September 16, 2010

OVERVIEW AGRICULTURAL ASSESSMENT REVISION 1

Albion Flats Area
Maple Ridge, BC

Submitted to:
Diana Hall
District of Maple Ridge
11995 Haney Place
Maple Ridge, BC
V2X 6A3

REPORT

Report Number: 10-1422-0026

Distribution:

6 copies - District of Maple Ridge

2 copies - Golder Associates Ltd.

Table of Contents

TABLES

FIGURES

APPENDICES

1.0 INTRODUCTION

Golder Associates Ltd. (Golder) was retained by the District of Maple Ridge (District) to conduct a preliminary agricultural assessment for the Albion Flats area, as shown on Figures 1 and 2.

This assessment consisted of:

- A review of available soil and land capability for agriculture (LCA) mapping;
- A reconnaissance level inspection of the study area to provide an overview assessment of existing surface conditions and current land uses;
- A preliminary assessment of achieving improved LCA ratings through implementation of drainage and irrigation improvements; and,
- A preliminary assessment of reclamation requirements for areas which have been disturbed.

The scope of work included no subsurface soil investigations and no testing or assessment of the potential presence or impact of soil and/or groundwater contamination within the study area.

2.0 AVAILABLE SOILS AND AGRICULTURAL CAPABILITY

The following sections summarize available soil (Luttmerding, 1980) and land capability for agriculture (LCA) mapping (Luttmerding, 1986), as shown on Figure 3. The methodology for determining Land Capability for Agriculture Ratings is summarized in Appendix I.

2.1 Available Soil Mapping

Study area soils are derived from floodplain, marine or glaciomarine deposits. The study area includes all or portions of 13 soil map polygons, as shown on Figure 3, and includes 14 soil series. Soil series in the area are differentiated by the thickness, texture and/or drainage regime of the parent material and by local topography. Brief descriptions of the soil series and summaries of soil management recommendations for the mapped soil series are contained in Appendix II.

The most common general soil profile within the study area consists of moderately fine to fine textured material over dense, compact subsoil. The majority of the mapped soil series are described as poorly to very poorly drained. Subsurface drainage systems and periodic subsoiling are recommended for the majority of the study area soils.

2.2 Available Land Capability for Agriculture

LCA ratings, both unimproved and improved, for the soil map polygons are shown on Figure 3.

Unimproved ratings range from Class 2 to Class 5. Limitations include excess water, poor soil structure, adverse topography and soil moisture deficits, with excess water being the most prevalent limitation. Excess water is mapped as a limitation over 88% of the study area. The mapped LCA ratings show 45% of the total study area as Class 2, 7% Class 3, 43% Class 4 and 5% Class 5.

With on-farm improvements, primarily on-farm drainage and, to a lesser extent, on-farm irrigation improvements, the LCA ratings range from Class 1 to Class 4, with limitations due to excess water, poor soil structure and topography. Improved ratings for the entire study area are 8% Class 1, 47% Class 2, 41% Class 3 and 4% Class 4. Excess water limitations apply to the improved ratings of 49% of the study area, poor soil structure to 45% and topography to 44% of the study area. The excess water limitations attached to the improved ratings suggest that even with drainage improvements, including subsurface drainage systems, soil drainage will remain a limitation to crop selection and productivity, although to a lesser extent than without drainage improvements.

The mapped LCA ratings are generally high, with 52% of the study area mapped as having high capability (Class 1 to 3) under unimproved conditions and 96% of the study area having high capability under improved conditions.

The current land use patterns and observed growing conditions do not reflect the improved LCA ratings. Potential reasons for the observed conditions not reflecting the improved LCA ratings include:

- Implementation of on-farm improvements, particularly drainage improvements, have not been feasible due to inadequate outlets for on-farm drainage systems or the unavailability of water for irrigation;
- Land owners have decided not to implement improvements; or,
- Mapped LCA ratings are too optimistic.

It is important to note that soil maps were prepared in 1980, at a scale of 1:20,000, and LCA ratings were interpreted from the mapped soils in 1986. Soil maps at a 1:20,000 scale are generally based primarily on air photo interpretation with one on-ground inspection every 2 to 30 ha.

Changes to surface conditions since the 1980 soil mapping will not be reflected in the mapping, and at a resolution of 1:20,000 the mapped soils may not accurately reflect actual ground conditions, particularly in an area such as this where there is a complex mix of soil series.

Observations of the study area, particularly the areas near Lougheed Highway and the south eastern portion of the study area, suggest that the mapped LCA ratings underestimate microtopographic limitations; limitations resulting from localized slopes and differential drainage conditions are more severe than indicated by the LCA ratings.

3.0 LAND USE

3.1 Study Area Land Use

The study area, as shown on Figures 2 and 3, consists of 52 lots plus road ROWs and is approximately 131.6 ha in area. The 52 lots total 123.9 ha in area. Approximately 17.8 ha of the study area, which includes 17 of the 52 lots, are outside of the Agricultural Land Reserve (ALR), as noted on Figure 2. There are 35 lots within the ALR with a total area of 105.8 ha.

Land use within the study area is mixed and includes agricultural, rural residential, recreational, park, commercial and institutional land uses. The majority of the commercial and institutional (school and community hall) use occurs on lots which are outside of the ALR. There are two lots within the ALR where a portion of the lot is used for non-farm use. It is our understanding that the non-farm use on these two lots predates the creation of the ALR and would therefore be considered legally non-conforming.

Approximate areas for current land uses are summarized in Table 1.

Table 1: Study Area Land Use

Land Use	Number of Lots	Approximate Area (ha)	Percentage of Study Area	Percentage Lot Area Within the ALR
Non-ALR	17	17.8	13	
Recreational and Parks	6	33.9	26	32
Agricultural	4	32.9	25	31
Rural Residential	25	39.0	30	37
ROWs (ALR and non-ALR)		8.0	6	
Total	52	131.6	100	100

For the 35 lots within the ALR, 25 lots representing 39.0 ha or 37% of the lot area within the ALR, are currently used for rural residential purposes. Recreational use and parks occupy 6 lots, with a total area of approximately 33.9 ha or 32% of the ALR lot area. Agriculture appears to be the primary use on 4 lots which total 32.9 ha, or 31% of the lot area within the ALR.

The rural residential lots range in size from about 0.3 to 4.2 ha, with 20 lots of less than 2 ha and another 4 between 2.0 and 2.6 ha in size.

3.2 Surrounding Land Uses

Surrounding lands include Lougheed Highway to the east and south, park (Kanaka Creek) to the north, residential development to the north east and residential, commercial and institutional development to the east.

4.0 SITE ASSESSMENT

The following comments on site conditions are based on interpretation of recent air photos and observations made from roads within and adjacent to the study area. No subsurface soil investigations or detailed inspections of individual properties were undertaken.

4.1 Topography

The study area slopes generally to the west from a high point at the northeast corner. Generally, the area has long, shallow slopes with areas of near level topography.

Site microtopography is more complicated. Some areas have depressional features and other areas have a complex slope pattern that has the potential to limit agricultural productivity. The complex microtopography results in differential drainage that will result in uneven growth, and areas with localized slopes which will restrict the operation of some agricultural equipment.

Complex slopes and depressional features were observed in the forested area west of 240th Street. The rural residential lots next to the Lougheed Highway show complex microtopography with depressions, ridges and swales.

4.2 Drainage

There are several drainage channels within the study area, including natural streams, channelized streams and what appear to be constructed ditches. The primary watercourse is Spencer Creek. Drainage from the study area is discharged to Kanaka Creek through an outlet at the downstream end of Spencer Creek. The outlet works consist of a floodbox and three pumps.

Recent reports on Maple Ridge agriculture have noted drainage problems within the Albion Flats area.

The “Maple Ridge Agricultural Area Planning Situation Analysis: 2008 Update” notes:

“Agricultural drainage in the Albion Flats is problematic even though the area has drainage improvements from a dyke system in the area. Unimpeded drainage from upland development is leading to more storm water draining onto the agricultural flood plain faster with higher peak flows. In addition, elevations surrounding non-agricultural land use in the Albion Flats floodplain have been raised relative to the agricultural land. The agricultural land, with the lowest elevation, is now the recipient of the displaced storm water and not effectively served by the disrupted drainage system.

The effects of deteriorated storm water drainage system on agricultural cropping include inability to grow perennial crops due to flooding, later spring seeding, higher water tables leading to difficult field operations during the growing season, early fall saturation resulting in the inability to harvest crops.”

“The Maple Ridge Agricultural Plan, 2009” notes:

“Drainage and flood control are significant issues in the Northwest and Albion Flats areas of the agricultural lowland of Maple Ridge.”

Observations of vegetation types and growth patterns within the study area during the 2010 growing season indicate that drainage conditions are variable and that current drainage conditions in many portions of the study area are not conducive to high levels of soil based agricultural productivity.

In areas of more significant microtopography, with complex series of ridge and swales, water ponds in the swales. The ponding appears to be significant enough to reduce early season trafficability and delay spring access to the lower lying portions of the fields.

Further investigations would be required to determine the causes of the apparent poor drainage.

4.3 Disturbed Areas and Reclamation

Many properties have disturbed areas consisting primarily of former building sites. If these disturbed areas are to be used for soil based agricultural production, reclamation will be required. Currently vacant rural residential lots often contain remnant foundations and driveways. Reclamation needs cannot be defined without more detailed site investigations to determine the extent of disturbances and available soil resources in the vicinity of the disturbed areas.

In some cases the disturbed areas may be reclaimed by removing structures, foundations and other waste, followed by grading the site with existing surface soils. In other cases, a high level of reclamation will require importing suitable quality soils from other sites.

Before any reclamation activities are started, previously disturbed areas should be evaluated for potential contamination and any required remedial action taken.

There are some areas that have been disturbed when watercourses were re-routed. Abandoned stream channels have been filled. It is not known if the fill material was imported or if the channels were filled by grading the nearby areas. If land grading was not done properly, areas may have been degraded by exposing subsoils.

Agricultural lots have been disturbed where barns and other agricultural outbuildings have been constructed. The remainder of the agricultural areas do not appear to have not experienced disturbance that limits sustainable soil-based agriculture.

If a portion of the study area were to be developed for non-farm use and surface soils removed, these removed soils would likely be suitable for reclaiming previously disturbed areas within the study area. If surface soils are removed from areas within the ALR, these soils should be used to improve agricultural fields on other ALR lands.

5.0 SMALL LOT AGRICULTURE

A 2004 Land Use Inventory (Agriculture Land Use in Surrey) related agricultural land use to parcel size, as summarized in Table 2.

Table 2: Primary Land Use Activities within the ALR

Primary land use activity	Median parcel size (ha)	Average parcel size (ha)
Agriculture	4.1	8.4
Residential use	1.6	1.9
Hobby farm	2.0	2.1

(City of Surrey, 2004)

A study investigating opportunities for expanded agricultural production in Abbotsford, Farmland Use in Abbotsford and the Potential for Future Growth (BCMAFF, 2004), noted that small lots provide fewer farming choices than larger lots and that lot sizes over 8 hectares provide the broadest range of agricultural opportunities. In Abbotsford, the average size of farmed parcels was 7.3 ha (18 acres) while the average size of unfarmed parcels was 2.0 ha (5 acres).

The 24 rural residential lots within the study area range in size from approximately 0.3 to 4.2 ha, with an average lot size of about 1.5 ha. Twelve of these lots are less than 1.6 ha, the median parcel size for residential use noted in the Surrey study. Nineteen of these lots are less than 2.0 ha in size, the median size for hobby farm use noted in the Surrey study. The largest rural residential lot is 4.2 ha, which is about the median size of lots where the primary land use noted in the Surrey study is agricultural.

6.0 DRAINAGE AND IRRIGATION CONSTRAINTS

6.1 Drainage

6.1.1 Existing Drainage Works

The outlet for drainage from the study area is at the mouth of Spencer Creek, where drainage water is discharged to Kanaka Creek.

The outlet works consist of a floodbox and three pumps. It is our understanding that the majority of the drainage water is discharged through the floodbox, with the pumps starting to operate when water levels at the upstream side of the pump station reach 1.1 m ASL. It is our understanding that the District will be replacing the flood gate with an automatic sluice gate whose operation can be adjusted.

The Engineering Department of the District of Maple Ridge has indicated that the capacity of the outlet is adequate to handle the flows that reach the pump station.

6.1.2 Agricultural Drainage Criteria

An adequate outlet for drainage water from an agricultural area should:

- For the period of November 1 to February 28, remove the runoff from the 10 year, 5 day storm within 5 days;
- For the period of March 1 to October 31, remove the runoff from the 10 year, 2 day storm within 2 days; and,
- Between storm events, maintain base flow water elevations at 1.2 m below the field elevation.

The outlet and the system of watercourses conveying water to the outlet need to be able to accommodate both the design storm flows and the base flow.

A 1.2 m freeboard (the difference between the field elevation and the base flow water level) provides a good level of drainage between storm events for deep rooted perennial crops. If the depth of flow during base flow conditions is 0.3 m, then channel depths should be 1.5 m below field elevations. For shallow rooted crops and grasses, a freeboard of 0.9 m may be adequate. This would require that channel bottoms be 1.2 m below field elevations to provide a 0.3 m depth of flow.

It is our understanding that studies completed in 2002 evaluated the capacity of the drainage system to meet criteria which would be acceptable for pasture. These studies were not reviewed as part of this assessment.

6.1.3 Potential Drainage Improvements

The information in recent agricultural studies and observations of study area drainage and vegetation patterns indicate that existing drainage is not adequate for higher levels of agricultural productivity. A drainage assessment would be required to accurately determine the existing drainage status and the specific constraints to improving agricultural drainage.

The Engineering Department provided cross sections of Spencer Creek, which were surveyed in 2000. A review of these cross sections indicates that surveyed channel bottoms may be deep enough to provide marginal freeboard for agricultural drainage, however there is no current information on channel bottom elevations. No information on other channels within the study area was available, nor was information on culverts within these channels.

Current survey data on study area channels and detailed analyses of runoff and channel hydraulics would be required to determine if the existing outlet capacity is adequate and what channel improvements would be required for adequate conveyancing capacity.

Based on study area observations, it is anticipated that the minimum level of channel improvements would include cleaning to increase capacity.

Efforts to increase the drainage capacity within the study area would have to consider the environmental values associated with the riparian areas within the study area.

6.2 Irrigation

The availability of water within the study area for irrigation use does not appear promising.

The BC Water Resources Atlas shows no groundwater aquifers underlying the study area and provides records for only three wells within the study area. Records show two dug wells in the northern portion of the study area; one dug to a depth of 16 feet with a static water level at 5 feet below the ground surface and the second dug to a depth of 9 feet with the static water level recorded as 4 feet below the ground surface. The well records show a third well, drilled to a depth of 65 feet in the southern portion of the study area. The record for the third well indicates that the static water level was 18 feet below the surface and the driller's estimate of yield was 10 gpm. A yield of this amount would be sufficient to irrigate perhaps 1.5 ha during periods of high crop water demand.

The BC Water Resources Atlas also shows no points of diversion for surface water licences within the study area. The Atlas notes a point of diversion, just to the east of the study area, for a now cancelled licence to withdraw 10 acre-feet per year from Spencer Creek for irrigation. That volume of water would have been sufficient to reliably irrigate about 4 ha.

Water from the municipal system may be available for irrigation use; however approval from the District may be required for larger scale irrigation.

7.0 IMPROVING AGRICULTURAL PRODUCTIVITY

Potential agricultural productivity within the study area is constrained by poor drainage, lot sizes, and topography and, to a lesser extent, by availability of water for irrigation.

7.1 Area "A" - Agricultural Lots North of 105th Avenue

There are two lots north of 105th Avenue, shown on Figure 4, which total approximately 24.7 ha and which are currently used for forage production. The mapped unimproved LCA ratings range from Class 2 to 4, with excess water noted as a limitation to the entire area within these two lots. Observations of vegetation growth are consistent with the excess water limitation. The causes of the apparent poor drainage were not determined. Possible causes include poor outlet conditions and/or inadequate on-farm drainage works.

The mapped improved ratings range from Class 1 to Class 3. With a properly functioning on-farm drainage system (subsurface drains with an adequate outlet) and proper soil management practices such as timely cultivation and periodic subsoiling, it is expected that these capabilities can be achieved.

There is one building site associated with these lots. No other soil disturbances were observed or evident on air photos.

The interface between this agricultural area and the residential lots to the east represent a potential conflict between land uses and it is our understanding that a trail exists along a portion of this interface. It is expected that a well designed buffer between the land uses would minimize the risk of disturbance and unauthorized access to the agricultural area.

7.2 Area "B" - Rural Residential Lots North of 105th Avenue

These 10 lots, shown on Figure 4, include the mostly cleared lots east of Lougheed Highway and north of 105th Avenue. They range in size from 0.7 to 1.9 ha, with an average size of about 1.2 ha and a total area of about 12.1 ha. All except two of these lots are vacant, and all of the lots appear to have some amount of soil disturbance, due to building foundation and driveway construction.

The mapped unimproved LCA ratings for these lots are Class 2 or Class 4, with excess water, topographic and soil moisture deficiency limitations. Excess water is the most significant limitation. If an adequate outlet is available and with the installation of subsurface drains, the LCA is expected to improve to Class 1 to 3, depending upon topography and soil texture.

The potential for these lots to be used for soil-based agriculture is limited by soil drainage, small lot size, and disturbance history. Considering lot sizes alone, it is unlikely that these lots would be used for commercial soil based agriculture.

With lot consolidation, reclamation of disturbed areas and drainage improvements the likelihood of this area being used for commercial soil based agriculture would be greatly increased. In some areas, land levelling may also be required to reduce localized slopes and eliminate differential drainage conditions.

7.3 Area "C" - Rural Residential Lots South of 105th Avenue

These 7 lots, shown on Figure 4, are the mostly cleared lots east of Lougheed Highway and south of 105th Avenue. They total approximately 11.9 ha, with lot sizes ranging from 0.3 to 2.4 ha, with an average lot size of about 1.7 ha. These lots are mostly occupied at present.

The mapped unimproved LCA ratings for these lots are Class 2 to Class 5, with excess water, topographic and soil moisture deficiency limitations. Excess water is the most significant limitation. If an adequate outlet is available and with the installation of subsurface drains, the LCA is expected to improve to Class 1 to 4, depending upon topography and soil texture.

As with the rural residential lots north of 105th Avenue, the potential for these lots to be used for soil-based agriculture is limited by soil drainage, small lot size, and existing development on the site. One of the lots is currently used for commercial purposes. Considering lot sizes alone, it is unlikely that these lots would be used for commercial soil based agriculture. Topography appears to be a greater limitation to agricultural capability on these lots than it is for the rural residential lots north of 105th Avenue.

With lot consolidation, removal of some of the existing buildings and driveways, reclamation of disturbed areas and drainage improvements, the likelihood of this area being used for commercial soil based agriculture would be greatly increased. It is expected that some amount of land levelling would be required to reduce localized slopes and eliminate differential drainage conditions for this area to reach its maximum potential for soil based agriculture.

7.4 Area "D" - Rural Residential Lots in South East Portion of the Study Area

These 7 lots, shown on Figure 4, are located in the generally forested, south eastern portion of the study area. They total approximately 12.8 ha and range in size from 0.6 to 4.2 ha, with an average size of 1.8 ha. The majority of these lots appear to be currently occupied and one appears to be partially used for commercial purposes.

The mapped unimproved LCA ratings for these lots ranges from Class 2 to 4 with excess water, adverse soil structure, topographic, and soil moisture deficiency limitations. Excess water and adverse soil structure are the most prevalent limitations in this area. With on-farm drainage improvements the LCA ratings would still range from Class 2 to Class 4, but with a higher proportion of Class 2 area. Adverse soil structure and topography would remain as significant limitations.

The potential for these lots to be used for soil-based agriculture is limited by soil drainage, generally small lot size, and topography. As with the other areas of rural residential lots, the small lot sizes limit the potential for commercial agriculture.

It appears that water ponding in low lying areas is common on these lots and additional channels may be required to drain these depressional areas.

Microtopographic constraints appear to be prevalent on these lots. Land levelling would be required to eliminate these constraints. Levelling could be accomplished by removing topsoil, levelling the subsoil and then replacing the topsoil, or by importing soils of acceptable quality to fill the depressional areas.

It is expected that lot consolidation, drainage improvements and some amount of land levelling would be required for the majority of this area to be used for commercial soil based agriculture.

7.5 Area "E" - Agricultural Lots in the Eastern Portion of the Study Area

There are two lots in the eastern portion of the study area, shown on Figure 4, each with an area of approximately 4.1 ha. One appears to be currently used for forage production while land clearing is taking place on the other.

The mapped unimproved LCA ratings are Class 2 and 4. Excess water and adverse soil structure are mapped as limitations over the entire area, with topography as a lesser limitation. With on-farm drainage improvements the mapped LCA becomes Class 2 and Class 3. Excess water remains a limitation, although to a lesser degree than without drainage improvements. Adverse soil structure and topographic limitations are not alleviated with drainage improvements.

With a properly functioning on-farm drainage system (subsurface drains with an adequate outlet) and proper soil management practices such as timely cultivation and periodic subsoiling, the potential productivity will be increased, but topographic limitations may be more significant than indicated by the LCA mapping.

It appears that water ponding in low lying areas and microtopographic constraints exist in portions of this area. New drainage channels and some amount of land levelling may be required to alleviate these constraints.

8.0 SUMMARY

Much of the study area is alienated from agricultural use; approximately 46% of the 131.6 ha study area is either outside of the ALR, currently used for recreational purposes or parks (non-farm use within the ALR), or is within road ROWs (both within and outside the ALR). Of the remaining 71.4 ha, 38.5 ha are used for primarily rural residential or commercial purposes and 32.9 ha primarily for agricultural use.

There are two areas which are currently used primarily for agriculture. One area, approximately 24.7 ha in size, is north of 105th Avenue. Within this area capability is limited by poor drainage. With on-farm drainage improvements and/or an improved outlet, it is expected that this area would have LCA ranging from Class 1 to 3.

The second area with current agricultural use is in the eastern portion of the study area and totals about 8.2 ha. With drainage improvements, which may need to include new drainage channels for parts of the area and some amount of land levelling, the LCA for this area would be Class 2 and 3.

For areas where the current land use is rural residential, the agricultural potential is constrained by poor drainage, small lot size and areas of soil disturbance and existing structures. As well, in much of these areas, agricultural potential is also constrained by topography, with localized steep slopes and differential drainage conditions.

To maximize the agricultural potential of these areas drainage conditions would have to be improved, lots consolidated, existing structures removed and disturbed areas reclaimed and land levelling done in areas of more significant topographic constraints.

9.0 LIMITATIONS AND USE OF REPORT

Recommendations and conclusions contained in this report are based on information obtained by Golder personnel, based solely on the condition of the Property at the time of the site reconnaissance visits.

The findings and conclusions documented in this report have been prepared for the specific application to this project, and have been developed in a manner consistent with that level of care normally exercised by environmental professionals currently practising under similar conditions in the jurisdiction. Golder makes no other warranty, expressed or implied.

If new information is discovered during future work, including excavations, soil borings, or other investigations, Golder should be requested to re-evaluate the conclusions of this report and to provide amendments, as required, prior to any reliance upon the information presented herein.

10.0 CLOSURE

We trust that the information contained in this report meets your requirements. Should you have any questions, or require further clarification, please do not hesitate to contact the undersigned.

Yours very truly,

GOLDER ASSOCIATES LTD.

ORIGINAL SIGNED

Patrick E. Brisbin, P.Eng., P.Ag.
Associate, Water Resources Engineer and Agrologist

Reviewed by:

ORIGINAL SIGNED

Russ Wong, P.Geo.
Associate and Senior Geoscientist

PEB/RW/tk

\\bur1-s-filesrv2\final\2010\1422\10-1422-0026\final report - rev 1\rep - 0916_10 albion flats report.docx

REFERENCES

BCMAFF. (2004) Farmland Use in Abbotsford and the Potential for Future Growth. 2004. BC Ministry of Agriculture, Food and Fisheries, Abbotsford, BC. < http://www.al.gov.bc.ca/resmgmt/sf/gis/lui_reports/Abbotsford2004_FarmlandUseReport.pdf > [Accessed June 25, 2010]

Bertrand, R. A., G. A. Hughes-Games, and D. C. Nikkel. (1991) Soil Management Handbook for the Lower Fraser Valley. BC Ministry of Agriculture, Fisheries and Food, Abbotsford, BC.

City of Abbotsford. (2008) A Landscape Buffering Strategy for the Agricultural-Urban Interface. < http://www.abbotsford.ca/AssetFactory.aspx?did=8351 > [Accessed June 25, 2010]

City of Surrey, Surrey Agricultural Advisory Committee and the BC Ministry of Agriculture and Lands. (2004) Agriculture Land Use in Surrey. <http://www.surrey.ca/Doing+Business/Agriculture+and+Farming/Agricultural+Land+Use+in+Surrey.htm > [Accessed June 25, 2010]

Climatology Unit. (1981) Climate Capability Classification for Agriculture in British Columbia. APD Technical Paper 4. Air Studies Branch, BC Ministry of Environment, Victoria, BC.

District of Maple Ridge. (2009) Bylaw No. 3510 – 1985. A Bylaw to Regulate Zoning in the District of Maple Ridge, Consolidated to November 2009

Howes, D. E. and E. Kenk (1997) Terrain classification system for British Columbia. BC Ministry of Environment, Victoria, BC.

Land Resource Research Institute. (1981) A Soil Mapping System for Canada, Revised. Research Branch, Agriculture Canada, Ottawa ON.

Luttmerding, H. A. (1980) Soils of the Langley-Vancouver Map Area. Report No. 15, British Columbia Soil Survey. Volume 1. BC Ministry of Environment, Kelowna, BC.

Luttmerding, H. A. (1986) Land Capability for Agriculture Langley-Vancouver Map Area. BC Ministry of Environment, Victoria, BC.

Province of British Columbia. Ministry of Environment. (2007) BC Water Resources Atlas < http://www.env.gov.bc.ca/wsd/data_searches/wrbc/ >. [Accessed XX].

Smith, B. E. (1998) Planning for Agriculture. BC Provincial Agricultural Land Commission. < http://www.alc.gov.bc.ca/publications/planning/planning_for_agriculture/ > [Accessed June 25, 2010]

PROJECT

DISTRICT OF MAPLE RIDGE
OVERVIEW AGRICULTURAL ASSESSMENT
ALBION FLATS, MAPLE RIDGE, B.C.

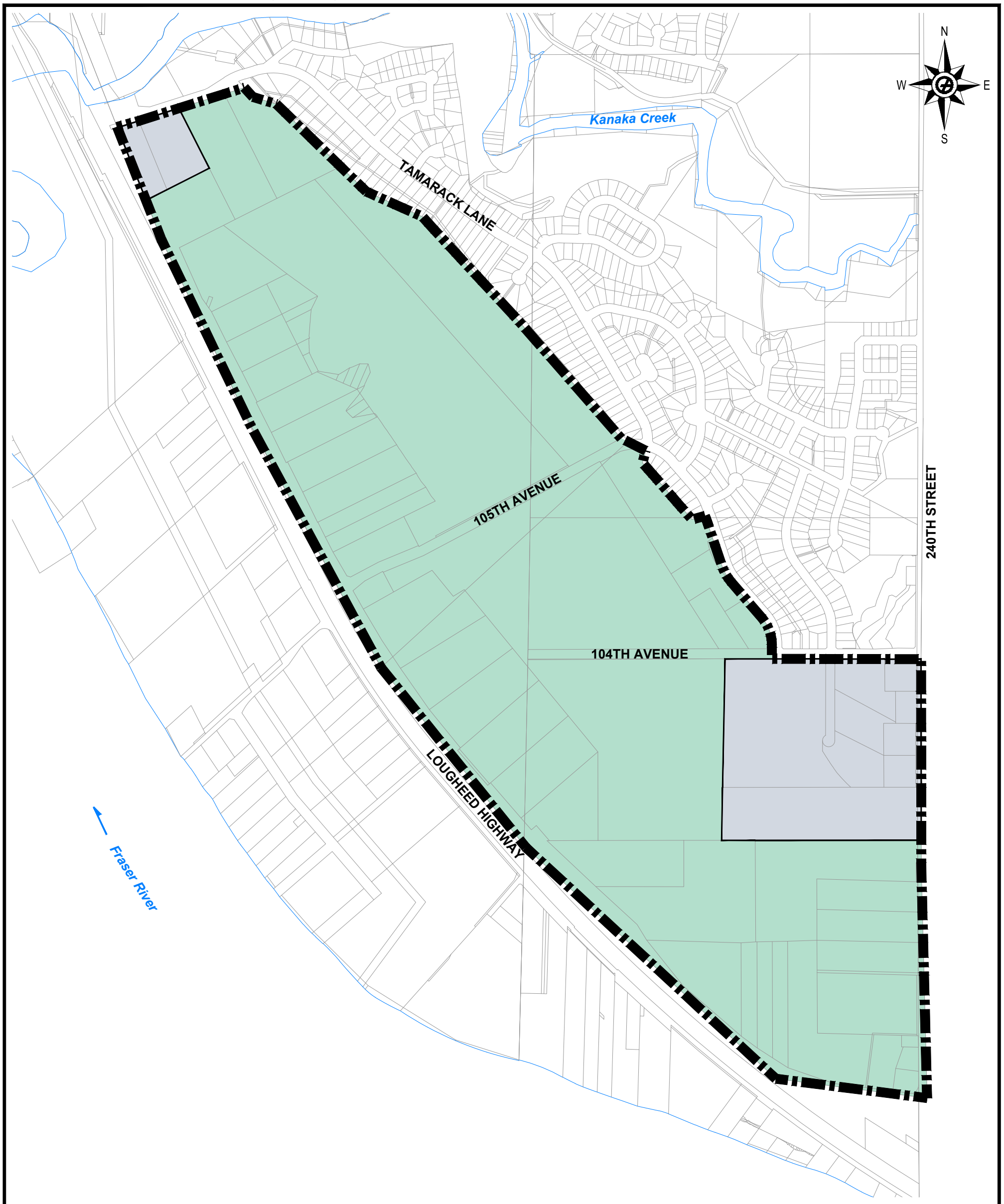
TITLE

KEY PLAN

Golder Associates
Greater Vancouver Office, B.C.

PROJECT No. 10-1422-0026			PHASE 1000	TASK –	
DESIGN	P.E.B	SEP-10-10	FILE No.		K1000-01
CADD	V.L.W.	SEP-10-10	SCALE AS SHOWN	REV.	0
CHECK	P.E.B.	SEP-13-10	**FIGURE 1**		
REVIEW	P.E.B.	SEP-13-10			

N:\Active\year 2010\1422\10-1422-0026 (albion flats)\Drafting\CAD\ Drawing file: K1000-01.dwg Sep 13, 2010 - 8:52am



LEGEND

- Project Boundary
- ALR
- Non-ALR

0 375

SCALE (m)

REFERENCE

1. District of Maple Ridge, CAD dwg: AlbionFlats.dwg, Received: September 9, 2010.

PROJECT

DISTRICT OF MAPLE RIDGE
OVERVIEW AGRICULTURAL ASSESSMENT
ALBION FLATS, MAPLE RIDGE, B.C.

TITLE

STUDY AREA

Golder Associates
Greater Vancouver Office, B.C.

PROJECT No. 10-1422-0026			PHASE 1000	TASK -
DESIGN	P.E.B.	SEP-10-10	FILE No.	P1000-02
CADD	V.L.W.	SEP-10-10	SCALE AS SHOWN	REV. 0
CHECK	P.E.B.	SEP-13-10	FIGURE 2	
REVIEW	P.E.B.	SEP-13-10		

N:\Active\year 2010\1422\10-1422-0026 (albion flats)\Drafting\CAD\ Drawing file: P1000-03.dwg Sep 13, 2010 - 9:04am

LEGEND

Soil Unit Boundary

Project Boundary

(unimproved)
6:3TA 4:2TA
6:3T 4:2T
(improved)
Land Capability for Agriculture Ratings

LAND CAPABILTY FOR AGRICULTURE MAP SYMBOLS

Precentage of Map Unit (x10)
Organic Soil Capability Capability Subclasses
6:5AP 4:Ø5W — Unimproved Rating
(6:4AP 4:Ø3W) — Improved Rating
Mineral Soil Capabilty Class
Improved Capability Subclasses

LAND CAPABILITY SUBCLASSES FOR MINERAL SOILS

A	Soil moisture Deficiency
D	Undesirable Soil Structure and/ or Low Perviousness
I	Inundation
T	Topography
W	Excess Water

0 375
SCALE (m)

REFERENCE

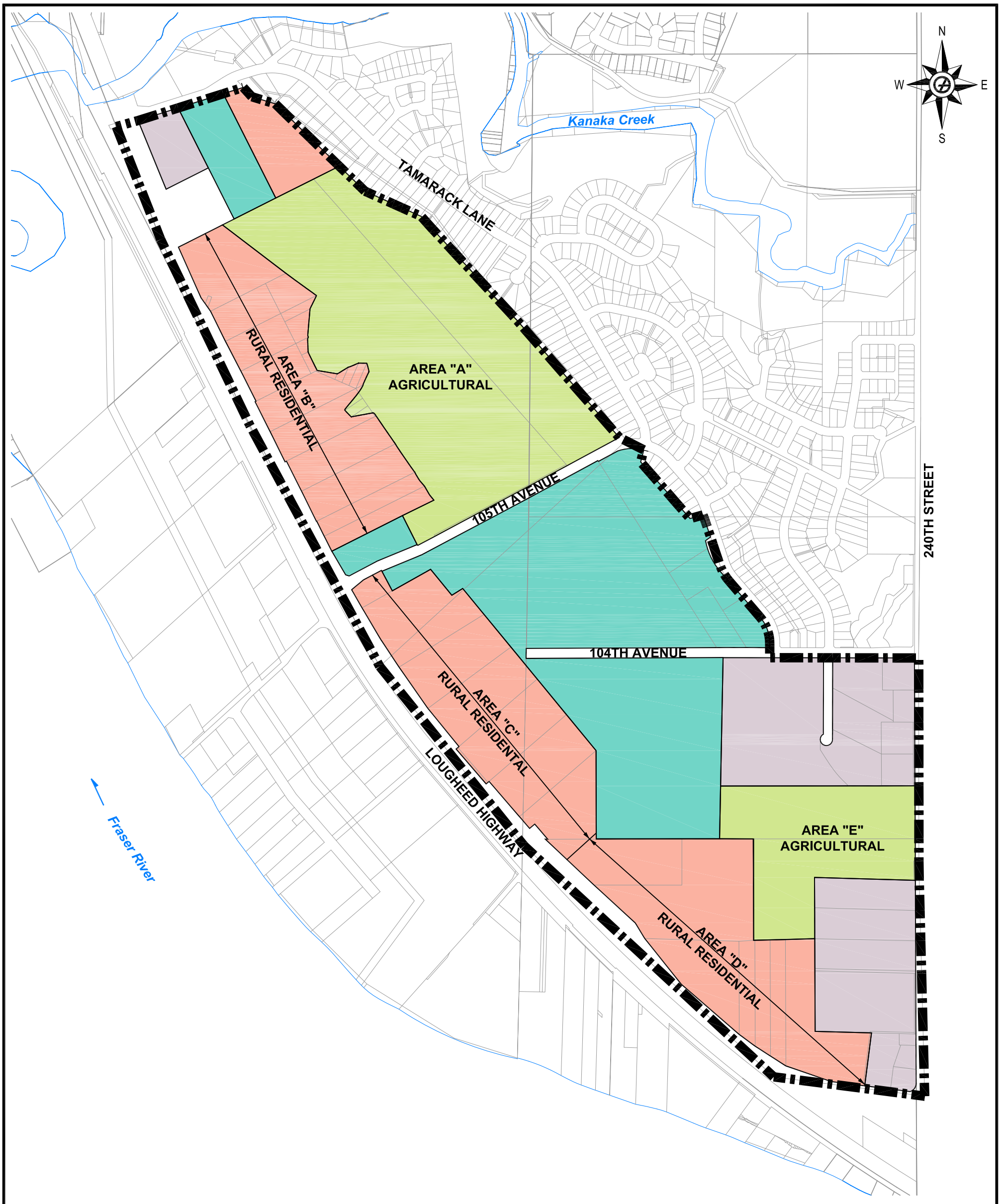
1. District of Maple Ridge, DXF dwg: lavan1_ac.dxf, Received: September 9, 2010.
2. District of Maple Ridge, Image File: 092g018_3_3.tif, Received: September 9, 2010.
3. District of Maple Ridge, Image File: 092g028_1_1.tif, Received: September 9, 2010.

PROJECT
DISTRICT OF MAPLE RIDGE
OVERVIEW AGRICULTURAL ASSESSMENT
ALBION FLATS, MAPLE RIDGE, B.C.

TITLE
SOILS AND LAND CAPABILITY FOR AGRICULTURE MAPPING

Golder Associates
Greater Vancouver Office, B.C.

PROJECT No. 10-1422-0026			PHASE 1000	TASK -
DESIGN	P.E.B.	SEP-10-10	FILE No.	P1000-03
CADD	V.L.W.	SEP-10-10	SCALE AS SHOWN	REV. 0
CHECK	P.E.B.	SEP-13-10	FIGURE 3	
REVIEW	P.E.B.	SEP-13-10		



LEGEND

- Project Boundary
- Rural Residential
- Recreation and Parks
- Agriculture
- Non-ALR and/or ROWs

0 400
SCALE (m)

REFERENCE

1. District of Maple Ridge, CAD dwg: AlbionFlats.dwg, Received: September 9, 2010.

PROJECT
DISTRICT OF MAPLE RIDGE
OVERVIEW AGRICULTURAL ASSESSMENT
ALBION FLATS, MAPLE RIDGE, B.C.

TITLE
CURRENT LAND USE

Golder Associates
Greater Vancouver Office, B.C.

PROJECT No. 10-1422-0026			PHASE 1000	TASK -	
DESIGN	P.E.B.	SEP-10-10	FILE No.		P1000-04
CADD	V.L.W.	SEP-10-10	SCALE AS SHOWN	REV.	0
CHECK	P.E.B.	SEP-13-10	**FIGURE 4**		
REVIEW	P.E.B.	SEP-13-10			

APPENDIX I

Summary of Land Capability for Agriculture Assessment Methodology

September 16, 2010
Report No. 10-1422-0026

Golder Associates

1.0 AGRICULTURE CAPABILITY ASSESSMENT

Land Capability for Agriculture (LCA) for a site is determined using site conditions, soil properties and climate conditions.

Slope, aspect, proximity to watercourses and drainage ditches and observations about the landscape are recorded during the site visit and are used to determine agricultural limitations related to topography, inundation and surface drainage.

Soil properties are described by examining soil profiles that are exposed or that are in test pits. Soil properties, such as texture, colour, horizon characteristics, parent material, etc. are recorded. Soil information is used to assign an LCA rating. In BC, soil characteristics are described according to the instructions in "Describing Ecosystems in the Field" (1998).

Climate conditions are determined using available climate data from Environment Canada and from Climatic Capability for Agriculture maps (1981).

Soil maps and Land Capability for Agriculture Ratings maps are used as a reference to determine the soil series and LCA ratings. In the lower Fraser Valley, soil maps and LCA ratings maps are published at a scale of 1:20 000. There are many instances where more detailed soil and site information can be used to refine existing maps and assign a better LCA rating to an area.

2.0 ASSIGNING LCA RATINGS

LCA ratings are assigned according to criteria provided in the "Land Capability Classification for Agriculture in British Columbia" manual (Kenk, 1983). These criteria incorporate site conditions, soil properties and climate conditions to classify lands into agricultural capability classes. There are two hierarchies, one for mineral soils and one for organic soils.

2.1 Mineral Soil

There are seven LCA classes for mineral soil, as described in Table 1. Agricultural capability decreases from Class 1 to 7, with Class 1 soils supporting the greatest range of crops with the least amount of management. Classes 1 through 4 are capable of supporting sustained agriculture.

Table 1: LCA Classes

Class	Description	Characteristics
1	no or very slight limitations that restrict agricultural use	■ level or nearly level ■ deep soils are well to imperfectly drained and hold moisture well ■ managed and cropped easily ■ productive
2	minor limitations that require ongoing management or slightly restrict the range of crops, or both	■ require minor continuous management ■ have lower crop yields or support a slightly smaller range of crops that Class 1 lands ■ deep soils that hold moisture well ■ managed and cropped easily
3	limitations that require moderately intensive management practices or moderately restrict the range of crops, or both	■ more severe limitations than Class 2 land ■ management practices more difficult to apply and maintain ■ limitations may: ▪ restrict choice of suitable crops ▪ affect timing and ease of tilling, planting or harvesting ▪ affect methods of soil conservation
4	limitations that require special management practices or severely restrict the range of crops, or both	■ may be suitable for only a few crops or may have low yield or a high risk of crop failure ■ soil conditions are such that special development and management conditions are required ■ limitations may: ▪ affect timing and ease of tilling, planting or harvesting ▪ affect methods of soil conservation
5	limitations the restrict capability to producing perennial forage crops or other specially adapted crops (e.g. cranberries)	■ can be cultivated, provided intensive management is employed or crop is adapted to particular conditions of the land ■ cultivated crops may be grown where adverse climate is the main limitation, crop failure can be expected under average conditions
6	not arable, but capable of producing native and/or uncultivated perennial forage crops	■ provides sustained natural grazing for domestic livestock ■ not arable in present condition ■ limitations include severe climate, unsuitable terrain or poor soil ■ difficult to improve, although draining, dyking and/or irrigation can remove some limitations
7	no capability for arable culture or sustained natural grazing	■ all lands not in Class 1 to 6 ■ includes rockland, non-soil areas, small water-bodies

LCA Classes, except Class 1 which has no limitations, have been divided into subclasses depending upon the type and degree of limitation to agricultural use. Tables 2 lists the subclasses used to describe limitations that may affect mineral soil.

Table 2: LCA Subclasses for Mineral Soil

LCA Subclass	Map Symbol	Description	Improvement
Soil moisture deficiency	A	used where crops are adversely affected by droughtiness, either through insufficient precipitation or low water holding capacity of the soil	irrigation
Adverse climate	C	used on a subregional or local basis, from climate maps, to indicate thermal limitations including freezing, insufficient heat units and/or extreme winter temperatures	n/a
Undesirable soil structure and/or low perviousness	D	used for soils that are difficult to till, requiring special management for seedbed preparation and soils with trafficability problems includes soils with insufficient aeration, slow perviousness or have a root restriction not caused by bedrock, permafrost or a high water table	amelioration of soil texture, deep ploughing or blading to break up root restrictions cemented horizons cannot be improved
Erosion	E	includes soils on which past damage from erosion limits erosion (e.g. gullies, lost productivity)	n/a
Fertility	F	limited by lack of available nutrients, low cation exchange capacity or nutrient holding ability, high or low pH, high amount of carbonates, presence of toxic elements or high fixation of plant nutrients	constant and careful use of fertilizers and/or other soil amendments
Inundation	I	includes soils where flooding damages crops or restricts agricultural use	dyking
Salinity	N	includes soils adversely affected by soluble salts that restrict crop growth or the range of crops	specific to site and soil conditions
Stoniness	P	applies to soils with sufficient coarse fragments, 2.5 cm diameter or larger, to significantly hinder tillage, planting and/or harvesting	remove cobbles and stones
Depth to solid bedrock and/or rockiness	R	used for soils in which bedrock near the surface restricts rooting depth and tillage and/or the presence of rock outcrops restricts agricultural use	n/a
Topography	T	applies to soils where topography limits agricultural use, by slope steepness and/or complexity	n/a
Excess Water	W	applies to soils for which excess free water limits agricultural use	ditching, tilling, draining
Permafrost	Z	applies to soils that have a cryic (permanently frozen) layer	n/a

2.2 Organic Soil

Organic soils are grouped into seven subclasses (Table 3) that are equivalent to those defined for mineral soils. Subclasses for Organic soils are based on the type and degree of limitation for agricultural use a soil exhibits.

Table 3: LCA Subclasses for Organic Soil*

LCA Subclass	Map Symbol	Description	Improvement
Wood in the profile	B	applies to organic soils that have wood within the profile	removal
Depth of organic soil over bedrock and/or rockiness	H	includes organic soils where the presence of bedrock near the surface restricts rooting depth or drainage and/or the presence of rock outcrops restricts agricultural use	n/a
degree of decomposition-permeability	L	applies to organic soils that are susceptible to organic matter decomposition through drainage	n/a

*Climate (C), Fertility (F), Inundation (I), Salinity (N), Excess Water (W) and Permafrost (Z) limitations are the same as defined for mineral soil

2.3 Unimproved and Improved Ratings

Most lands are given two ratings, unimproved and improved. Unimproved ratings are determined under the conditions that exist at the time of the survey; therefore past improvements are assessed under the unimproved rating.

Improved ratings are given when improvements can be implemented that will increase the LCA rating by alleviating the limitations.

3.0 REFERENCES

BC Ministry of Environment, Lands, and Parks and BC Ministry of Forests. (1998) Field Manual for Describing Terrestrial Ecosystems Land Management Handbook Number 25 < http://www.for.gov.bc.ca/hfd/pubs/Docs/Lmh/Lmh25/02-Soil.pdf > [Accessed June 2010]

Climatology Unit. (1981). Climate Capability Classification for Agriculture in British Columbia. APD Technical Paper 4. Air Studies Branch, BC Ministry of Environment, Victoria, BC.

Luttmerding, H. A. (1980). Soils of the Langley-Vancouver Map Area. Report No. 15, British Columbia Soil Survey. Volume 1. BC Ministry of Environment, Kelowna, BC.

Luttmerding, H. A. (1986). Land Capability for Agriculture Langley-Vancouver Map Area. BC Ministry of Environment, Victoria, BC.

APPENDIX II

Soil Management Recommendations

September 16, 2010
Report No. 10-1422-0026

Table 1: Soil Management Notes

Soil Name	Soil Management Group	General Soil Profile Description	Nutrient Holding Capacity	Water Holding Capacity	Soil Limitations	Drainage Limitations	Tillage / Erosion	Irrigation	Subsoiling	Lime / Fertilizer	Well Suited Crops	Suited Crops	Unsuited Crops
Albion	Scat	Moderately fine to fine textured glaciomarine deposits over dense, compact subsoil	relatively high	relatively high	poor drainage and compacted subsurface layers, often with a perched water table	drains at 12 m; gravity outlet may be problematic	timely tillage is required to minimize structural degradation	-	routine subsoiling required	-	none	annual legumes, blueberries, cereals, cole crops, corn, perennial forage crops and shallow rooted annual vegetables (except celery)	nursery and Christmas trees, raspberries, root crops, strawberries and tree fruits
Annis	Alouette and Blundell	15 to 40 cm of decomposed organic material overlying medium to moderately fine textured floodplain deposits	high	high	shallow organic layer limits rooting zone and water movement; variable depth to mineral soil results in uneven crop growth, slowly permeable subsoils	underdrains at 12 m; for perennial or overwintering crops drainage system must be operational year round	susceptible to water and wind erosion if surface bare and pulverized; cover cropping required to minimize erosion and maintain effectiveness of drainage system	-	periodic subsoiling required to break compacted layers and improve effectiveness of drainage system	requirements often high, organic soils often deficient in copper	none	annual legumes, blueberries, cereals, cole crops, corn, perennial forage crops, root crops (except carrots), shallow rooted annual vegetables	none
Berry	Berry	Medium textured marine deposits, compact subsoils at about 70 cm	moderate to high	moderate to high	Some drainage problems related to compacted subsoil; soils on slopes >5% are subject to erosion	underdrains at 16 m	timely tillage practiced required; where slopes are greater than 5%, erosions control practices are needed	-	-	-	annual legumes, blueberries, cereals, cole crops, corn, nursery and Christmas trees, perennial forage crops, root crops, and shallow rooted annual vegetables	raspberries, strawberries and tree fruits	none

Soil Name	Soil Management Group	General Soil Profile Description	Nutrient Holding Capacity	Water Holding Capacity	Soil Limitations	Drainage Limitations	Tillage / Erosion	Irrigation	Subsoiling	Lime / Fertilizer	Well Suited Crops	Suited Crops	Unsuited Crops
Cloverdale	Cloverdale	Moderately fine to fine textured marine deposits over dense, compact subsoils	high	high	poor soil drainage; dense compacted subsoils inhibit water movement and root development	underdrains at 10 m spacing	there is a narrow moisture content window during which these soils can be worked into a seedbed while minimizing compaction	required during summer months due to shallow rooting depth	recommended to open up dense subsoil	add organic matter to overcome adverse soil structure	none	annual legumes, cereals, cole crops, corn, perennial forage crops and shallow rooted annual vegetables (except celery)	nursery and Christmas trees, raspberries, root crops, strawberries, and tree fruits
Dewdney Fairfield	Fairfield	Medium to moderately fine textured floodplain deposits	moderately high	moderately high	excess water for some crops	a fluctuating water table is typical and may restrict rooting depth of some crops; may have excess water during part of the growing season for some crops; subsurface drains may be required for some crops	tillage operations should not occur when soils excessively wet		soils should be managed to promote infiltration and percolation with periodic subsoiling, organic matter maintenance and minimum tillage	-	annual legumes, blueberries, cereals, cole crops, corn, nursery and Christmas trees, perennial forage crops, root crops and shallow rooted annual vegetables	raspberries, strawberries and tree fruits	none
Hazelwood	Carvolth and Vedder	Fine to moderately fine floodplain deposits, slowly pervious	high	high	poor drainage, soils have a high clay content; a crop rotation which includes a perennial sod crop is recommended to maintain a favourable soil structure	due to high clay content, spacings of 16 m between underdrains are recommended	timely and appropriate operations are required. Working with clay soils at the wrong moisture content will break down soil structure which could result in compaction, poor aeration, crusting, and clod formation	-	periodic subsoiling is required to break up compacted layers and to fracture the subsoil, thereby enhancing the drainage system	moderately fertile; winter cover crop recommended to enhance infiltration and improve soil organic matter	none	annual legumes, blueberries, cereals, cole crops, perennial forage crops and shallow rooted annual vegetables (except celery)	nursery and Christmas trees, raspberries, root crops, strawberries, and tree fruits

Soil Name	Soil Management Group	General Soil Profile Description	Nutrient Holding Capacity	Water Holding Capacity	Soil Limitations	Drainage Limitations	Tillage / Erosion	Irrigation	Subsoiling	Lime / Fertilizer	Well Suited Crops	Suited Crops	Unsuited Crops
Hjorth Page Prest	Page, Pitt and Prest	Medium to moderately fine textured floodplain deposits	moderate to high	moderate to high	soils are very poorly drained; subsoils may limit root penetration; difficult to remove water from root zone quickly enough for some crops, high water table common	subsurface drains at 14 to 18 m (Hjorth 16 m, Page 18 m, Prest 14 m)	-	-	-	-	none	annual legumes, blueberries, cereals, cole crops, corn , perennial forage crops, root crops and shallow rooted annual vegetables	nursery and Christmas trees, raspberries, strawberries and tree fruits
Matsqui Monroe	Monroe	Medium textured floodplain deposits	moderate to high	moderate to high	none	-	-	climatic moisture deficit makes irrigation necessary during summer months for maximum production of some crops	-	-	annual legumes, blueberries, cereals, cole crops, corn, nursery and Christmas trees, perennial forage crops, raspberries, root crops, shallow rooted annual vegetables, strawberries and tree fruits	none	none
Sunshine	Columbia and Sunshine	Sandy littoral or glacial outwash deposits	low	low	low nutrient supplying ability; excessive stoniness; steep slopes	-	stone removal required for some soils	frequent applications of low volumes of water	-	subject to nutrient deficiencies; organic matter additions to improve water and nutrient holding capacities	none	annual legumes, blueberries, cereals, corn, nursery and Christmas trees	cole crops, root crops and shallow rooted annual vegetables

Soil Name	Soil Management Group	General Soil Profile Description	Nutrient Holding Capacity	Water Holding Capacity	Soil Limitations	Drainage Limitations	Tillage / Erosion	Irrigation	Subsoiling	Lime / Fertilizer	Well Suited Crops	Suited Crops	Unsuited Crops
Whatcom	Whatcom	Moderately fine textured glaciomarine deposits over compact subsoils	moderate to high	moderate to high	root zone and water movement restricted when impervious layer <50cm from surface	Underdrains should be spaced at 12 m for drainage and erosion control	bare soils will erode at slopes less than 5%; practices such as contour planting and cultivation, grasses waterways, interceptor drains, and stabilized drainage outlets are required to minimize soil loss	required for maximum production in some years; if root zone restricted irrigation required	subsoiling is required to maintain maximum root zone and to enhance water movement into and through the soils	-	perennial forage crops where slopes are less than 5%, annual legumes, cereals, cole crops, corn and shallow rooted annual vegetables where the depth to the impervious layer is greater than 50 cm, raspberries, root crops, strawberries and tree fruits	perennial forage crops, annual legumes, cereal, cole crops, corn, shallow rooted annual vegetables, nursery and Christmas trees, raspberries, strawberries and tree fruits	none except where slopes are steeper than 10% then perennial forage crops and tree fruits

At Golder Associates we strive to be the most respected global group of companies specializing in ground engineering and environmental services. Employee owned since our formation in 1960, we have created a unique culture with pride in ownership, resulting in long-term organizational stability. Golder professionals take the time to build an understanding of client needs and of the specific environments in which they operate. We continue to expand our technical capabilities and have experienced steady growth with employees now operating from offices located throughout Africa, Asia, Australasia, Europe, North America and South America.

Africa	+ 27 11 254 4800
Asia	+ 852 2562 3658
Australasia	+ 61 3 8862 3500
Europe	+ 356 21 42 30 20
North America	+ 1 800 275 3281
South America	+ 55 21 3095 9500

solutions@golder.com
www.golder.com

Golder Associates Ltd.
#300 – 2190 West Railway Street
Abbotsford, British Columbia, V2S 2E2
Canada
T: +1 (604) 850 8786

Golder Associates