risen significantly in the past 3 years due plant supply shortages (Table 2).

Table 2: Per Acre Blueberry Establishment Costs

Cost Item	2022 $
Field preparation	$1,900
Plants	$12,000
Planting labour	$1,300
Irrigation	$2,500
Sawdust	$1,600
Total	$19,300

3.5.2 Cost of Bringing the Crop to Maturity

Table 3 presents a per acre budget showing costs of installing the orchard and bringing the crop to maturity. In general, blueberries attain maturity about 10 years after planting. Yields are highly dependent on management with yields ranging between low (<10,000 lbs/ac) to high (>16,000 lbs/ac). For budgeting purposes, a low estimate of crop yield has bene used.

Pricing is dependent on marketing plan. The property owner indicates that he will run a U-pick operation. This approach could work and pricing could be in the range of $2.50/lb. However, it is anticipated that it would be difficult to market the whole crop in this fashion and that about 20% would be left in the field, unless discounted U-picking could be employed to complete the harvest. The prospect of machine harvesting is considered remote, given the small acreage involved and difficulty in attracting custom harvesting.

Table 3: Per Acre Contribution Margins Associated with New Crop Establishment

Year	Year from 2022	Replant Maturation Schedule	Yield (lbs./ac)	Gross Revenues	Direct Expenses	Expected Contribution Margin
2023	1	Plant	0	$0	$0	$0
2024	2	No Production	0	$0	$1,215	-$1,215
2025	3	No Production	0	$0	$5,236	-$5,236
2026	4	Immature Production	538	$1,185	$6,932	-$5,747
2027	5	Immature Production	2,615	$5,754	$7,597	-$1,843
2028	6	Immature Production	4,769	$10,492	$8,161	$2,331
2029	7	Immature Production	6,346	$13,962	$8,550	$5,412
2030	8	Immature Production	8,077	$17,769	$9,000	$8,769
2031	9	Immature Production	9,231	$20,308	$9,450	$10,858
2032	10	Full Production	10,000	$22,000	$9,450	$12,550

3.5.3 Putting it All Together

A grower needs to incur various costs prior to realizing a return on investment. The costs in the first years of production are soil reclamation and crop establishment. Yields and revenues will start about Year 4 and increase to maturity in Year 10. Table 4 indicates the value of costs and revenues over this period and the number of years until the grower can realize a return on investment.

Table 4: Estimated Per Acre Costs and Returns Associated with Blueberry Production

Year	Replant Maturation Schedule	Plant Establishment	Contribution Margin	Annual Loss/Return	Cumulative Position (nominal $)
2023	Plant	$19,300	$0	-$19,300	-19,300
2024	No Production		-$1,215	-$1,215	-20,515
2025	No Production		-$5,236	-$5,236	-25,751
2026	Immature Production		-$5,747	-$5,747	-31,498
2027	Immature Production		-$1,843	-$1,843	-33,341
2028	Immature Production		$2,331	$2,331	-31,010
2029	Immature Production		$5,412	$5,412	-25,598
2030	Immature Production		$8,769	$8,769	-16,829
2031	Immature Production		$10,858	$10,858	-5,971
2032	Full Production		$12,550	$12,550	6,579

As Table 4 indicates, the farm will start generating a positive contribution margin[1] in 2028. By 2032, when mature yields may be expected, the farm development costs will have been paid off (not including interest costs if the money is borrowed). Thereafter, the crop would be anticipated to be capable of generating an annual return of about $12,550 under good management.

3.5.4 Establishing Blueberries on the Garcha Property

The productive area of the Garcha property has been estimated at 0.382 acres. Table 5 shows that schedule of costs and returns associated with that field size. The field will begin to generate a positive contribution margin in 2028. However, soil reclamation costs will not be paid off until about 2035 and thereafter, the field will generate a contribution margin of about $4,800 per year.

Table 5: Estimated Costs and Returns Associated with Blueberry Production on the Garcha Property

Year	Replant Maturation Schedule	Soil Reclamation	Plant Establishment	Contribution Margin	Annual Loss/Return	Cumulative Position (nominal $)
2022	Soil Reclamation	$13,000			-$13,000	-$13,000
2023	Plant		$7,373	$0	-$20,373	-$20,373
2024	No Production			-$464	-$20,837	-$20,837
2025	No Production			-$2,000	-$22,837	-$22,837
2026	Immature Production			-$2,195	-$25,032	-$25,032
2027	Immature Production			-$704	-$25,736	-$25,736
2028	Immature Production			$890	-$24,846	-$24,846
2029	Immature Production			$2,067	-$22,778	-$22,778
2030	Immature Production			$3,350	-$19,429	-$19,429
2031	Immature Production			$4,148	-$15,281	-$15,281
2032	Full Production			$4,794	-$10,487	-$10,487

4.0 Field Improvements

Blueberry production will require fertility, drainage, and irrigation improvements to the field

4.1 Soil Fertility

The salvaged peat/topsoil from the property is low in nutrients. Soil testing should be employed to ensure that soil fertility is suitable for blueberries, especially with respect to pH (ideally less than 6.0) and salt content.

If compost application is considered, the chemical characteristics of the compost should be known before deciding how much compost to apply. Manure composts tend to have low carbon-to-nitrogen ratio (C:N<12) and high salt, nitrogen (N), and potassium (K) content, which

[1] Contribution margin is gross revenues minus direct costs of production and does not include returns to management or depreciation.

make them generally unsuitable for blueberries. The compost should be spread on the field and worked into the subsoil prior to field preparation for planting.

Sawdust is spread as a thick mulch on the hilled rows after planting to suppress weeds, keep roots moist in summer, and provide an organic layer that feeds the plants as it decomposes over time.

4.2 Drainage

At this time, it appears that the amount of mineral soil on the site is just adequate to meet the mineral soil needs for reclamation of the land. The amount of salvaged peat/topsoil is also just adequate to meet the topsoil needs. However, the final elevation of the reclaimed field within the confines of the farm access road may be slightly lower than the farm access road.[2] It is advisable to install drains under the farm access road to allow the flow of surface stormwater to the swale along the south boundary and out to the No. 5 Road municipal ditch.

The water table on the property is also high. Blueberry rows should be hilled prior to planting to provide a rooting zone above the water table.

4.3 Irrigation

The blueberry establishment budget provides for the installation of drip irrigation to the plants. The water supply would be from the municipal water system.

[2] The peaty soil will decompose when exposed to air and the field will subside over time.

Appendices

- Appendix A: Soils Investigation
- Appendix B: Hydrology Investigation
- Appendix C: Geotechnical Investigation

Agrologists Report

8251 No 5 Rd, Richmond BC

April 26, 2022

Prepared by:

G Hughes-Games, PAg Soil Specialist / Senior Agrologist
Abbotsford, BC

Prepared For:

Mr Harry Garcha

8521 No 5 Road

Richmond BC V#X #x#

Summary

Geoff Hughes-Games was requested by Darrell Zbeetnoff, Zbeetnoff Agro-Environmental Inc. on behalf of Mr. Harry Garcha to investigate and prepare an soils and agricultural capability assessment for 8251 No 5 Road, Richmond, BC. This report highlights the mapped soils and agricultural capability. It provides a summary of the findings of a site visit on March 10, 2022. That site visit included examination of soils, landscape and inventory of current activities on the property. It also included discussions with landowner regarding proposed or potential agricultural activities.

A review of those findings is presented in relation soil and non-soil bound agricultural use, including some suggestion soil management activities related to water and nutrients.

The report is intended to assistance in resolving the City of Richmond/BC Agricultural Land Commission (ALC) concerns related to the unauthorized placement of fill, as such there are some suggested actions provided.

The total parcel area is approximately 0.5 ha of which rough 50% is available for crop production. The remaining 50% is covered by residential footprint. With the possible cropping area three distinct native soil/fill areas are present. ~0.07 ha of peat soil remains relatively undisturbed. ~ 0.18 ha of land is covered with fill to a maximum depth of 0.75 m. Total fill volume is estimated at 1065 m^2 of mineral material and 240 m^3 of peat. The filled areas could be cropped with inputs of organic matter, nutrients and water management system.

Limitations

This report was prepared by Geoff Hughes-Games, PAg. I am a Professional Agrologist registered with the BC Institute of Agrologists (member #616). My areas of expertise include soil science, including classification and management as well as agriculture environmental risk assessment. I am not trained as a climatologist, biologist or land use planner and as such, any comments in this report related what maybe defined as climatology, vegetation, land use planning are restricted solely to my expertise in soil classification and management for agricultural purposes.

Contents

Subject Property

CIVIC ADDRESS:	8521 No. 5 Road, Richmond, BC
LEGAL:	LOT 25 SEC 24 BLK 4N RG 6W PL NWP41716 Lot 25, Block 4N, Plan NWP41716, Section 24, Range 6W, New Westminster Land District
PID:	003-898-741
Size:	4,994 m^2 (1.23 Ac)
Zoning:	AG1
ALR:	Yes

Scope

The site visit and review of available mapping resources was intended to Investigation of soil and drainage conditions at the **subject property**. The report was to include a desktop review of available soil, agricultural capability and landscape mapping and available historic aerial imagery. Including review of zoning and bylaws related to agricultural land use of the subject property.

The on-site investigation of existing soils on the property to be based on ALC P-10 Policy (Criteria for Agricultural Capability Assessments[1]). This was to include a review of areas that are "undisturbed" and areas that have been disturbed by human activity. The criteria require soil pit and auger hole descriptions as well as general landscape descriptions. The investigation was to primarily focus on soil-based agricultural activities. Soil samples were to be taken from areas that could be used for soil based agriculture for fertility analysis.

A review of the agricultural capability and soil/landscape drainage was to be completed. The report was to provide recommendation for drainage and capability improvements related to soil based agriculture.

A review of any rationale to support improvements for soil (or non-based) agriculture. General comments on agricultural-environmental risks on the property will be included as appropriate.

Active Regulatory Items

The above noted property is the subject of enforcement action by the City of Richmond related to unauthorized placement of soil fill. Reference: *CD 130242 (ALC C & E file: 52424) - COR Soil deposit application requirements - 8251 No. 5 Rd – Correspondence January 21, 2022, Mike Morin, CoR Soil Bylaw Officer to Mr. H. Garcha.*

[1] ALC - CRITERIA FOR AGRICULTURAL CAPABILITY ASSESSMENTS Policy P-10 October 2017 https://www.alc.gov.bc.ca/assets/alc/assets/legislation-and-regulation/policies/alc_-_policy_p-10_-_criteria_for_agricultural_capability_assessments.pdf

Desktop Assessment

A desk top assessment of available soil, agricultural capability, terrain and climate and zoning information was completed for the property. The results of that assessment are summarized in the following sections.

Soils Mapping

The following available soil mapping was reviewed:

- **British Columbia Soil Information Finder Tool (BC SIFT)**[2]
- Report reference from **Soils of the Langley-Vancouver Map Area, BC Soil Survey Report 15, 1980 (RAB Bulletin 18) Volumes 2, 3 and 6.**[3]

This mapping (Figure 1) indicated the presence of two soil series (Lumbum (L), and Triggs (T). on the assessed parcel. These are primarily developed on nearly level deep organic deposits at least 160 cm thick over moderately fine to fine textured Fraser River and deltaic deposits. A summary of the mapped soils series is provided below.

Figure 1 Mapped soil polygons

[2] https://www2.gov.bc.ca/gov/content/environment/air-land-water/land/soil/soil-information-finder

[3] https://sis.agr.gc.ca/cansis/publications/surveys/bc/bc15/index.html

Table 1 Mapped Soil Series

Soil Series name (% of map polygon)	Classification	Description	Map Label
Lumbum (LM) 70%	Typic Mesisol	These soils developed on deep partially decomposed organic material between 0.4 and 2 m in depth overlying moderately fine-textured deltaic mineral deposits. Upper layers are often humic as a result of cultivation while lower layers range from fibric to mesic. The soil is poorly drained, has a high water and nutrient-holding capacity and is relatively infertile and acidic in its natural state. Decomposition and subsidence will be accelerated by drainage and cultivation. Nearly level to very gently undulating slopes (less than 2% slopes). Developed under a range of plants including birch, share pine, western red cedar, western hemlock, red alder, Labrador tea, salal, sedges and mosses.	***LM - TR*** ***a***
Triggs (TR) 30%	Orthic Humo-ferric Podzol	These soils have developed on deep undecomposed organic deposits at least 2 meters thick. Mainly sphagnum and other mosses. The underlying mineral deposits are usually medium or moderately fine textured Fraser River deltaic or floodplain sediments. These soils are very poorly drained with water tables at or near the surface except when influenced by drainage activities. These soils are typically extremely acidic. Slopes are nearly level except where either depressions of domes have formed from peat vegetation growth and decay. Gradients are usually under 2%. Developed mainly under birch, stunted lodgepole pine, hardhack, Labrador tea, blueberry, cranberry, bracken and with sphagnum and other mosses on the ground surface.	
Landform:	*Organic deposits over moderately fine to fine textured Fraser River deltaic or floodplain deposits*		
Topography:	***a*** = nearly level complex slopes ranging up to 0.5%		
Data source: *BC SIFT and Soil Survey Report 15 Volume 3*			

Climatic Data

The property lies within the Moist Maritime Coastal Douglas-fir biogeoclimatic subzone (CDFmm[4]. This a warm summer oceanic climate zone. Characterized by mild wet winters and moderate dry summers. The annual precipitation is just under 1200 mm with over 70% of this falling primarily as rain during November and March. Mean annual temperature is 10.4 °C with winter temperatures averaging above 3 °C and summer temperatures averaging below 18 °C. A long frost free period and high growing degree days make for favourable growing conditions. Heavy winter rains and dry summers lead to the need for water management systems that include drainage infrastructure for winter and irrigation for summer months.

[4] https://www.for.gov.bc.ca/ftp/HRE/external/!publish/becmaps/PaperMaps/field/DCK_ChilliwackResourceDistrict_SouthCoastRegion__field.pdf and https://www.for.gov.bc.ca/hfd/pubs/Docs/Lmh/Lmh28/lmh28-01.pdf

Weather data is available a station at Vancouver International Airport, (Environment and Climate Change Canada (ECCC)) approximately 7.5 km northwest and ~1 m higher in elevation.

Table 2 Climate Normal Information

Climate Normal 1981-2010 (source: ECCC)													
STATION NAME: Vancouver International Airport[5]						**CLIMATE ID:** 1108447							
LATITUDE	49°11'42.000"N			**LONGITUDE**		123°10'55.000" W				**ELEVATION**		4.3 m	
	Jan	*Feb*	*Mar*	*Apr*	*May*	*Jun*	*Jul*	*Aug*	*Sep*	*Oct*	*Nov*	*Dec*	*Year*
Temperature (°C)													
Daily Average	4.1	4.9	6.9	9.4	12.8	15.7	18.0	18.0	14.9	10.3	6.3	3.6	10.4
Daily Maximum	6.9	8.2	10.3	13.2	16.7	19.6	22.2	22.2	18.9	13.5	9.2	6.3	13.9
Daily Minimum	1.4	1.6	3.4	5.6	8.8	11.7	13.7	13.8	10.8	7.09	3.5	0.8	6.8
Precipitation													
Rainfall (mm)	157.5	98.9	111.8	88.1	65.0	53.8	35.6	36.7	50.9	120.7	185.8	148.3	1152.8
Snowfall (cm)	11.1	6.3	2.3	0.3	0	0	0	0	0	0.1	3.2	14.8	38.1
Precipitation (mm)	168.4	104.6	113.9	88.5	65.0	53.8	35.6	36.7	50.9	120.8	188.9	161.9	1189.0

Climate Normal (source: BC SIFT)	
Frost free period (days)	247
Degree days above 5 °C (days)	2273

Projected Changes in Climate

Some insights as to the projected changes in climate and the impacts of those changes. The source is the data and modelling completed by the Pacific Climate Consortium. The table below summarizes the potential changes to temperature and precipitation in the Greater Vancouver Region. Overall (for the period 2010 to 2039) temperatures and growing degree days are expected to increase while and annual precipitation, winter snowfall and heating degree days will decline.

These changes in precipitation and temperature may result in moderate changes to the types of crops that can be grown and the availability of water for late season irrigation. Reductions in annual precipitation will not reduce the need for a drainage system as winter precipitation is expected to stay the same with the risk of more intense rainfall events. Drier and warmer summers will result in a greater need for irrigation or careful soil water management such as the judicious use of mulch and cover crops. Variability and number of extreme weather events will likely occur, and this will drive the need for more careful management of soil cover to reduce soil and nutrient run-off losses.

[5] Canadian Climate Normals 1981-2010 Station Data - Climate - Environment and Climate Change Canada (weather.gc.ca)

Table 3 Projected Climate Change Impacts

Climate Variable	Season	Projected Change from 1961-1990 Baseline for period 2010-2039	
		Median Greater Vancouver	**Range** (10^{th} to 90^{th} percentile)
Temperature* (°C)	Annual	+1.6 °C	+1.2 °C to +2.1 °C
Precipitation (%)	Annual	-2.0%	-4.9% to +1.4%
	Summer	-12.0%	-30% to +0.38%
	Winter	+0.22%	-4.5% to +7.3%
Snowfall* (%)	Annual	-56%	-64% to -43%
	Winter	-56%	-68% to -42%
	Spring	-36%	-63% to -13%
Growing Degree-Days* (degree days) >5 °C	Annual	+436 degree days	+289 to +568 degree-days
Heating Degree-Days* (degree days) >18 °C	Annual	-515 degree days	-687 to -411 degree-days
Frost-Free Days* (days)	Annual	+29 days	+23 to +35 days
Pacific Climate Consortium – projected changes in temperature and precipitation PLAN2ADAPT – 2020s (2010 to 2039) https://services.pacificclimate.org/plan2adapt/app/ * These values are derived from temperature and/or precipitation.			

Agricultural Capability

Table 4 provides an indication of the mapped agricultural capability ratings for the subject property. There is one capability polygon covering the property. It has two ratings which relate directly to the two mapped soil series. The lower capability classifications are linked to the Triggs soil series.

Table 4 Mapped Agricultural Capability

Mapped Agriculture Capability (source: BCSIFT)	
Capability Class (CC) Label Class	7:O4W~3:O5WF **Class O4** = land has more severe limitations that require reduce the range of crops and require special management practices or inputs **Class O5** = land has limitations that restrict its capability to producing only perennial forage crops or other specially adapted crops
Improved Class (IC) Label Class	[7:O2W~3:O3LWF] **Class O2** = land has minor limitations that would require on going management practices in order to achieve good crop growth for a range of crops **Class O3** = land has limitations that require moderately intensive management practises or moderately restrict the range of crops, or both
Limitations (subclass):	**W** = excess soil moisture due to highwater table or seepage/runoff (improvable with drainage) **F** = low fertility due to soil characteristics (acidic and low cation exchange capacity) **L** = degree of decomposition affects the movement of water into, through and out of the soil layers

Figure 2 Agricultural Capability Classification (unimproved and [improved])

Site Visit Results

A site visit was carried out on March 10th, 2022. Weather conditions on that day were ideal for soil pit installation, with a mix of sun and cloud, light winds and temperatures around 5°C. Precipitation in the preceding 5 days (~0.3 mm) and preceding 10 days (~8.7 mm). The preceding month of February ~60 mm of precipitation had fallen.

This low level of rainfall would not have contributed to the level of high soil moisture on the site. However, it would provide an indication for the potential drainage issues.

Overall Site Observations

The subject parcel is approximately 1.5 acres (0.5 ha). Site observations and a review of most recent aerial imagery (Google Earth) indicated the presence of various structures including, a single family house, U shaped driveway, lawns and other residential landscape features on the eastern half of the parcel. The eastern half of the parcel also appears to have a different soil (based on vegetation, elevation and colour) than the vegetated area in the rear half of the parcel. This is portion was likely filled by previous landowners as the home site was developed. The current owner indicated a septic tank and field were located in the leveled lawn area west of the house.

Images from 2004 and 2009 (Google Earth), as well as observations made on March 10th, provided some indication that the western half of the parcel had been previously cleared and may have been historically used for blueberry farming. Figure 3 shows two cropped areas on west half (outlined in green and yellow). There was little evidence of this crop other than possible mowed root wads in the most westerly part of the parcel at the time of the site visit.

Figure 3 March 2004 – previous crop areas, residence structures and historic fill on east half

Site conditions March 10th, 2022

As noted above the site had variable levels of moisture due to rainfall, soils and topography. Water was ponded in a couple of locations, but for the most part the surface was 'dry'. Water was present in the soil profile – see soil pit descriptions.

At the time of the site visit the following structures or items were observed. These are noted in Figure 4 as an overlay on the 2021 Google Earth Image.

Parcel boundary (PID) outlined in red.

Area	Outline colour	Description	Size (m^2)
1		house/driveway - historic fill/solid surface – based on historic aerial imagery	1,720
2	black	back yard/lawn/septic field – historic mineral fill – based on surface observation	795
3	pale green	mineral fill mainly glacial till - mixed silts and some gravels and underlain by native peat	975
4	yellow	disturbed fibrous peat over sandy gravelly fill	790
5	pale blue	native peat	715
		Total	4,995

Figure 4 Delineated areas of disturbance

Discussion of Observed Site Conditions/Structures

Area 1 – House and driveway – based on elevation in relation to 5 Road and rear of property (as well as old topographic survey supplied by landowner) this appears has a historic fill pad present. Covers approximately 1,720 m^2.

Area 2 – Lawn/Septic field. This area was elevated above what appeared to be the original site elevation (preconstruction). Area slopes west and south away from house. Exposed soil patches indicate it is mineral soil. Covers about 795 m^2 of parcel.

Area 3 – Mineral Fill. Moderately fine to fine textured mineral fill covering approximately 975 m^2 ranging in depth from 20 to 75 cm. Dense compacted soil with little if any vegetation. Rare evidence of construction debris (less than 1%) including small pieces of brick and glass. No evidence of other foreign matter. Some coarse fragments ranging from gravel to small stones on surface (less than 1%). Generally, level with abrupt edges on fill pad. Underlain by relatively undisturbed native peat soil.

Area 4 – Disturbed peat/Mineral Fill. This area contains disturbed peat placed over mineral fill covering approximately 790 m^2. Peat ranged in depth from 15 to 40 cm. Underlying mineral soil was coarse to moderately fine textured with some coarse fragments. No evidence of foreign matter. Very little vegetation with some remnants of roots, likely from vegetation at source of peat. Slightly hummocky surface but generally level. Abrupt edge on southern boundary of area and adjoins filled/disturbed soils on adjacent farm to north. Some ponded water in area separating Area 3 and Area 4.

Area 5 – Native peat soil. This area is relatively undisturbed native peat soil. Area was about 715 m^2. Recently mowed (brushed) vegetative cover. Remnants of birch, hard hack, fireweed, blackberry and blueberry vegetation as well as moss and woody chip residue on surface. Level area except thin slivers on north and south of Area 3, which were hummocky due to disturbance from older soil movement. No standing water evident and this soil appears to extend west and south into adjacent properties with slight difference in elevation (less than 20 cm) resulting from different soil management on each parcel.

Source(s) of fill materials was unknown. Mineral materials appeared to glacial marine and glacial fluvial till based on colours, texture, and size/shape of coarse fragments.

Surrounding Land Uses

The adjacent parcels have a variety of agricultural land uses. Most area mixture of residential with soil bound crop production of various forms.

East (across No. 5 Road) – mixed educational/religious with portions of land used for market gardens

South – residential, with underutilized garden/some unpruned blueberries (Note: some evidence of filling prior to 2014). The second lot south is an active blueberry farm with a fill farm road on its northern parcel boundary.

West – blueberry planting, very old plants, with grass cover between rows, low intensity management

North – residential with mixed use, small portion covered with landscape construct materials/machines, larger area of young blueberry plants – actively managed and remainder as residential home plate. (Note Google Earth historic Imagery indicates this parcel was completely covered in fill beginning around 2008 and completed in 2012.)

Soils

Three soil pits were installed, one with the assistance of a bobcat loader the other two were shovel/auger dug.

Details of field observations for each location are indicated in Appendix 1.

Soil Pit 1 west

Shovel/auger pit located on a level area at the western end of the parcel in mowed brush. A thick root matt contained well decomposed Humic materials overlying less decomposed peat. Three distinct layers were noted within 100 cm of the surface. No coarse fragments or apparent mineral lenses were observed. Shallow groundwater at about 20 cm depth. No surface ponding was observed in the immediate are of the soil pit however there was some limited ponding on other areas that did not have fill placed. Abundant roots in upper layers.

Soil Pit 2 center south

Pit located in near the center and what appear to be highest point of the mineral fill pad. Upper 60 cm excavated with Bobcat loader and remainder dug with shovel. Upper 75 cm contained at least two distinct layers of mineral fill. The upper 35 cm was a silty glacial or glacial marine till with about 25% fine gravelly coarse fragments (CF). Lower 40 cm was more of mix of till and gravelly outwash materials. This

layer contained greater than 40% CF ranging up to rounded or subrounded small cobbles (< 15 cm). This second layer was very wet, with a water table at about 70 cm. The native peat soils underlay this mineral fill at about 75 cm depth. The fill layer tapered to less than 20 cm at its outer extent.

Soil Pit 3 center north

Pit located in the center of the fill pad area on the norther part of the parcel. This area had loose disturbed peat spread over mineral fill. The source of peat was unknown although it appeared to be similar to the deeper peat layers in Pit 1. The peat layer was observed to be about 40 cm in thickness. This over lay greater than 75 cm of mineral fill. The upper 20 cm of mineral soil was sandy gravelly and loose material with about 30% CF ranging up to rounded small cobbles (~15 cm). The lower mineral layer was sandy loam with some fine gravels (10% CF) less than 5 cm. No water table was observed although the moisture level at 120 cm was near saturation.

Review of Soil Survey and Agricultural Capability Assessment

As noted above, the soil survey mapping indicated the potential presence of two soil series. From the pit observations it appears only one series was present prior to the fill placement. In addition, two anthropogenic soils are present on the property. Pit 1 (west) appeared to fit the Lumbum (LM) soil series. Pit 2 (center south) was primarily mineral fill derived from glacial till and outwash over native peat. Pit 3 (center north) was disturbed peat overlying sandy gravelly outwash fill.

The pits 1 and 2 indicated poor or very poor drainage with high water tables. Pit 1 had a water table within 20 cm of the surface. In Pit 2 the lower 15 cm of mineral fill was fully saturated although the free water table was observed to settle at about 5 cm above the mineral – peat interface. There was no observed water table with the upper 120 cm of Pit 3 although the soil was very moist.

Mapping indicates the subject property is primarily Class 4 due to excessive moisture. It is improvable to primarily Class 2 with adequate subsurface drainage control. Again, with limitations due to excess moisture. Minor areas with limitations due to lower fertility and degree of decomposition of the peat are mapped. These were observed in Pit 1. Excess water limitations can generally be overcome by 'standard' water management activities such drainage or use of raised planting beds.

These Classes and limitations were confirmed in Pit 1 based on presence of water table. Pits 2 exhibited low CE and low organic matter in topsoil, these along with marginal nutrient levels would indicate a fertility (F) limitation. Pit 2 was a dense mineral soil with coarse fragments and limited rooting – indicating undesirable soil structure limitations.

Suggestions on the range of suited crops and how these soils series can be managed are detailed in the Soil Management Handbook for the Fraser Valley. Excerpts pretraining to these soils can be found in Appendix 5. There are no well suited crops, however, there are a wide range of suited crops. Inputs such as lime, fertilizer, water management and organic matter incorporation are recommended.

Review of Soil Nutrient Test Results

Grab samples of topsoil and subsoil from each of the three pits were collected for analysis. Lab results are found in Appendix 4 and summarized below. In general, topsoil layers are deficient in macro

nutrients (N, P, K) and optimal for most micronutrients. Soil pH in the topsoil of pits 1 and 3 were 5.2 or lower – indicating very acidic conditions typical of organic soils of the region. The mineral soil of pit 2 was slightly acidic as well. Organic matter contents were above 80% in pit 1 indicating a true organic soil. Pit 2 had very low organic matter and very low Cation exchange capacity (CEC) 9.8 meq/100g in topsoil layer indicating it was likely a subsoil. The soils are non-saline (EC less than 1 dS/m). Lab test of pit 2 confirmed the surface texture as loam (51% sand, 34% silt 15% clay).

Table 5 Table 6 Summary of Soil Test Results

Parameter	Location	Pit 1 – West		Pit 2 – Center		Pit 3 – East	
		topsoil	subsoil	'topsoil'	subsoil	topsoil	subsoil
		peat	peat	mineral	mineral	peat	mineral
Sample # 79668 -		-51	-52	-53	-54	-55	-56
Report # 2727 -		-591	-600	-592	-601	-593	-602
pH		5.2	4.3	6.6	6.4	4.9	6.0
EC	dS/m	0.2	0.29	0.2	0.26	0.1	0.2
OM	%	81.9	82.1	2.1	0.9	45.6	5.1
Nitrate-Nitrogen (N)	ppm	<2	<2	<2	<2	<2	<2
Phosphorus (P)	ppm	7	<5	11	25	11	14
Potassium (K)	ppm	58	30	57	82	<25	52
Sulfate-Sulfur (S)	ppm	20	27	18	46	10	14
Calcium (Ca)	ppm	1690	385	1080	580	695	948
Magnesium (Mg)	ppm	163	104	202	73	101	185
Iron (Fe)	ppm	198	53.3	112	31	139	275
Copper (Cu)	ppm	11	1	2.0	0.5	2	1.6
Zinc (Zn)	ppm	28	<5	1	<0.5	2	1
Boron (B)	ppm	1	<1	0.3	0.1	<1	0.3
Manganese (Mn)	ppm	13	2.3	7.2	23.5	11	26.8
Chlorine (Cl)	ppm	13	16	7.1	6.6	503	8.9
CEC	meq/110g	70.6	133	9.8	3.9	62.5	19.3

Deficient	*Marginal*	*Optimum*	*Excess*

Note: Colour codes are based on nutrient levels on lab results.

Although the lab results indicate optimal soil nutrient levels for most secondary nutrients in the upper soil layers, all pits indicated a deficiency in N, P and K. Pit 2 indicates deficiency of most nutrients, an acidic pH and very low organic matter – a very infertile soil.

Mapped Vs Observed Capability

Only the portion of the parcel that might be farmed and is impacted by recent fill will be reviewed.

Area	Mapped Capability	Observed/Proposed Capability	Improvable to
3 – Mineral Fill	7:O4W~3:O5WF	3DWF	3DW
4 – Disturbed peat over mineral fill	7:O4W~3:O5WF	3FP	2F
5 Native Peat	7:O4W~3:O5WF	O4W	04WF

Drainage

A topographic survey was not conducted as part of the agrologist site visit. General observations were:

- Buried pipe inlet near southwest corner of back lawn (Area 2) which owner understood was connected to storm drainage on No 5 Rd. (See Figure 5)
- Shallow swale/partially filled ditch on southern parcel boundary and no other drainage channels elsewhere on parcel (see Figures 6 and 7)
- Slight differences in elevation between subject property and adjacent lands to west and south (likely caused by historic land/soil management) but did not appear to be likely to impact water flow on or off the parcel
- Parcel to north was elevated by at least 30 cm (appears to be fill – historic imagery/observation from parcel
- Some minor surface ponding on water between Areas 3 and 4 (water could be trapped between the two fill pads)
- No subsurface drainage infrastructure (like Big-O) was observed or reported in Areas 3, 4 and 5.

Landscape and soil conditions would generally indicate that the parcel should be considered to be poorly drained.

Figure 5 Surface Inlet to storm drain (looking west along southern parcel boundary at SW corner of Lawn area

Figure 6 South Parcel boundary looking east

Figure 7 West property boundary looking north

Fill Character Summary

The table below summarizes the type, quality, volume and usefulness of the pre existing soils, and pre existing fill.

Area	3- Mineral Fill	4- Disturbed Peat/Mineral Fill	5- Native Peat
Area (m^2)	975	790	715
Depth range (cm)	20 to 75	Peat 20 to 40 Mineral up to 75	> 90
Volume estimate (m^3)	~465	Peat ~240 Mineral ~600	N/A
Source	Unknown – local geologic overburden glacial marine/glacial fluvial till	Unknown – local well decomposed peat and local geologic overburden glacial fluvial till	In situ – native peat
Quality	Poor – moderate fine gravely, loam matrix, low organic matter, imperfect to poor drainage, dense and compacted	Moderate – well decomposed acidic peat over sandy gravelly till, moderately well drained	Moderate – well decomposed, poorly drained
Usefulness for crop production	Low capability due to texture, low organic matter and compaction	Moderate capability	Low capability

Options to Improve Possible Cropping Areas.

Table below provides options for improve potential for cropping the three defined areas observed during the March 10th site visit.

Area	3- Mineral Fill	4- Disturbed Peat/Mineral Fill	5- Native Peat
Required amendments of practices	Requires incorporation of organic matter, pH modification and nutrient application as well as appropriate tillage, drainage and irrigation practices	Requires cover cropping and possibly irrigation to prevent subsidence of peat. Will require nutrient application.	Requires water control (drainage and irrigation) – limited range of crops. Careful nutrient application and cover cropping to maintain peat soils.
Additional fill or other soil materials required	Yes - as above, addition and incorporation of organic matter Existing mineral fill should be regraded to extend and square off south edge within 4 m of to parcel boundary allowing for gradual slope and drainage swale running east to storm drain inlet. West could be squared off as outlined in purple on Figure 8 No additional fill would be required.	Yes, some additional peat may be required at the west end to create a uniform layer at a similar depth the remainder of this area (~ 25 m^3)	No, unless this remnant area is filled to level it with Areas 3 and 4. Some of peat could be salvaged for incorporation into the previously imported fill. Volume of mineral soil required ~300 m^3. (Outlined in orange on Figure 8)

Figure 8 Fill areas requiring alteration (grading and/or more fill)

Appendix 1 – Field Notes and Soil Pit Descriptions from Site Visit March 10, 2022

Depth	Horizon	Texture	Apparent Parent material	Colour	Structure	Roots	Coarse Fragments	CF (%)	Description
Pit 1 West (49.153334 N, 123.093997 W)									
2 - 0	LFH		Forest floor			abundant	Stone free		Woody residue, brushed stumps of birch, hardhack, blueberry, black berry. Fireweed and moss.
0 - 35	Oh	Von post 6/7	peat	black	Fibrous	many	Stone free		Water table present at about 20 cm. Moderately well decomposed
35 - 90	Om	Von post 3/4	peat	red brown	Very fibrous	few	Stone free		Weakly decomposed
90+	Oh	Von post 1/2	peat	dark brown	Mushy	very few	Stone free		
Pit 2 center south (49.153345 N, -123.093561 W)									
0 – 35	C_1	Loam	glacial-marine	Layer with colours of 10YR3/3 – 10YR4/1 – 10YR 2/1	Massive to SBK	Very few	Fine gravels	<25%	Mixed layers – upper 12 cm sandy, 12- 25 silty clay, 25- 35 silty with some humic materials. Layers not separated as other faces of pit where highly variable in relation to described face. Very firm consistence. Little if any vegetation.
35 - 75	C_2	Loam	glacial-fluvial	10YR 4/1	Massive to SBK	none	gravelly	~40 %	Saturated in lower 5 cm) Very firm consistence.
75 +	Oh	Von post 4/5	peat	red brown		none	Stone free		Water table rising above this layer – water weak tea colour when undisturbed.
Pit 3 center north (49.1535 N, -123.09346 W)									
0 - 40	Oh	Von post 6/7	peat	red brown/black - mixed		few	Stone free		Few seedling weeds. Remnant roots. Hummocky surface – machine spread peat. No ponded

Depth	Horizon	Texture	Apparent Parent material	Colour	Structure	Roots	Coarse Fragments	CF (%)	Description
									surface water
40 - 60	C_1	Sandy loam	glacial-fluvial	10YR4/4	SBK	none	gravelly	<40%	CF up to 25 cm most less than 2.5 cm
60 - >115	C_2	Loamy sand	glacial-fluvial	510YR2/1	Single grained - SBK	none	Slightly gravelly	<10%	No water table although higher moisture level nearing saturation at 115 cm

Appendix 2 – Photos of Soil Pits and Adjacent Landscapes

Figure 9 Soil Pit 1 West

Figure 10 Oh (topsoil) horizon Pit 1

Figure 11 Pit 1 - landscape looking east

Figure 12 Pit 2 center south

Figure 13 Landscape - Pit 2 looking east

Figure 14 Pit 3 Center north

Figure 15 Pit 3 - mineral fill (left) in contrast with peat fill (right)

Figure 16 Landscape looking north towards pit 3

LUMBUM SOIL MANAGEMENT GROUP

General Characteristics

This group occupies 12,700 ha on the lowlands of Delta, Richmond and Surrey Municipalities, in the Big Bend area of Burnaby, in Glen Valley, Matsqui Prairie and in the Pitt Meadows, Pitt Polder and Port Coquitlam areas. The soil is partially to well decomposed organic material between 0.4 and 2 m in depth overlying moderately fine-textured mineral deposits. The group is poorly drained, has a high water and nutrient-holding capacity and is relatively infertile and acidic in its natural state. Decomposition and subsidence will be accelerated by drainage and cultivation. Refer to the Alouette Soil Management Group if the organic layer has been reduced to 40 cm or less in depth.

Soil Series: Annacis, Banford, Gibson, Goudy, Judson, Lulu, Lumbum, Richmond, Widgeon

Dominant Soil Limitations:

- Soils are very poorly drained.
- Soils are naturally infertile and acidic.
- The bulk density of the soil is low.
- The root zone is restricted where the depth of the organic layer is reduced to less than 40 cm due to subsidence.

Well Suited Crops: None

Suited Crops: Annual legumes, blueberries, cereals, cole crops, corn, perennial forage crops, root crops and shallow rooted annual vegetables.

Management Inputs:

Water Management System: A close drainage spacing of 12 m is recommended. With adequate water table control, these soils are highly productive and are used mainly for intensive vegetable production.

Cover Cropping: When dry, soils are subject to wind erosion and a cover crop is recommended following harvest to maintain infiltration.

Subsidence: Refer to section 4.4, Management of Peat and Muck Soils, on controls of subsidence in peat soils.

Lime and/or Fertilizer Application: In their natural state, these soils have limitations that require high levels of fertilizer and lime inputs, but most are presently under intensive management and these limitations have been eliminated.

Unsuited Crops: Nursery and christmas trees, raspberries, strawberries and tree fruits.

Reasons: It is difficult to adequately drain these soils to prevent winter injury due to a high water table.

TRIGGS SOIL MANAGEMENT GROUP

General Characteristics

This group occupies 4,800 ha in the lowlands of Delta (Burn's Bog), Glen Valley, Richmond and Pitt Meadows. There are small areas along the Fraser River in Surrey and Langley. The soil has developed in deep, undecomposed organic deposits, which are poorly drained. The fibric (undecomposed) nature of the soil results in a very low bearing capacity. Soils are very infertile and extremely acid.

Soil Series: Glen Valley, Triggs

Dominant Soil Limitations:

- Soils are very poorly drained.
- Infertility: In their natural state, these soils are very acidic and low in many essential plant nutrients.
- Low Bulk Density: These soils have undergone very little decomposition and the soil is basically peat moss. When cultivated, the soil becomes very loose and fluffy making for a poor seedbed and rooting medium.

Management Inputs and Crop Groups:

The Triggs soil group is either in production of blueberries and/or cranberries. Where these crops are not being grown, the peat soils have been mined out. The balance of this soil group is being used as either an industrial or construction landfill.

12294 272 Street
Maple Ridge, BC. V2W1C2

April 21, 2022

Agro-Environmental Inc.
15787 Buena Vista Avenue
White Rock, BC
V4B 1Z9

Attn: Darrell Zbeetnoff

Re: Water Management – 8251 No. 5 Road, Richmond, B.C.

Dear Darrell,

This report describes a water management assessment including potential adverse effects associated with the placement of soil fill at the above captioned property which is the subject of a Soil Deposit Application to the City of Richmond and the Agricultural Land Commission (ALC).

The subject property is located at 8251 No. 5 Road, Richmond.

The property is rectangular with an area of approximately 0.5ha and principal dimensions of approximately 145m in the est-west direction and 32.5m in the north-south direction.

The east end of the property has a single family dwelling (SFD) and surrounding pavement and landscaping.

The property is bounded to the east by No. 5 Road, to the north and south by similar properties with residential development and to the west by agricultural fields (see Attachment 2).

The property is relatively flat with elevations of approximately 1.25-1.75mASL slightly sloping (<0.3%) to the west (see Attachment 1).

The existing and proposed fill is described in the Farm Plan (see Attachment 1).

Site soil conditions and existing fill are described in general terms in the agrologist's report (see Attachment 3).

This review is limited to a consideration of water management implications of soil placement. Agricultural implications of the soil placement are outside the scope of this study and dealt with in the Farm Plan.

I

The principal water management issues are related to storm water and irrigation water management and surface permeability changes caused by the fill.

The regional drainage is limited to the east by No. 5 Road which provides an effective barrier to surface water.

The City of Richmond storm drain infrastructure in the vicinity of the subject property is shown in Attachment 4. This consists of a storm sewer flowing to the north.

There is a connection from the SFD in the central part of the east property boundary and connections at the south and north property lines.

Areas 1 (House/Driveway) and 2 (Lawn/Septic) are assumed to be adequately served by the existing SFD storm sewer connect. No evidence of water management issues were observed during a site visit during a period of intense rain.

In the absence of the residential development along No. 5 Road and indeed, No. 5 Road itself, the natural drainage would be exclusively by infiltration into the surficial soils and dissipation as groundwater in indeterminate direction(s).

The Area 1 and 2 elevations provide an effective barrier to eastward water movement from Areas 3 and 4.

As there is no evidence of any adverse effects erosion or hydrological issues on the subject property or the adjacent properties it can be concluded that the existing and proposed fill has a negligible effect on regional drainage and infiltration can continue to be the operative process for storm water management.

In summary, the placed soil described in the Farm Plan will have no adverse effects on the subject property or on adjacent properties.

Yours truly,
INFORM PIPELINE SERVICES INC.

PROFESSIONAL ENGINEER
PROVINCE OF BRITISH COLUMBIA
D. S. RAMSAY
25112

PERMIT TO PRACTICE
Inform Pipeline Services Inc
1000824
Engineers and Geoscientists BC

Dr. Stephen Ramsay P.Eng.

APR 25 2022

12294 272 Street
Maple Ridge, BC. V2W1C2

April 21, 2022

Agro-Environmental Inc.
15787 Buena Vista Avenue
White Rock, BC
V4B 1Z9

Attn: Darrell Zbeetnoff

Re: Geotechnical Assessment – 8251 No. 5 Road, Richmond, B.C.

Dear Darrell,

This report describes a geotechnical assessment of potential adverse effects associated with the placement of soil fill at the above captioned property which is the subject of a Soil Deposit Application to the City of Richmond and the Agricultural Land Commission (ALC).

The subject property is located at 8251 No. 5 Road, Richmond.

The property is rectangular with an area of approximately 0.5ha and principal dimensions of approximately 145m in the east-west direction and 32.5m in the north-south direction.

The east end of the property has a single family dwelling (SFD) and surrounding pavement and landscaping.

The property is bounded to the east by No. 5 Road, to the north and south by similar properties with residential development and to the west by agricultural fields (see Attachment 2).

The property is relatively flat with elevations of approximately 1.25-1.75mASL slightly sloping (<0.3%) to the west (see Attachment 1).

The existing and proposed fill is described in the Farm Plan (see Attachment 1).

Surficial geology of the area is shown in Geological Survey of Canada (GSC) Map 1486A Vancouver (Armstrong 1980). The surficial soils are SAb Bog, swamp and shallow lake deposits – lowland peat up to 8m thick overlying Fc Fraser River Sediments-overbank silty to silt clay normally less than 2m thick overlying 15m or more of Fd – deltaic and distributary channel till 10 to 25m interbedded fine to medium sand and minor silt beds.

Site soil conditions are described in general terms in the agrologist's report (see Attachment 3).

This review is limited to a consideration of geotechnical implications of soil placement. Agricultural implications of the soil placement are outside the scope of this study and dealt with in the Farm Plan.

This assessment does not consider the Area 1 and Area 2 of the property (see Attachment 3) which are assumed to be part of the pre-existing residential development.

The depth of the existing fill (Areas 3 and 4) and the proposed depth of placed soil is 50-75cm. Assuming a soil density of approximately 1500kg/m^3 this implies a bearing pressure of approximately 7-11 kPa). Assuming a very pessimistic bearing capacity for the underlying silty clay layer there is adequate margin to avoid any bearing failure.

There will be some limited settlement of the placed soil layer due to consolidation of the underlying silty clay layer however this will have no effect beyond the area of the placed soil and a narrow region at the edges extending less than 1m. A 1.5m buffer surrounding the placed soil will provide adequate spatial separation from any settlement effects.

In summary, the placed soil described in the Farm Plan will have no adverse effects on the subject property or on adjacent properties.

Yours truly,
INFORM PIPELINE SERVICES INC.

PROFESSIONAL ENGINEER PROVINCE OF BRITISH COLUMBIA DR. S.E. RAMSAY #23413

PERMIT TO PRACTICE
Inform Pipeline Services Inc
1000824
Engineers and Geoscientists BC

Dr. Stephen Ramsay P.Eng.

Attachments

1 8251 No. 5 Road, Richmond, BC Topographic plan
2 8251 No. 5 Roasd, Richmond, BC Aerial photograph
3 Agrologist Field Notes

inform
12294 272 Street
Maple Ridge, BC. V2W1C2

November 14, 2022

Agro-Environmental Inc.
15787 Buena Vista Avenue
White Rock, BC
V4B 1Z9

Attn: Darrell Zbeetnoff

Re: **Drainage – 8251 No. 5 Road, Richmond, B.C. - ADDENDUM**

Dear Darrell,

This letter is an addendum to a previous submission describing a drainage system for the above captioned property related to a soil deposit permit.

This addendum considers drainage from the entire site including the area at the east end of the property occupied by a single family dwelling (SFD) and parts of the site that are not part of the proposed fill area.

This report describes a water management assessment including potential adverse effects associated with the placement of soil fill at the above captioned property which is the subject of a Soil Deposit Application to the City of Richmond and the Agricultural Land Commission (ALC).

Site Description

The subject property is located at 8251 No. 5 Road, Richmond.

The property is rectangular with an area of approximately 0.5ha and principal dimensions of approximately 145m in the west-west direction and 32.5m in the north-south direction.

The east end of the property has a single family dwelling (SFD) and surrounding pavement and landscaping.

The property is bounded to the east by No. 5 Road, to the north and south by similar properties with residential development and to the west by agricultural fields (see Attachment 2).

The property is relatively flat with elevations of approximately 1.25-1.75mASL slightly sloping (<0.3%) to the west (see Attachment 1).

Rational Method Calculation

Section 3.2 indicates that the Rational Method can be used for development <10 ha.

Q=RAIN=(0.1)(0.75)(3.2)(0.00278)=0.000667 m3/s

For the fill area, the runoff coefficient R is chosen as 0.1. Richmond shows a range of runoff coefficient from 0.1 to 0.25. The lower value is appropriate for a deep layer of soil with infiltration drainage as proposed.

For the impermeable roof area of the SFD a runoff coefficient of 0.95 is used.

For the structural fill area, excluding the SFD, a runoff coefficient of 0.70 is used.

For the balance of area outside the areas listed above, a runoff coefficient of 0.25 is used.

The rainfall intensity based on a 10 year return period 24 hour storm event is 3.2 mm/hr. The coefficient N is given by Richmond as 0.00278.

Details of the calculation of runoff from agricultural land can be found in many authoritative references (see, for example, material from Purdue University, Department of Agricultural and Biological Engineering course ABE 325 Soil and Water Engineering).

Areas 1 (House/Driveway) and 2 (Lawn/Septic) are assumed to be adequately served by the existing SFD storm sewer connect. No evidence of water management issues were observed during a site visit during a period of intense rain.

Peak Flows - Area 1, 2

The calculated peak flow from Area 1 is 0.0015 m3/s.
The from Area 2 is 0.0005 m3/s.

The combined peak flow is 0.002 m3/s.

This flow is assumed to enter the City of Richmond storm drainage infrastructure on No. 5 Road.

Area 3

The calculated peak flow from Area 3 (fill) is 0.0006m3/s.

This flow will drain to the south and combine with natural infiltration in Areas 4 and 5.

Attachments

1 8251 No. 5 Road, Richmond, BC Topographic plan
2 8251 No. 5 Road, Richmond, BC Aerial photograph
3 Agrologist Field Notes
4 Richmond storm drainage in vicinity of 8251 No. 5 Road

Brief Notes Harry Garcha Property – Agrologist Site Visit March 10, 2022

Prepared by Geoff Hughes-Games, PAg

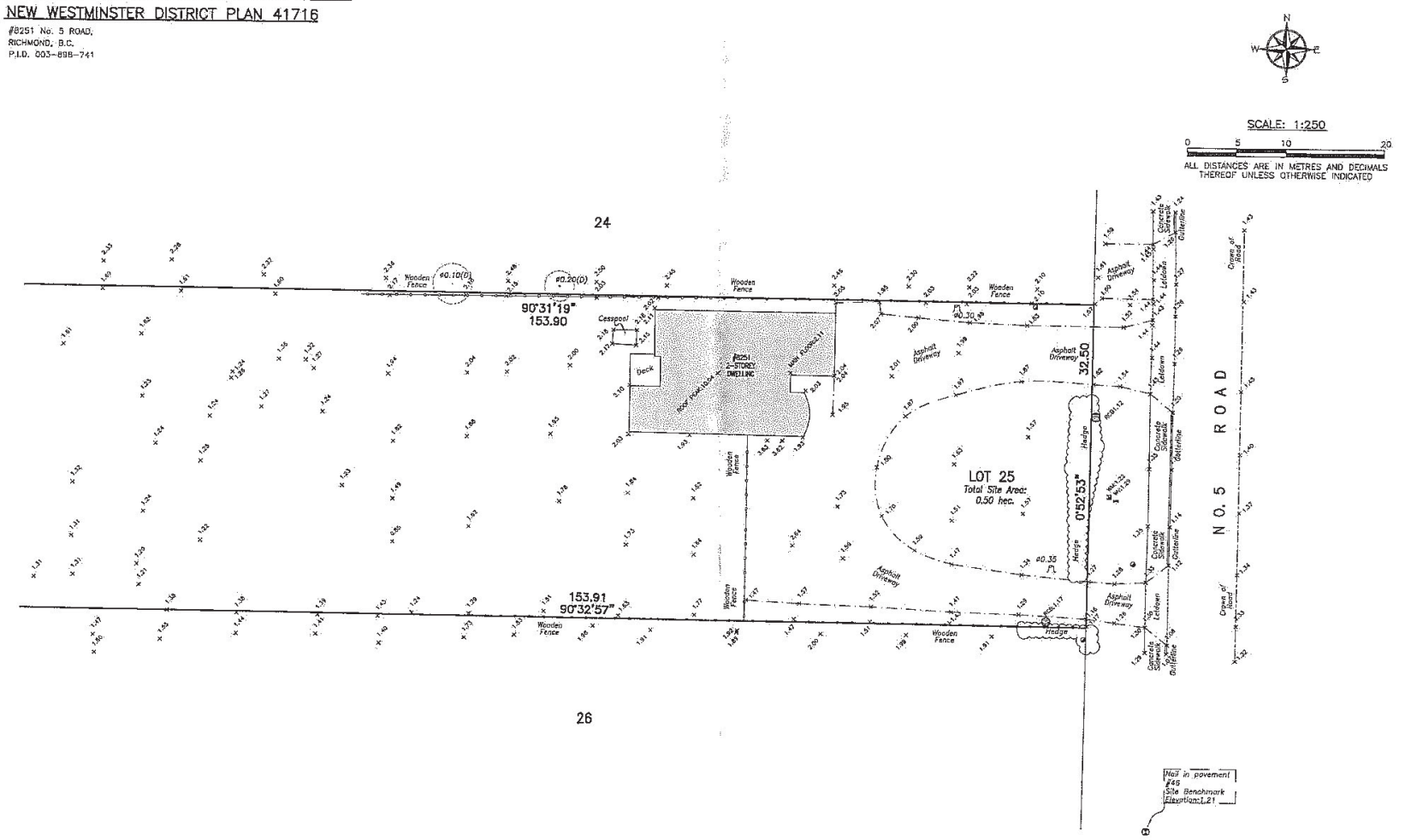
April 19 2022

Subject Property

CIVIC ADDRESS:	8521 No. 5 Road, Richmond, BC
LEGAL:	LOT 25 SEC 24 BLK 4N RG 6W PL NWP41716 Lot 25, Block 4N, Plan NWP41716, Section 24, Range 6W, New Westminster Land District
PID:	003-898-741
Size:	4,994 m^2 (1.23 Ac)
Zoning:	AG1
ALR:	Yes

TOPOGRAPHIC SURVEY OF A PORTION OF LOT 25
SECTION 24 BLOCK 4 NORTH RANGE 6 WEST
NEW WESTMINSTER DISTRICT PLAN 41716

#8251 No. 5 ROAD,
RICHMOND, B.C.
P.I.D. 003-898-741



J. C. Tam and Associates
Canada and B.C. Land Surveyor
115 – 8833 Odlin Crescent
Richmond, B.C. V6X 3Z7
Telephone: 214-8928
Fax: 214-8929
E-mail: office@jctam.com
Website: www.jctam.com
Job No. 7195
FB-353 P70-71
Drawn By: CY

DWG No. 7195-TOPO

LEGEND:
(D) denotes deciduous
denotes catch basin
denotes round catch basin
denotes water valve
denotes water meter
denotes manhole
denotes power post

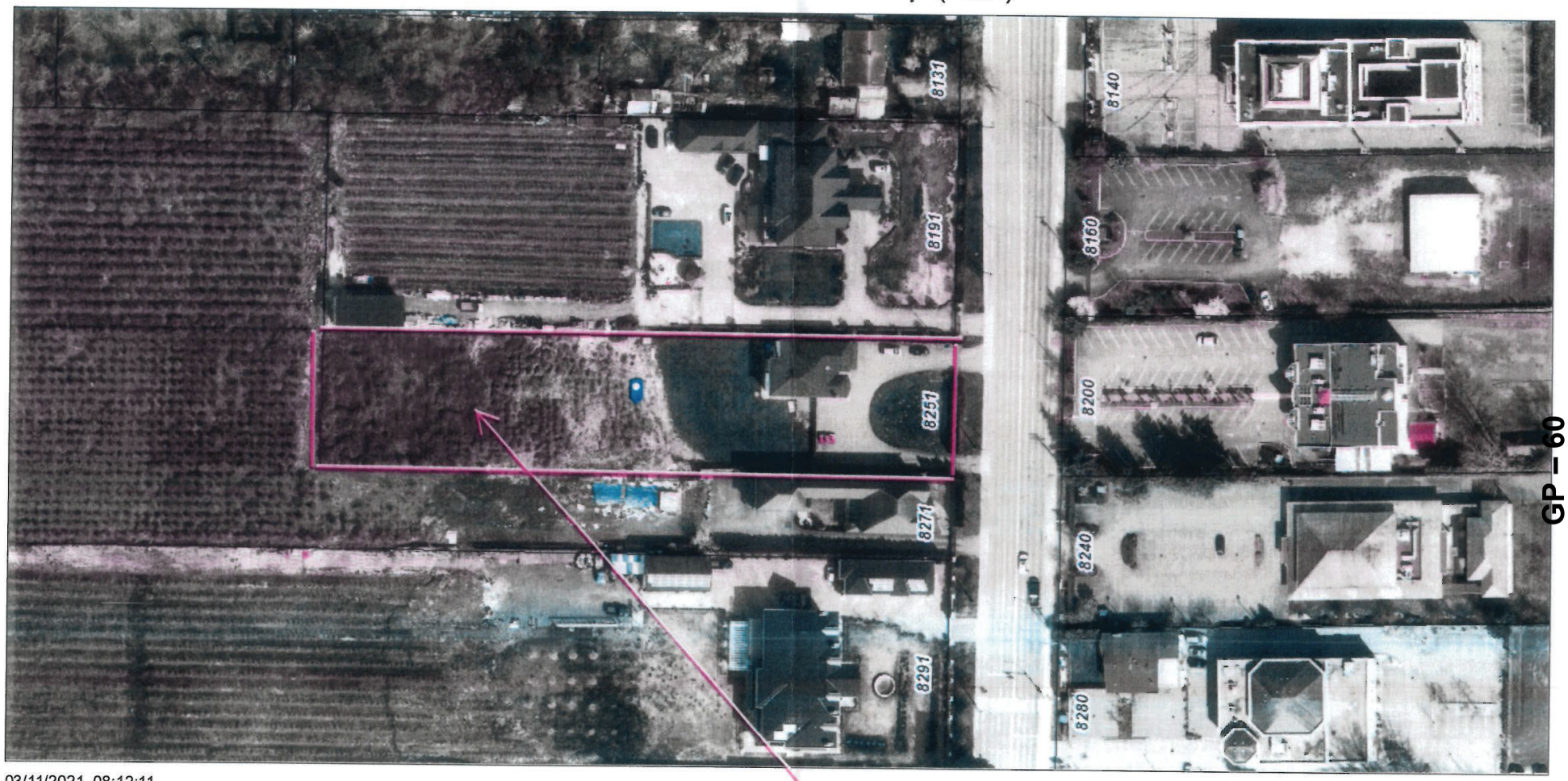
NOTE:
Elevations shown are based on City of Richmond HPN Benchmark network.
Benchmark: HPN #190
Control Monument 94H1624
Elevation: 2.353m
Benchmark: HPN #191
Control Monument 02H2453
Elevation: 1.664m

NOTE:
Use site Benchmark Nail #45 for construction elevation control.

CERTIFIED CORRECT:
LOT DIMENSION ACCORDING TO FIELD SURVEY.

JOHNSON C. TAM, B.C.L.S., C.L.S.
MAY 7th, 2018.

Richmond Interactive Map (RIM)



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Property Address

- Air Parcels
- Strata
- Parcels (black line)
- Community Centres
- Richmond Oval
- Skating Arenas
- Swimming Pools
- Libraries
- Theatre
- City Hall
- Fire Stations
- Police Stations
- Ambulance Stations
- Hospitals
- Red: Band_1
- Green: Band_2
- Blue: Band_3

1:1,411

0 0.015 0.03 0.06 mi

0 0.025 0.05 0.1 km

PRESENT WILD BUSHES , TALL GRASS AND DITCHES ON THE PROPERTY, WE WANT TO PLANT NEW BLUBERRY PLANTS PLEASE HELP US IMPROVE OUR PROPERTY

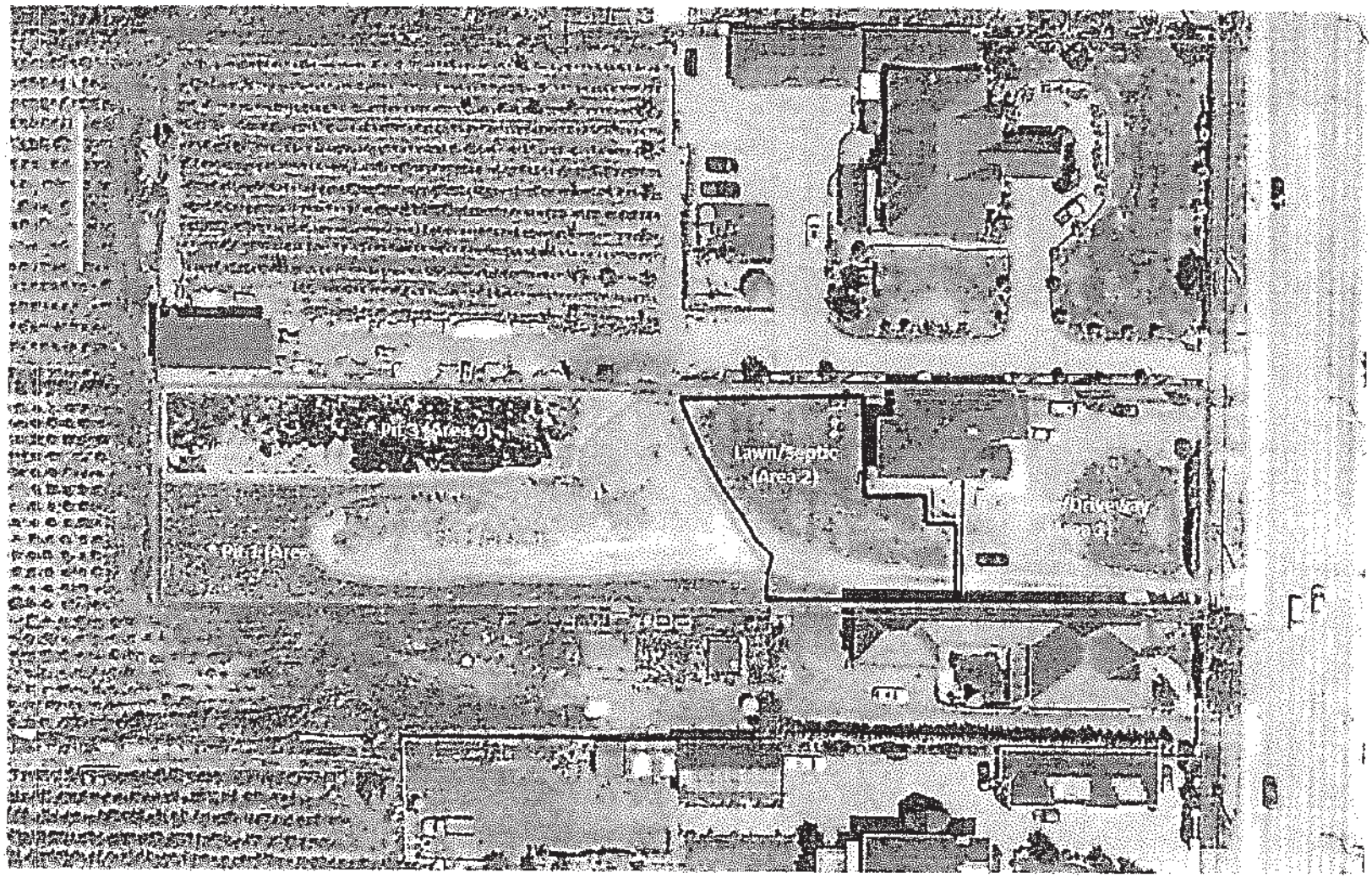


Figure 1 Delineated areas

1		house/driveway - historic fill/solid surface – based on historic aerial imagery	1,720
2	black	back yard/lawn/septic field – historic mineral fill – based on surface observation	795
3	pale green	mineral fill mainly glacial till - mixed silts and some gravels and underlain by native peat	975
4	yellow	disturbed fibrous peat over sandy gravelly fill	790
5	pale blue	native peat	715
		Total	4,995

Discussion of Observed Site Conditions/Structures

Area 1 – House and driveway front yard landscaping – based on elevation in relation to 5 Road and rear of property (as well as old topographic survey supplied by landowner) this appears to be a historic fill pad. Covers approximately 1,720 m^2 of parcel.

Area 2 – Lawn/Septic field. This area was elevated above what appeared to be the original site elevation (preconstruction). Slopes westward and southward away from house. Exposed soil patches indicate it is mineral soil. Covers about 795 m^2 of parcel.

Area 3 – Mineral Fill. Moderately fine to fine textured mineral fill covering approximately 975 m^2 ranging in depth from 20 to 75 cm. Dense compacted soil with little if any vegetation. Rare evidence of construction debris (less than 1%) including brick and glass. No evidence of other foreign matter. Some coarse fragments (ranging from gravel to small stones on surface (less than 1%). Generally, level with abrupt edges on fill pad. Underlain by relatively undisturbed native peat soil.

Area 4 – Disturbed peat/Mineral Fill. This area contains disturbed peat placed over mineral fill covering approximately 790 m^2. Peat ranged in depth from 15 to 40 cm. Underlying mineral soil was coarse to moderately fine textured with some coarse fragments. No evidence of foreign matter. Very little vegetation with some remnants of roots, likely from vegetation at source of peat. Slightly hummocky surface but generally level. Abrupt edge on southern boundary of area and adjoins filled/disturbed soils on adjacent farm to north. Some ponded water in area separating Area 3 and Area 4.

Area 5 – Native peat soil. This area is relatively undisturbed native peat soil. Area was about 715 m^2. Recently mowed (brushed) vegetative cover. Remnants of birch, hard hack, fireweed, blackberry and blueberry vegetation as well as moss and woody chip residue on surface. Level area except thin slivers on north and south of Area 3, which were hummocky due to disturbance from older soil movement. No standing water evident and this soil appears to extend west and south into adjacent properties with slight difference in elevation (less than 20 cm) resulting from different soil management on each parcel.

Drainage

A topographic survey was not conducted as part of the agrologist site visit. General observations were:

- Buried pipe inlet near southwest corner of back lawn (Area 2) which owner understood was connected to storm drainage on No 5 Rd.
- Shallow swale/partially filled ditch on southern parcel boundary and no other drainage channels elsewhere on parcel
- Slight differences in elevation between subject property and adjacent lands to west and south (likely caused by historic land/soil management) but did not appear to be likely to impact water flow on or off the parcel
- Parcel to north was elevated by at least 30 cm (appears to be fill – historic imagery/observation from parcel
- Some minor surface ponding on water between Areas 3 and 4 (water could be trapped between the two fill pads)
- No subsurface drainage infrastructure (like Big-O) was observed or reported in Areas 3, 4 and 5.

Surrounding Land Uses

The adjacent parcels have a variety of agricultural land uses. Most area mixture of residential with soil bound crop production of various forms.

East (across No. 5 Road) – mixed educational/religious with portions of land used for market gardens

South – residential, with underutilized garden/some unpruned blueberries, second lot south – active blueberry farm

West – blueberry planting, very old plants, with grass cover between rows, low intensity management

North – residential with mixed use, small portion covered with landscape construct materials/machines, larger area of young blueberry plants – actively managed and remainder as residential home plate

Soils

Three soil pits were installed, one with the assistance of a bobcat loader the other two were shovel/auger dug.

<u>Soil pit 1 west</u>

Shovel/auger pit located on a level area at the western end of the parcel in mowed brush. A thick root matt contained well decomposed Humic materials overlying less decomposed peat. Three distinct layers were noted within 100 cm of the surface. No coarse fragments or apparent mineral lenses were observed. Shallow groundwater at about 20 cm depth. No surface ponding was observed in the immediate are of the soil pit however there was some limited ponding on other areas that did not have fill placed. Abundant roots in upper layers.

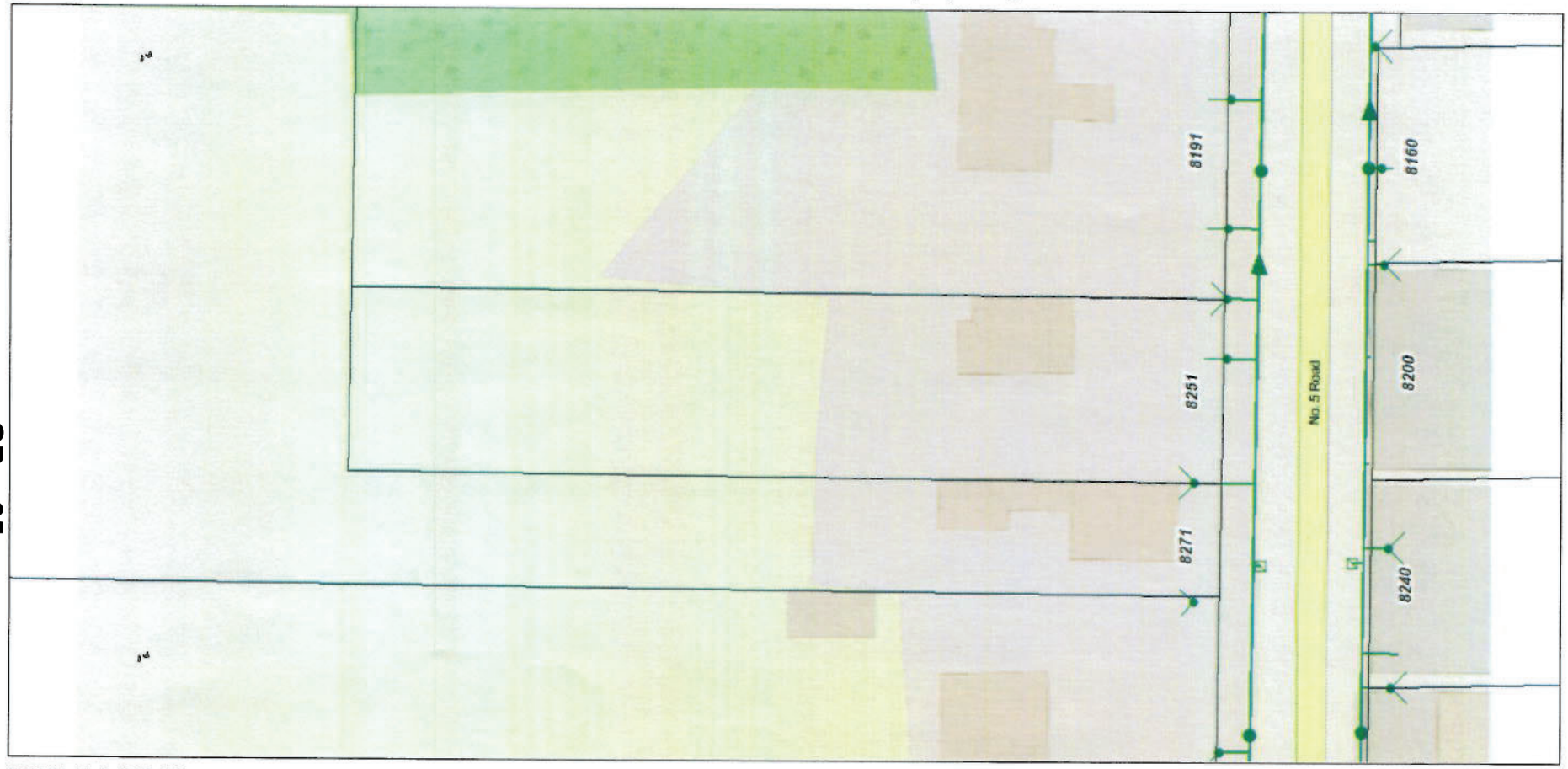
Soil pit 2 center south

Pit located in near the center and what appear to be highest point of the mineral fill pad. Upper 60 cm excavated with Bobcat loader and remainder dug with shovel. Upper 75 cm contained at least two distinct layers of mineral fill. The upper 35 cm was a silty glacial or glacial marine till with little or no coarse fragments (CF). Lower 40 cm was more of mix of till and gravelly outwash materials. This layer contained greater than 50% CF ranging up to rounded or subrounded small cobbles (< 15 cm). This second layer was very wet, with a water table at about 70 cm. The native peat soils underlay this mineral fill at about 75 cm depth. The fill layer tapered to less than 20 cam at its outer extent.

South pit 3 center north

Pit located in the center of the fill pad area on the norther part of the parcel. This area had loose disturbed peat spread over mineral fill. The source of peat was unknown although it appeared to be similar to the deeper peat layers in Pit 1. The peat layer was observed to be about 40 cm in thickness. This over lay greater than 75 cm of mineral fill. The upper 20 cm of mineral soil was sandy gravelly and loose material with about 25% CF ranging up to rounded small cobbles (~15 cm). The lower mineral layer was sandy loam with some fine gravels (10% CF) less than 5 cm. No water table was observed although the moisture level at 120 cm was near saturation.

Richmond Interactive Map (RIM)



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0 0.01 0.02 0.04 mi

0 0.0175 0.035 0.07 km

Property Address

- Air Parcels
- Strata
- Parcels (black line)
- Community Centres
- Richmond Oval
- Skating Arenas
- Swimming Pools
- Libraries
- Theatre
- City Hall
- Fire Stations
- Police Stations
- Ambulance Stations
- Hospitals
- Drainage Flow Direction

Drainage Features

- Inspection Chamber
- Manhole
- Catch Basin

Sensors

- Rain Gauge

Drainage Mains

- Arch
- Box
- Trash Screen
- Pipe
- Lateral
- Culvert
- Connection
- Perimeter Drain
- Drainage Ditches
- Drainage Lift Stations