

# **SCREENING LEVEL ASSESSMENT OF TWO SUMAS MOUNTAIN QUARRIES**

Prepared for:

**532470 BC Ltd.  
And  
Jamieson Quarries Ltd.**

Prepared by:

**Levelton Consultants Ltd.**  
150 – 12791 Clarke Place  
Richmond, BC V6V 2H9  
Canada

R.G. Humphries

Date: 7 June 2013

Files: EE10-2199-00 and EE10-2382-00

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## LIST OF ACRONYMS

BBS	Bianchini Biological Services
BCCDC	British Columbia Conservation Data Centre
BMP	Best Management Practices
CoA	City of Abbotsford
CoA SPB	City of Abbotsford's Streamside Protection Bylaw No. 1465-2005
CGPVT	Cleared/Gravel Pit Vegetation Type
CWD	Coarse Woody Debris
DFO	Fisheries and Oceans Canada
EMCP	Environmental Mitigation and Compensation Plan
FVC	Fraser Valley Conservancy
Gpm	gallons per minute
HADD	Harmful Alteration, Disruption or Destruction of fish habitat
L.S. 13	Sec 28, Twn 19, Plan L.S. 13
L.S. 16	Sec 29, Twn 19, Plan L.S. 16
532470 BC	A Numbered Company – operator of quarries
Levelton	Levelton Consultants Ltd.
Lot 2	Lot 2, Sec 29, Twn 19, Plan BCP03736
Lot S1/2	Lot S1/2, Sec 32, Twn 19, Plan SE1/4
M	Metre
MFLNRO	Ministry of Forests, Lands and Natural Resource Operations
MMFVT	Mature Mixed Forest Vegetation Type
MOE	Ministry of Environment
Jamieson	Jamieson Quarries Ltd.
MB	McKay Brook
OCP	Official Community Plan
QEP	Qualified Environmental Professional
SARA	Species at Risk Act
SMEA	Sumas Mountain Eligibility Area
SMP	Stormwater Management Plan
SPEA	Streamside Protection and Enhancement Area

SRDP	Soil Removal and Deposit Permit
SRS	Scott Resource Services Inc.
TOB	Top of Bank
WC	Watercourse
YDFVT	Young Deciduous Forest Vegetation Type

# 1. INTRODUCTION

This document provides a screening level assessment of two quarries operating at Sumas Mountain: the Summit Quarry operated by 532470 BC Ltd. (532470 BC) and the Jamieson Quarry operated by Jamieson Quarries Ltd. (Jamieson). The operators retained Levelton Consultants Ltd. (Levelton) to manage the environmental component and Levelton retained Scott Resource Services Inc. (SRS) in association with Bianchini Biological Services to undertake an Environmental Assessment (EA) of the aggregate quarries located on Sumas Mountain, Abbotsford, B.C.

The two operators currently have permits for aggregate extraction down to the 200 m elevation. They are now seeking approval to expand their operations for aggregate removal from the 200 m elevation down to the 170 m elevation. The two operators are requesting an amendment to their existing Soil Removal and Deposit Permits (SRDPs) for aggregate extraction within the Sumas Mountain Eligibility Area. The quarry operators plan to coordinate operations to lower the elevation of the working surfaces within the quarry footprints, from 200 m to 170 m. The overall footprint of the quarries will increase by approximately 20% (rounded to the nearest 5%). Each operator will submit their own application for the amendment for the Notice of Work, but for efficiency the EA covers both projects.

The original draft of the EA was prepared when it was expected that the City of Abbotsford's (CoA) Streamside Protection Bylaw would have to be applied. However, after discussions with the CoA, approval was given to follow the BC Ministry of Environment Riparian Areas Regulation (RAR) instead of the Abbotsford bylaw. Upon completion of negotiations with environmental regulators, the proponent's Qualified Environmental Professional will prepare an Environmental Mitigation and Compensation Plan (EMCP). The EMCP will provide options for offsite habitat compensation in order to achieve no net loss to the productive capacity of the watershed.

This summary report is based on:

- SRS's assessments of fish and wildlife habitat, and ecological communities that could be affected by the proposed mining activity,
- Levelton's desktop hydrological assessment, and
- Levelton's overview study of the Sumas Mountain aggregate resource mining and reclamation plan.

# 2. PROJECT OBJECTIVES AND JUSTIFICATION

In 2009 Levelton, under contract to CoA, conducted an overview study of the mining operations located on the south side of Sumas Mountain. The overview assessment was conducted in order to determine the feasibility of mining from the 200 m elevation down to 170 m and amending the former Official Community Plan (OCP) Bylaw (1483-2005) to reflect this. CoA Council has since approved OCP Bylaw, 2005, Amendment Bylaw No. 10-01 (No. 1957-2010) and has included the Sumas Mountain Eligibility Area (SMEA) into the OCP. This allows the CoA to review proposals to the 170 m elevation within the SMEA (CoA, 2010).

Aggregate resources in the Lower Mainland are in great demand and it makes sense from an economic and environmental standpoint to extract and haul these resources locally. By expanding the aggregate removal to the 170 m floor elevation, mining operations would be expected to continue for approximately 30 to 40 additional years (Levelton, 2009). This will inject money into the local economy and reduce fuel consumption and greenhouse gas emissions by keeping extraction and hauling operations local. The plan is to mine the area flat down to the 170 m level in



those areas where the 170 m contour is within quarry property. In other words the mine will be a plateau day lighted to the 170 m level.

As an alternative to expanding the existing quarry sites, new quarries could be developed in other regions of the Lower Mainland. However, this would have a larger ecological footprint as additional roads would need to be constructed and potentially undisturbed and intact habitat areas would be impacted.

In addition, future land use planning supports development within the SMEA. The groundwork will be laid out for such development to occur upon completion of mining to the proposed 170 m elevation. Utilities, transportation, sustainable stormwater management features, and protected areas will already be established.

### **3. GENERAL PROJECT DESCRIPTION**

#### **3.1 SITE DESCRIPTION**

532470 BC and Jamieson have existing approvals to mine down to the 200 m elevation for the quarries on the southern slope of Sumas Mountain, Abbotsford, B.C. (Figures 1 and 3). The total area of the two quarries is approximately 83 hectares and the zoning is One Unit Rural Residential and Resource Use Zone with the exception of Lot 1, Sec 32, Twn 19, Plan 64443 which is zoned One Unit Rural Residential Zone (RR2) and is presently not being used for any mining operations (CoA Web map, 2011).

Over half of the total area is being actively mined under existing permits for aggregate extraction to the 200 m floor elevation (yellow contour line in Figure 2). The forested areas of the site are primarily second growth, dominated by mature deciduous trees and shrubs and provide quality vegetation and wildlife habitat. The site maintains several groundwater seepages that ultimately discharge to the Sumas River. Residential properties to the north and east, mining quarries to the south, and a mining quarry and Kinder Morgan Canada Tank Farm to the west surround the site.

The study area for this assessment, therefore consists of the land within the property boundaries shown in Figures 2 and 3 plus any vegetation, habitat or water courses that are within 50 m of the property and which may be impacted by the quarry activities.

##### **3.1.1 532470 BC**

There are three properties currently being mined that are operated by 532470 BC within the Summit Quarry: Lot 2, Sec 29, Twn 19, Plan BCP03736 (Lot 2); Sec 29, Twn 19, Plan L.S. 16 (L.S. 16); and, Sec 28, Twn 19, Plan L.S. 13 (L.S. 13) (Figure 2). Access to the quarry is via Ward Road. The geology of this quarry consists mainly of igneous granitic rock (Levelton, 2009).

The Summit Quarry has an existing permit for extraction down to the 200 m floor elevation. 532470 BC estimates that mining down to the 200 m elevation will continue for approximately four more years.

The southern half of Lot 2 and east 2/3 of L.S. 13 have not been disturbed. Four groundwater seepages drain from the north and east side of the property into McKay Brook (MB), which drains through the northeast corner of the property and one unnamed tributary (WC19) transects properties L.S. 16 and Lot 2. For everything between the 200 m and the 170 m elevation that will be cleared, habitat compensation is proposed for impacts to this watercourse.

### 3.1.2 Jamieson Quarries

Three properties currently being mined are operated by Jamieson namely the Jamieson, Friesen and Emmerson lands. The respective properties include Lot S1/2, Sec 32, Twn 19, Plan SE1/4; Lot 2, Sec 32, Twn 19, Plan 64443; and, Lot 3, Sec 32, Twn 19, Plan 64444. Access to the quarries is via Ward Road. The geology of these properties consists mainly of igneous granitic rock (Levelton, 2009).

The quarries have existing permits for extraction down to the 200 m floor elevation. Jamieson estimates that mining to the 200 m elevation will continue for another ten to fifteen years.

The north and east perimeters of quarry operations slope into a ravine which has been relatively undisturbed. MB drains southeast through the ravine and across the northeast corner of the quarry. Five groundwater seepages drain from the north and east side of the proposed site towards MB. Three watercourses (WC 7, 12 and 18) and one pond (Pond 1) exist between the 200 and 170 m elevations. Between these contours, Pond 1, WC 7 and WC 12 will be removed and replaced with offsite compensation. WC 18 will remain in place with a 10m buffer zone. Pond 2 (above 200 m) will remain accessible per the current approved mining plan for clean-out of sediment from its storm water retention function.

## 4. PROJECT OVERVIEW AND SCOPE

### 4.1 PROPOSED ACTIVITIES

532470 BC and Jamieson are proposing to mine the existing quarries on the south slope of Sumas Mountain down from the 200 m elevation to the 170 m elevation. This will require clearing, extracting, and reclaiming the area while maintaining base flows to the two main watercourses draining the site, McKay Brook and Kilgard Creek.

#### 4.1.1 Clearing and removal of overburden materials

The undisturbed forested areas will require clearing down to the 170 m elevation. Clearing will be conducted between August 16<sup>th</sup> and March 14<sup>th</sup> to avoid nesting birds. If clearing is essential during the nesting period, a detailed raptor survey and bird nesting survey will be required prior to any clearing activities. If nesting birds are detected, clearing activities will require management plans with appropriate avoidance buffers and monitoring in order to protect and monitor the nesting birds while the works commence, or clearing will need to be avoided in affected areas until the birds have fledged. Timber resources will be harvested and overburden materials removed immediately after clearing. Overburden materials will be sorted by type and stockpiled in a location where they can be accessed and reused during reclamation upon completion of mining (Levelton, 2009).

#### 4.1.2 Quarry operations

The quarry operations consist of blasting, gravel crushing and screening, and hauling. The quarries will mine in approximate 15 m layers until mining is complete (Levelton, 2009). Blasting will continue as currently approved to the 200 m elevation. No additional facilities will be required for gravel crushing operations or for maintenance and fuel storage.

Transportation corridors already exist for hauling aggregates extracted down to the 200 m elevation. Both quarries utilize the Truck Route to link Ward Road with Atkinson Road and Highway 1. The Truck Route is a statutory right-of-way with a 10-year lease period (Levelton, 2009). All truck traffic exits via Ward Road to the truck route.

#### 4.1.3 Post-mining activities

Upon completion of mining, soil and substrate engineering may be required to provide infiltration and detention of groundwater seepages to maintain flows to downstream watercourses in order to mimic pre-existing flow rates, water quality, and watercourse features and functions.

### 4.2 FUTURE LAND USE

Future land use is ultimately contingent on the CoA's OCP Bylaw No. 1957-2010. Before the OCP Bylaw amendment, the future land use designations for the quarries were designated as a mix of Suburban Residential and Resource Conservation (Levelton, 2009). These designations may change before mining is finished, but in any event, future use will be based OCP requirements.

### 4.3 TIMELINE AND PHASING

Extraction to the proposed 170 m floor elevation will occur over 30 to 40 years. Therefore, works will be conducted gradually. Operations will continue in the same manner as currently approved to the 200 m elevation. Post-mining activities including any remedial works required will be conducted upon completion of mining down to the 170 m elevation.

## 5. REGULATORY FRAMEWORK

The regulatory framework and processes applicable to the project are outlined within the Levelton overview assessment prepared for the CoA in 2009. In 2010, since the overview assessment was prepared, OCP Bylaw No. 1957-2010 came into force allowing proposals within the SMEA to be reviewed by the CoA down to the 170 m elevation. Also in 2010, the CoA introduced the Erosion and Sediment Control Bylaw No. 1989-2010, which prohibits the discharge of sediment or sediment-laden water into any watercourse.

Specific to fish habitat as outlined in this assessment, the Provincial RAR provides the definition of fish habitat and outlines the SPEA widths for watercourses that are classified as streams providing fish habitat.

Subsection 35(1) of the federal *Fisheries Act* prohibits any harmful alteration, disruption or destruction of fish habitat (HADD) from occurring, unless otherwise authorized under Subsection 35(2). Subsection 36(3) of the *Fisheries Act* prohibits the release of deleterious substances either directly or indirectly into any fish bearing water.

Section 9 of the provincial *Water Act* requires that any changes in or about a stream be conducted under an approval in accordance with Part 7 of the provincial Water Regulation.

## 6. DESCRIPTION OF THE ENVIRONMENT

### 6.1 HYDROGEOLOGICAL ASSESSMENT

#### 6.1.1 Background

This section is based on Levelton's desktop hydrogeological assessment for the above-referenced properties and is provided in the accompanying documentation.

The quarries have been developed in predominantly Lower Jurassic<sup>1</sup> massive volcanic rocks of the Harrison Lake Formation, starting at elevations ranging from 220 to 250 m asl. The BC Geological Survey<sup>2</sup> has mapped the bedrock as intermediate, light coloured flows and pyroclastic<sup>3</sup> rock. There are small inclusions of fine-grained sediment and conglomerate present within the volcanic host rock. As the volcanic rock mass cooled, following its emplacement, an interconnected series of joints, faults and fractures developed.

The bedrock west of the quarries consists of Eocene aged<sup>4</sup>, undivided sedimentary rock of the Kitsilano Formation and includes conglomerate, sandstone, shale with lesser basalt flows and minor pyroclastics. The sedimentary rock inclusions within the Lower Jurassic volcanics are likely pieces of the Kitsilano Formation rocks.

The surficial deposits consist of Sumas Drift of varying thickness and locally developed colluvial and organic based soils. Sumas Drift includes glacial till, glacio-fluvial outwash sand and gravel and ice-contact sediments, deposited during the last Ice Age, between roughly 10,000 and 11,500 years ago. The surficial material did not form a continuous cover and has been stripped to facilitate the quarrying of bedrock.

Levelton conducted a visit in late January 2011 to review site conditions and to familiarize staff with the local geology and the hydrogeological setting. During inspections of the Jamieson Quarry, the Summit Quarry and the Western Rock Products Quarry on LS 9, our field observations of the geology matched the mapping described above.

### 6.1.2 Hydrogeological Setting

The quarries are located within a groundwater recharge area. Given the quarries' elevation and the surrounding topography, the only source of recharge for groundwater on Upper Sumas Mountain is precipitation. Rainfall records for Mission West and the Abbotsford Airport revealed that an average of 1,875 mm and 1,573 mm of precipitation falls annually at these stations, respectively. However, the precipitation on the top of Sumas Mountain may be as much as 25 to 40% higher than that recorded at lower elevations, due to orographic influences<sup>5</sup>. Although the majority of the precipitation falls between October and March, there is a significant portion of the annual precipitation that falls during the remainder of the year.

A portion of the precipitation falling on Sumas Mountain will return to the atmosphere via evapotranspiration. The remainder will initially be retained in the either unsaturated areas in the soil or within shallow, weathered and fractured bedrock. Some of the precipitation that recharges the unsaturated zone will flow through the subsurface towards local topographically low areas and discharge after a brief travel time<sup>6</sup>. The remaining precipitation will migrate vertically downwards through the unsaturated material and act as recharge to the shallow and deep groundwater flow systems.

Shallow groundwater and interflow may also be discharged as seepages in rock faces, where fractures 'daylight'. During the visit, Levelton staff noted seepage in the northeast corner of LS 9 and the central area of the Makara lot. We were unable to determine if this was shallow

<sup>1</sup> The Jurassic period ranged from 213 to 144 million years ago.

<sup>2</sup> BC Geological Survey Open File 1994-17, K. Bellefontaine, D. Alldrick and P.J. Desjardins.

<sup>3</sup> Pyroclastic rocks consist of fragmented particles, caused by volcanic explosions.

<sup>4</sup> The Eocene epoch ranged from 55 to 38 million years ago. Geologically, an epoch is a subdivision of a period.

<sup>5</sup> As moist air rises and cools over a mountain, precipitation is produced.

<sup>6</sup> Subsurface water that migrates through the unsaturated zone prior to discharge is not considered groundwater (which only occurs under fully saturated conditions) but is termed interflow.

groundwater or interflow. However, our site guide indicated that the flow tends to cease after prolonged periods in the summer with no precipitation, indicating that the flow is likely shallow seasonal groundwater.

Precipitation that falls on exposed bedrock will infiltrate directly, and then migrate deeper into the groundwater flow system under the influence of gravity, along faults, fractures and joints in the bedrock. The fracture system is likely complex and consists of both interconnected and discontinuous fractures of varying lengths, widths and continuity. The shallow and deep groundwater flow systems likely exhibit seasonal, and possibly annual, fluctuations in water levels, depending on the seasonal variability of precipitation.

There are two potential aquifers on Sumas Mountain. The first is a shallow, unconfined aquifer hosted in the surficial Sumas Drift deposits. Unconfined shallow aquifers tend to be hosted in sand and gravel deposited either by flowing water or glacial ice. Typically shallow aquifers dry up in summer after periods of minimal precipitation and during periods of high evapotranspiration. Because the water is present under fully saturated conditions, even if only for part of the year, it is considered groundwater and is commonly called a perched or seasonal water table.

The second aquifer is hosted deep within the bedrock. Groundwater flow through the massive bedrock tends to be complex and is typically controlled by the geometry and connectivity of fractures, faults and jointing. Well yields in bedrock aquifers, while suitable for domestic use, tend to be low, depending on the number and spacing of fractures intercepted during well drilling.

A thorough understanding of groundwater flow in bedrock aquifers requires detailed study and numerical modeling. This type of study has not been completed in the Sumas Mountain area. For the purposes of this report, groundwater flow is assumed to largely follow surface topography and move south towards the Fraser Valley under the influence of gravity

### **6.1.3 Water Quality**

Levelton was unable to review any water quality data for local wells, as none was listed in the *BC Water Resources Atlas*. However, we expect that the shallow groundwater surrounding the quarries is of high quality, as it is derived from precipitation and has short residence times as both surface and groundwater flow. Locally, the surficial deposits may have high organic content that may contribute to elevated concentrations of iron, manganese, tannins and lignins. Levelton expects these areas are small and uncommon on Sumas Mountain.

The deeper groundwater is likely also high quality, as the predominantly volcanic rocks are resistant to weathering and groundwater residence time is also relatively short.

### **6.1.4 Water Well Records**

Levelton reviewed water well and aquifer information contained in the *BC Water Resources Atlas*, an on-line database maintained by the Ministry of Environment (MOE). This database was populated with well logs that were submitted on a voluntary basis by water well drillers or well owners. Well logs were not subjected to quality checks and frequently use different terms when referring to the same deposit. Nevertheless, they form a valuable database for assessing hydrogeological settings. Aquifers that are presented in the database were mapped largely on the basis of water well records, surficial geology mapping and topographic or physical features.

There were no aquifers identified on Sumas Mountain by the MOE, as there are too few water wells to allow complete aquifer mapping. However, numerous water well records submitted to the database show essentially two main types of wells – shallow dug wells that are developed in the surficial deposits and deeper, drilled bedrock wells. The well logs reviewed by Levelton are

presented in Appendix 1 of the attached hydrogeological assessment. Well tag numbers match those presented in Figure 6.

As shown in Figure 6, there are numerous water wells located on Keeping Road to the north of the existing quarries, on Sumas Mountain Road to the west, and on Ward Road to the south. There may be additional wells in the area that are not listed in the database as well drillers and owners are not required to submit well records. The locations of the wells in the database are approximate and their status and use are unknown.

A summary of the information in the *BC Water Resources Atlas* for the shallow wells, dug in surficial deposits shows that well yields are generally very low (Table 1 – well numbers correspond to those shown in Figure 6) and numerous well logs contain comments related to the well drying up or being inadequate during summer months. It is likely that these shallow wells were developed into a perched water table that contains enough groundwater for domestic use for most of the year, but dries up in late summer.

**Table 1: Summary of Shallow Well Information near Sumas Mountain Quarries.**

Well Number	Location	Depth (m)	Material	Driller Estimated Well Yield (gpm)
6628	Keeping Rd	3.65	Glacial clay	0
6684	Keeping Rd	3.65	Glacial hardpan	0 (Insufficient in dry season)
6686	Sumas Mtn Rd	4.57	Glacial	0 (Insufficient in dry season)
6642	Sumas Mtn Rd	5.49	Glacial	0
6777	Sumas Mtn Rd	3.05	Glacial quicksand	0 (Insufficient in dry season)
6710	Sumas Mtn Rd	6.40	Glacial	0 (Insufficient)

Although there are no records of shallow wells along Ward Road, Levelton is aware of one shallow, dug well located at 37316 Ward Road<sup>7</sup>. The well is roughly 8 m (25 feet) deep and is located in the unnamed watercourse that originates within the Summit Quarry at 37403 Ward Road. According to the previous property owner, the unnamed watercourse tends to dry up in late summer; however, this well has been able to supply the three residences located at 37314 and 37316 Ward Road. Levelton has been unable to assess the validity of this observation.

Figure 6 also shows the approximate locations of several deep, bedrock wells, including four wells drilled on properties located on Ward Road. There does not appear to be any pattern to the location or depths of the wells. The well records indicate that the wells ranged from 60 to 160 m in depth and that yields were generally low, which is typical of bedrock wells. One well on Keeping

<sup>7</sup> Overview Study, Sumas Mountain Aggregate Resource Mining and Reclamation Plan; Levelton File Number FV08-0434. June 2009.

Road had an estimated yield of 1.9 L/s (30 gpm), which is high for a well drilled in bedrock. This well likely was drilled into an area where a number of fractures intercepted or into a local fault zone. A summary of well information for bedrock well logs in the *BC Water Resources Atlas* is listed in Table 2. The wells along Ward Road ranged from 60 to 65 m deep and reported yields were low.

**Table 2: Summary of Deep Well Information near Sumas Mountain Quarries.**

Well Number	Location	Depth (m)	Material	Driller Estimated Well Yield (gpm)
101305	Keeping Rd	129.5	Shale	1
101306	Keeping Rd	99	Shale	1.25
67529	Keeping Rd	160	Bedrock	30
100947	Sumas Mtn Rd	61	Grey sandstone	3
1177	Ward Rd	67	Shale, bedrock, granite	0
47355	Ward Rd	67	Green bedrock, granite	0
52147	Ward Rd	61.5	Green granite, black shale quartz, some limestone	0.5
52102	Ward Rd	61.5	Black shale, green granite	1

Figure 6 indicates a well on the property north of Ward Road (Well 75552), which appears to be within the Makara lot. The well record shows that it was drilled for Mr. Jamieson in 1984 and the well yield was 0 gallons per minute (gpm). No other information regarding well depth, water level or whether this well is bedrock or shallow, dug well is listed. Levelton is of the opinion that the indicated location of this well is likely inaccurate and that it is located near the former Jamieson residences, north of its indicated location.

However, there is likely at least one well serving the residence located just west of the Makara lot, near the intersection of Ward Road and Sumas Mountain Road. Levelton was unable to find any well records for wells on this property in the *BC Water Resources Atlas*.

## 6.1.5 Potential Recharge Impacts

### 6.1.5.1 Unnamed Creek (WC 19)

Levelton understands that the unnamed creek currently flows virtually year round, although anecdotal information from both the former owner of 37316 Ward Road and Levelton's site guide indicated that the flow slows considerably or dries up completely during late summer, depending on the severity of the summer. During our site visit, Levelton observed an area of undisturbed overburden on both sides and upslope of the unnamed creek. The surficial deposits, as well as the sedimentation ponds observed on the Summit Quarry, likely serve as a source of recharge to the



unnamed creek during periods of non-precipitation and provide base flow to the creek on a year round basis.

Currently the water in the unnamed watercourse is derived from a combination of overland (surficial) flow, interflow and shallow groundwater during wet winter months and primarily from shallow groundwater during dry parts of the year. Winter precipitation saturates the surficial deposits, which discharge base flow into the unnamed watercourse during periods of low or no precipitation. The unnamed watercourse is a local groundwater discharge zone.

Based on Levelton's field visit and background information review, Levelton understands that the lowering of the pit floors to elevation 170 m, from elevation 200 m will involve:

1. removal of soil cover and vegetation surrounding the unnamed creek;
2. flattening the overall site topography; and
3. effectively eliminating any surficial deposits within the quarry footprints.

Any area where drilling and blasting occurred, the resulting fractured rock will likely allow winter precipitation to infiltrate and recharge the unnamed creek.

Removal of the surficial deposits will likely have a direct impact on the unnamed creek and the shallow well discussed above that has supplied the three residences on Ward Road. The removal of the surficial deposits surrounding the unnamed watercourse and the lowering of the quarries to elevation 170 m will essentially eliminate the storage of shallow groundwater within the surficial deposits and disrupt the area that contributes recharge into the watercourse. Disruption of the recharge may reduce or eliminate both interflow and the flow of shallow groundwater into this well and may cause either periodic or permanent water shortages for the well users. It may be possible to mitigate this loss of recharge water by developing a series of large sedimentation ponds on the upstream portions of the Makara property or the Summit Quarry.

#### **6.1.5.2 Nearby Shallow Wells**

As discussed, lowering the pit floors to elevation 170 m will involve removing the soil cover and vegetation (if present) and flattening the overall site topography. Recharge of the bedrock aquifer will be via direct infiltration. Discussions with the quarry operators indicate that drilling and blasting tends to fracture the rock below the excavation level. As a result, water is not observed to accumulate in the quarries, but instead percolates into the subsurface. The impacts to nearby offsite, shallow wells due to the removal of glacial, deposits within the quarry footprints is likely negligible.

#### **6.1.5.3 Bedrock Wells**

Depending on the slope and configuration of the working areas within the quarry footprints, recharging precipitation may infiltrate the bedrock more quickly and may enhance the groundwater levels and volumes within the bedrock aquifer. However, faster runoff times and shorter runoff distances may offset the increased recharge, as precipitation flows across the working surface into engineered catchment areas or towards the property boundaries.

The blasting associated with lowering the quarry floors may also impact well water quality or quantity. The property owner at 37314 Ward Road reported that the well deteriorated following blasting and that the well was abandoned as a result. In addition, the well owner at 37226 Keeping



Road (Well 101305) has experienced silt or sand in the well since 1995<sup>8</sup>. Whether the problems with silt and sand were related to blasting was not discussed in the background reports that Levelton reviewed.

Levelton is familiar with changes in groundwater quality and quantity elsewhere in BC due to blasting vibrations being transmitted through bedrock. Impacts may include changes in water chemistry as well as increases in turbidity and sand content. Occasionally increases or decreases in yield have also been noted by well users, as blasting has either opened fractures or caused them to close. Given the distances between the bedrock wells and the quarries, and given the well depths, Levelton is of the opinion that impacts on the bedrock wells will be negligible.

## **6.2 DESCRIPTION OF BIOPHYSICAL ENVIRONMENT**

### **6.2.1 Surface Water**

As noted in the previous section based on the hydrogeology of the area, precipitation infiltrates into the overburden and is retained within the fractures of the bedrock until seeping out at a lower elevation, becoming a surface flowing watercourse. Flow measurements were collected previously by SRS at three different locations along WC19. It was noted that flows increased as they moved downstream suggesting that there is a “continuous and increasing input of groundwater” seeping out of the bedrock (SRS, 2008).

In active mining areas within the proposed site the infiltration capacity is temporarily removed until blasting commences and new fractures are produced to capture the surface runoff. The surficial runoff of stormwater will be directed towards drainage ditches and sediment detention ponds for infiltration. The sediment detention ponds also improve the quality of the water by removing suspended solids prior to being released to the environment.

### **6.2.2 Fish and Fish Habitat**

SRS conducted the fish habitat assessment of the watercourses that would be potentially impacted by the proposed mining expansion. The assessment was conducted on February 1, 2 and March 16, 17, 23 and 31, 2011 by Selena Shay (BSc), Ryan Anaka (MSc, BA Geog.) and Remi Masson (BSc, Dipl.Tech.) of SRS. Quality assurance of the field assessment was conducted by Patrick Ehnes (R.B.Tech., ASCT) on October 31, 2011 to confirm findings of the fieldwork.

Watercourses were classified using the RAR. The functions, features and conditions within and adjacent to each watercourse are summarized below and described in detail in the attached report and Appendices. Watercourse locations have been professionally surveyed.

#### **6.2.2.1 Watercourses Within the Proposed Site**

Three watercourses, a pond, and a wetland that offered poor to marginal fish habitat conditions and occurred within the subject properties between the 200 m and 170 m elevations (Table 3 and see also Attachment 4 in Appendix 2 of the SRS assessment report) were noted. The proposed works will permanently affect these watercourses.

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<sup>8</sup> *Hydrogeological Report 37124 Keep Road, Sumas Mountain, Abbotsford BC.* Morrow Environmental Consultants File V0-948, February 2001.

**Table 3: Classification of watercourses within the subject properties and between the 200 m to 170 m elevations.**

<b>Watercourse identifier</b>	<b>Description</b>	<b>Classification (RAR)</b>	<b>Stream (Y/N) per RAR</b>
WC1	Not a stream; discharges towards MB when flowing	Non-permanent, non-fish bearing	N
WC2	Not a stream; discharges towards MB when flowing	Non-permanent, non-fish bearing	N
WC4	Not a stream; discharges towards MB when flowing	Non-permanent, non-fish bearing	N
WC6	Not a stream; terminates to ground	Non-permanent, non-fish bearing	N
WC7	Discharges from Pond 1 and is a tributary directly connected to MB	Permanent stream, non-fish bearing	Y
WC8	Not a stream; discharges into WC7 when flowing	Non-permanent, non-fish bearing	N
WC12	Tributary directly connected to MB	Non-permanent, non-fish bearing	Y
WC17	Not a stream; terminates to ground	Non-permanent non-fish bearing stream	N
WC18	Discharges from Pond 2 and is a tributary directly connected to MB	Permanent non-fish bearing stream	Y
WC19	Tributary to the Sumas River	Permanent fish bearing stream	Y
Pond 1	Tributary directly connected to WC7	Permanent stream, non-fish bearing	Y
Wetland 1	Tributary directly connected to WC19	Permanent non-fish bearing stream	Y

#### **6.2.2.2 Watercourses Adjacent to the Subject Properties and/or Outside of the 170 m to 200 m Elevation**

Watercourses within the immediate area and outside of the property boundaries were also assessed. Eleven watercourses offering poor to marginal fish habitat conditions were located

adjacent to the subject properties and/or outside of the 170 m to 200 m elevation (SRS assessment report). Classifications of the watercourses are per the RAR.

**Table 4: Classification of watercourses adjacent to the subject properties and/or outside of the 170 m to 200 m elevation.**

Watercourse identifier	Description	Classification (RAR)	Stream (Y/N) RAR
MB	Tributary to the Sumas River	Permanent fish bearing stream	Y
Kilgard Creek	Tributary directly connected to the Sumas River	Permanent fish bearing stream	Y
WC3	Tributary directly connected to MB	Permanent non-fish bearing stream	Y
WC5	Tributary directly connected to MB	Permanent non-fish bearing stream	Y
WC9	Not a stream; terminates to ground	Non-permanent, non-fish bearing	N
WC10	Tributary directly connected to MB	Non-permanent, non-fish bearing	Y
WC11	Tributary directly connected to MB	Permanent non-fish bearing stream	Y
WC13	Tributary directly connected to MB	Permanent stream, potentially fish accessible	Y
WC14	Tributary directly connected to WC13	Permanent non-fish bearing stream	Y
WC15	Tributary directly connected to WC13	Permanent non-fish bearing stream	Y
WC16	Tributary directly connected to WC13	Permanent non-fish bearing stream	Y
Pond 2	Tributary directly connected to WC18	Permanent non-fish bearing stream	Y

## 6.3 VEGETATION AND WILDLIFE

### 6.3.1 BACKGROUND

SRS requested Bianchini Biological Services (BBS) to conduct a site assessment of the subject properties. BBS undertook a preliminary site assessment of the study area on September 8, 2009, a winter assessment in February 4, 2010 and spring assessments on May 5, 2010 and May 19, 2011.

The site was assessed for occurrences of species listed under the Federal *Species at Risk Act* (SARA), provincially Red and Blue-listed species and for general wildlife and vegetation species as well as raptor/heron nests and current wildlife use. As per the CoA's Wildlife Assessment Report Guidelines (April 2010), a wildlife habitat report was also requested from the Fraser Valley Conservancy (FVC).

The study area fell within the Georgia Depression Ecoprovince, Lower Mainland Ecoregion, and Fraser Lowland Ecoregion. The study area was situated in the Dry Maritime Coastal Western Hemlock Biogeoclimatic subzone.

### 6.3.2 METHODS

Prior to the field assessment, a literature search was conducted covering the Sumas Mountain area of Abbotsford, including British Columbia Conservation Data Centre (BCCDC) searches, Wildlife Tree Stewardship Program, FVC wildlife report and local knowledge. The CoA and provincial web mapping services were also reviewed to obtain the most current aerial imagery. Area calculations were obtained using online mapping tools. The BCCDC website was searched for all species listed under SARA, the Committee on the Status of Endangered Wildlife in Canada, Provincial Identified Wildlife and the Provincial *Wildlife Act* that are suspected to occur within habitats identified within the study area. In addition, species listed as Red and Blue-listed by the BCCDC but not specifically covered under legislation were also included. Data was also requested from the BCCDC for all records within 2 km of the study area.

Random transects were surveyed through all habitats identified during the site assessment. Vegetation species within each site were identified and recorded. In addition, the presence of coarse woody debris (CWD), wildlife trees, dens, burrows and other habitat features were also recorded. All wildlife trees were classified according to methodologies identified by Backhouse (1993) and Fenger et al. (2006).

Pacific water shrew habitat was assessed following methodologies described by Craig and Vennesland 2008. Potential raptor/heron nest trees were scanned visually with binoculars. All wildlife and wildlife sign encountered was recorded.

### 6.3.3 FEDERALLY AND PROVINCIALLY LISTED SPECIES OF CONCERN

Thirteen federally and/or provincially listed species whose geographic range overlap the subject properties and preferred habitats may occur within the Summit Quarry and Jamieson Quarry study area. These species are listed in Table 5.

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Species	Federal/Provincial Status		Legislation			Site Occurrence
Common/Scientific Name	COSEWIC/SARA Status	BCCDC Status*	SARA	Provincial Identified Wildlife	Provincial Wildlife Act	Expected Onsite Habitat Use
Vegetation:						

Species		Federal/Provincial Status		Legislation		Site Occurrence
Common/Scientific Name	COSEWIC/SARA Status	BCCDC Status*	SARA	Provincial Identified Wildlife	Provincial Wildlife Act	Expected Onsite Habitat Use

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## 6.3.4 RESULTS

### 6.3.4.1 Vegetation Overview

Three vegetation types were identified within the study area:

1. Mature Mixed Forest Vegetation Type
2. Young Deciduous Forest Vegetation Type
3. Cleared/Gravel Pit Vegetation Type

The location of each of these vegetation types, representative photographs of and a list of observed vegetation species in each type were provided by BBS. The three vegetation types located within the subject area are described below.

#### **Mature Mixed Forest Vegetation Type**

The Mature Mixed Forest Vegetation Type (MMFVT) occurred within the northeast portions of LS 13 and Lot S1/2. This generally steep (~40 - 80%), northeast facing (~028° - 055°) forested area was dominated by mature big leaf maple (*Acer macrophyllum*) with western redcedar (*Thuja plicata*), red alder (*Alnus rubra*), western hemlock (*Tsuga heterophylla*) and occasional Douglas-fir (*Pseudotsuga menziesii*), paper birch (*Betula papyrifera*) and black cottonwood (*Populus balsamifera trichocarpa*). The patchy shrub layer was dominated by sparse to dense areas of salmonberry (*Rubus spectabilis*) and snowberry (*Symphoricarpos albus*). The herb layer was dominated by sword fern (*Polystichum munitum*) and youth-on-age (*Tolmiea menziesii*). MB occurred within this vegetation type. In addition, a number of small watercourses, seepages and ephemeral drainages also occurred within this vegetation type (Figure 4).

#### **Young Deciduous Forest Vegetation Type**

The Young Deciduous Forest Vegetation Type (YDFVT) was mainly situated within Lot 2 and LS 16 and occurred along an intermittent, unnamed watercourse (WC19). Portions of WC19 appeared to have been mechanically trenched. A road also bisected this drainage with no evidence of a culvert connecting the headwaters (eastern end) to the downstream portion. This vegetation type was dominated by young red alder with salmonberry and thimbleberry (*Rubus parviflorus*). The herb layer was dominated by abundant cover of lady fern (*Athyrium filix-femina*) with occasional bracken fern (*Pteridium aquilinum*), stinging nettle (*Urtica dioica*), youth-on-age, common horsetail (*Equisetum arvense*) and bleeding heart (*Dicentra formosa*).

Two moderate-sized (~10m x 6m) ponds formed a riparian complex and occurred within Lot 2 with the upper pond likely created by the bisecting of the drainage by an access road. The vegetation surrounding these ponds were dominated by willow (*Salix* spp.), red alder with patches of skunk cabbage (*Lysichiton americanus*), gramanoids and aquatic obligates.

A smaller (~3m x 5m) anthropogenic pond occurred at the eastern tip of the YDFVTA. This shallow (<50 cm deep) pond was likely created by the side broadcast of material from the surrounding gravel extraction operation. Young red alder dominated the edge of the gravel bank surrounding the pond. The shrub and herb layer was very sparse and a large algae bloom was evident. No CWD was observed within or adjacent to the pond.

#### **Cleared/Gravel Pit Vegetation Type**

The Cleared/Gravel Pit Vegetation Type (CGPVT) was situated throughout most of the study area. This habitat was heavily disturbed with recent clearing occurring at the southwest portion of Lot S1/2 and northern portions of Lot 2 and LS 16 and southwest portion of Lot S1/2. Active gravel extraction occurred in most of Lot S1/2, LS 13 and LS 16.

#### **6.3.4.2 Wildlife Trees**

A wildlife tree is any standing dead or living tree with special features that provides present or future important habitats for the maintenance or enhancement of wildlife. There are nine classifications of coniferous and six classes of deciduous wildlife trees in various successions from live and healthy with no decay, to stumps and debris (Fenger et al. 2006). All of these wildlife tree stages provide important habitat, and are known to support more than 90 animal species in British Columbia, including cavity nesting birds and mammals (Backhouse 1993). Some of the uses include nesting, feeding, territoriality (i.e. bear mark trees, bird singing sites, etc.), roosting, shelter, and overwintering (Backhouse 1993).

There are nine decay classes of coniferous trees and six decay classes of deciduous trees within British Columbia (Fenger et al. 2006). Most of the trees observed in the study area were identified as Class 1 wildlife trees. Class 1 wildlife trees are described as live healthy trees with no decay. Class 2 to 7 wildlife trees were also identified within the study area. Most of the decayed trees were situated in the mature portion of the MMFVT.

No active nests were observed within the study area during the field program. Nest cavities (likely from this breeding season) were detected in many of the wildlife trees observed. A number of old cavities were also observed in many of the wildlife trees encountered. These trees also provided habitat for many bird and mammal species including songbirds, squirrels and bats.

#### **6.3.4.3 Coarse Woody Debris**

CWD is typically described as woody debris greater than 0.3 m in diameter. CWD provides important foraging, nesting, and cover components in the forested ecosystem for small mammals (Anonymous 1991). Many insectivorous small mammals, birds, and black bears feed on insects found in decomposing woody material. CWD provides a safe, moist environment in which species such as salamanders and shrews can forage and seek shelter.

Limited CWD cover (<1%) was recorded within the MMFVT. Moderate cover of CWD (1-10%) was recorded in portions of the YDFVT. No CWD was observed in the CGPVT.

#### **6.3.4.4 Potential Vegetation Species and Ecological Communities with Special Federal/Provincial Status that May Occur in the Study Area**

##### **Pacific Waterleaf**

No Pacific waterleaf was detected within the study area during the field program. The Pacific waterleaf has been Red-listed by the BCCDC (2011). This species is typically found in lowland moist forests and streambanks (Klinkenberg 2006). Within BC it has been found on southern Vancouver Island and the lower Fraser Valley. No BCCDC records for this species occurred within 2 km of the study area.

##### **Phantom Orchid**

No phantom orchid plants were detected within the study area during the field program. The phantom orchid has been listed as threatened by SARA and is on the provincial Red List. In Canada, it is found only in the extreme southwest of British Columbia with populations on the



Saanich Peninsula of Vancouver Island, Saltspring Island, and the lower Fraser Valley on the mainland. While suitable habitat exists throughout the Fraser Valley and additional locations may turn up in the future, the overall range of the species is unlikely to change. This plant has a very restricted distribution in Canada. The phantom orchid is known to have occurred at twelve sites in Canada, but it now occurs at only eight of these. There are few individuals at each site for a grand total for all sites of probably less than 100 individuals (EC1 2011). The phantom orchid grows in the humus litter in coniferous forests with little or sparse ground cover, but at one site, it grows on limestone tailings from a quarry. It is often found at the base of mature birch trees. The species prefers low mountains or hills, where it usually occurs on south or west facing slopes (EC1 2010).

### **Tall Bugbane**

Tall bugbane was not detected during the field program. It has been listed as endangered by SARA and is on the provincial Red List. This plant grows west of the Cascade Mountains from Oregon to Washington, and north to southern British Columbia where it is confined to the Chilliwack Valley. No BCCDC records for this species occurred within 2 km of the study area. This species grows in deciduous and mixed wood forests, mainly composed of bigleaf maple, red alder, Douglas-fir, and western redcedar. Preferred habitat characteristics include small gaps in the forest canopy resulting from windthrow, fire or the death of older trees, as they allow sufficient light to penetrate the understorey. Tall bugbane is also found in disturbed habitats, along road-cuts and in recently logged areas, where plentiful light favours its growth. However, on these artificially open sites it is quickly out-competed by species more adapted to open habitats (Fontaine and Douglas 1999).

### **Ecological Communities**

The BCCDC defines listed ecological communities as ecosystems identified in a Sensitive Ecosystems Inventory. These sites are generally old growth stands that are generally 500 m<sup>2</sup> or greater. These ecosystems are often the remnants of the natural ecosystems that once occupied a much larger area. Typically, mature and old growth upland ecological communities are of concern to the BCCDC. In addition, all listed riparian, wetland and estuarine communities at any growth stage are also of concern to the BCCDC (K.A. McIntosh pers. comm.). The listed ecological communities are classified using methodologies and nomenclature developed by Green and Klinka (1994).

The forested portions within the study area were second to third growth stands. The upper and midslopes of the MMFVT were classified as the Blue-listed Western Redcedar / Sword Fern Dry Maritime (Site Series 05) and the riparian area of Lot S1/2 and LS 13 was classified as the Bluelisted Western Redcedar - Foamflower (Site Series 07) ecological communities.

#### **6.3.4.5 General Wildlife Observations**

Wildlife sign and activity was recorded throughout the study area. Songbirds were observed flying and feeding in vegetation throughout the site. Columbian black-tailed deer (*Odocoileus hemionus columbianus*) trails, beds and pellets were also observed. The SARA and provincially listed Oregon forestsnail and red-legged frog were detected during the field program. In addition, active dens of the SARA and provincially listed mountain beaver were observed within LS 13 and adjacent to the study area; approximately 85 m north of Lot S1/2.

#### **6.3.4.6 Wildlife Habitat Assessment**

Habitats were assessed for the ten wildlife species listed in Table 5. The following are the results of the habitat assessment for each of the ten species.

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#### **6.3.4.7 Wildlife Corridors**

Moderately used wildlife trails, attributed to Columbian black-tailed deer, were detected within the study area. These animals appeared to travel through the site to adjacent properties not impacted by gravel extraction.

### **6.3.5 CONCLUSIONS AND DISCUSSION**

#### **6.3.5.1 General Summary**

Given the extreme modification of the topography in the proposed mine site (200m down to 170m) there will be no opportunity to retain vegetation communities or wildlife habitats within the proposed mining area. There is a significant amount of offsite habitat compensation that is being implemented to address fish habitat impacts due to the mine. The fish habitat that is being created as compensation will include areas of riparian habitat that will also benefit the wildlife species that may have utilized habitats in the proposed mine site.

#### **6.3.5.2 Vegetation and Ecological Communities**

No SARA listed vegetation species were detected during the field program. The Blue-listed Western Redcedar / Sword Fern Dry Maritime (Site Series 05) and the Blue-listed Western Redcedar - Foamflower (Site Series 07) ecological communities were observed within the study area. No Best Management Practices (BMP's) currently exist for ecological communities. These ecosystems are important to many wildlife species and are of special concern due to development pressures.

#### **6.3.5.3 Wildlife Trees**

Most wildlife trees in the study area were identified as Class 1 wildlife trees. Class 2-7 wildlife trees occurred within the YDFVT and MMFVT. Wildlife trees provide important habitat for cavity nesting birds and roosting bats. Currently, no BMP exists for wildlife trees. Coarse Woody Debris

Limited CWD cover was recorded within the MMFVT. Moderate cover of CWD was recorded in portions of the YDFVT. No CWD was observed in the CGPVT. CWD is important for many small mammals, amphibians, reptiles and invertebrates. Currently, no BMPs exist for wildlife CWD.

#### **6.3.5.4 Wildlife**

Signs of deer, woodpecker and passerines were also detected within the study area. The treed portions within the forested sections of the study area provided potential breeding/roosting habitat for passerines, woodpeckers and a number of bat species.

#### **6.3.5.5 Wildlife Corridors**

Moderately used wildlife corridors were observed throughout the MMFVT during the field survey. Well-defined trails were particularly evident along the riparian area of MB. These trails appeared to be used by deer accessing various habitats surrounding the study area. These wildlife corridors provided connectivity to adjacent feeding areas and alternate security habitats for many wildlife species. Wildlife corridors also provide important links and ensure the integrity of ecosystems. Wildlife corridors adjacent to the study area will be maintained.

#### **6.3.5.6 Legislation**

Under the Provincial *Wildlife Act* all native wildlife species listed in the Act are protected. Under SARA all listed wildlife are protected. In addition, defined critical habitats on Federal lands are also protected. Although SARA protects defined critical habitats on Federal lands the "Safety Net" clause gives local governments the first opportunity to prevent the up-listing of any species listed in the Act. If local governments do not prevent the up-listing of a species then the Minister of Environment may order that the provisions of Sections 32 and 33 of SARA apply to the species of concern. To date no critical habitats have been defined for the above mentioned species, although management options are suggested in the most recent BMPs available for each species.

### **6.4 EFFECTS ON BIOPHYSICAL ENVIRONMENT**

#### **6.4.1 Surface water**

Surface water runoff will be collected from hard surface areas including roads and directed to stormwater retention/recharge areas for treatment and infiltration to ground. This will allow treated surface water to recharge the groundwater aquifers and maintain flow paths and flow rates to the seepage watercourses draining the site. A stormwater management plan (SMP) will be prepared consistent with the BC Ministry of Environment's regulatory requirements.

#### **6.4.2 Fish habitat component**

Three streams, a wetland, and one pond providing fish habitat will be impacted by mining down to the 170 m elevation including: WC7; WC12; WC19, Wetland 1, and Pond 1. All other watercourses are either located outside of the property boundaries, located outside the 170 m to 200 m elevation, or are not considered streams under the RAR. Per the RAR, WC7, WC12, WC18, and WC19

would require a 10 m wide SPEA from the high water mark (HWM). Pond 1 and Wetland 1 will require a 15 m wide SPEA on the west, north, and east sides, and a 30 m wide SPEA on the south side. As Wetland 1 is on the southern boundary of Lot 2, only impacts that will occur on the subject property will be compensated for. Fish habitat impacts have been calculated using the RAR SPEA designations and surveyed watercourse locations. A professional survey of watercourses has been conducted. The fish habitat impacts are shown the watercourse and fish habitat assessment and are summarized in Table 6 below.

**Table 6: Instream and riparian habitat impacts associated with the proposed works.**

Feature	Habitat Impacts (m <sup>2</sup> )
Wetland 1	9,561.5
Pond 1	2,478.7
WC7	2,580.7
WC12	673.0
WC19	2,355.5
<b>Total habitat loss</b>	<b>17,649.4</b>

Approximately 17,650 m<sup>2</sup> of fish habitat will be impacted during the proposed works. These impacts will result in a HADD and will require Authorization under Subsection 35(2) of the federal *Fisheries Act*. These impacts will also result in changes in and about a stream and will require Approval under Section 9 of the provincial *Water Act*.

#### 6.4.3 Fish habitat impacts

The proposed mining activities between the 200 m elevation and the 170 m elevation will result in a loss of approximately 17,650 m<sup>2</sup> of fish habitat.

#### 6.4.4 DISCUSSION AND CONCLUSIONS

The proposed expansion of mining operations will permanently impact fish, vegetation and wildlife habitat. The environmental consultants understand that the proposed mining operations will result in a HADD and will require Authorization under Subsection 35(2) of the federal *Fisheries Act*. Approximately 17,650 m<sup>2</sup> of fish habitat will be impacted during the proposed mining expansion. Offsite fish habitat compensation has been negotiated with DFO to address the impacts from the first phase of mining down to the 200m elevation. DFO has authorized the HADD for Phase 1. The proponents are currently negotiating an addendum to the Authorization to address the Phase 2 (down to 170m) impacts. The proposed mining operations will also result in changes in and about a stream and will require Approval under Section 9 of the provincial *Water Act*.

Levelton has indicated that the proposed mining expansion is favoured over mining new areas within the Lower Mainland. The existing quarries have already significantly altered the landscape, and the infrastructure to support current mining operations already exists. Levelton also noted that many of the socio-economic impacts in this area have already been addressed.

The CoA has already given approval in concept to further mining in this area and is allowing proposals to be reviewed for mining down to the 170 m elevation within the SMEA which was recently adapted into the amended OCP. An EMCP will be prepared with the following objectives:

- maintain base flows to McKay Brook and lower reaches of WC19;
- maintain water quality;
- minimize impacts to fish, vegetation, and wildlife habitat; and,
- compensate for impacts to fish, vegetation, and wildlife habitat at an offsite location.

By implementing mitigation measures and providing appropriate habitat compensation, the proposed project should achieve the goal of no net loss of fish habitat to the productive capacity of the Fraser River watershed.

## 6.5 ARCHAEOLOGY

Per information provided by BC's Ministry of Forests, Lands and Natural Resource Operations (MFLNRO) Sumas Mountain is a historically and culturally significant area for the Sumas Aboriginals who would use the area for hunting, trapping, fishing, picking berries, and harvesting plants for medicinal purposes.

Sumas Lake was historically located at the base of Sumas Mountain. However, it was drained in the early 1900's via the Sumas and Vedder Canals to provide fertile farming land in which is now known as the Sumas Prairie (Chilliwack Museum, 2011).

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The project site has changed dramatically as the total area has been logged and mining has been conducted to the 200 m elevation. For continuing operations the operators will train staff to remain vigilant and to follow protocol if archaeological artefacts are found.

## 7. SUMMARY AND RECOMMENDATIONS

532470 BC and Jamieson Quarries Ltd. currently have permits for aggregate extraction down to the 200 m elevation level. They are now seeking approval to extend their operations for aggregate removal down to the 170 m elevation. The operators of quarries on Sumas Mountain plan to coordinate final designs to lower the elevation of the working surfaces within the quarry footprints from 200 m to 170 m.

The operators intend to apply to the CoA for amendments to their soil removal permits to allow extraction down to 170 m. The CoA has agreed to allow the operators to follow the BC RAR instead of the guidelines set out in the CoA Bylaw. This may allow the 170 m surface of quarries that lie along MB to extend to the edge of the bank along that waterway. In any event, upon completion of negotiations with environmental regulators, the proponents Qualified Environmental Professional will prepare and Environmental Mitigation and Compensation Plan. With regard to the EMCP, DFO has indicated that offsite compensation may be considered in lieu of any fish habitat lost to because of quarry operations.

### Hydrology

Although there are likely to be minimal to negligible impacts on local wells, with the exception of the well in the unnamed watercourse, there are mitigation measures that could be considered if required for the area around the Sumas Mountain quarries, including:

- Installing a series of suitably sized sedimentation ponds on the Makara property or in the Summit Quarry may mitigate the loss of storage for recharge water (and the resultant base flow) into the unnamed creek.
- As noted previously, fracturing caused by drilling and blasting appears to limit water accumulation on the floor of the quarries. Although the requirement for additional control measures are unlikely, if the situation arises controlling offsite runoff of precipitation through the construction of water routing and retention structures and settlement ponds would assist in reducing runoff effects and help maintain shallow offsite groundwater quality and quantity.
- Refuelling and fuel storage areas should continue to have controls to ensure inadvertent spills are confined.
- Spill response kits and personnel will continue to be on-site, in the event of inadvertent spills.
- No storage of explosives on site and using explosives in such a manner that limits or minimizes exposure to precipitation and runoff will continue.
- Sloping the quarry working surfaces to allow for drainage and to minimize ponding water within the quarries, as necessary. It is noted that ponding has not been an issue.
- Monitoring impacts to unnamed watercourse and the dug well within the watercourse as the surficial deposits are stripped from the Summit Quarry.
- Ensuring that domestic water supply is available for local residents that are impacted by the lowering of the quarries to 170 m elevation, if required.

## **Surface Water**

- 532470 BC, Jamieson and their engineers should commit to the design and preparation of an integrated SMP that will satisfy CoA targets as they relate to Ministry of Forest, Lands and Natural Resource Operations and DFO guidelines. The SMP will incorporate strategies for infiltrating water to ground (where viable), detaining or retaining stormwater and for treatment of water collected from hard surface areas including roads to improve water quality and contribute to onsite productivity.
- Mitigation measures should be included in a detailed EMCP prepared by a QEP to protect MB and any adjacent watercourses located outside the proposed mining area.
- Base flow will be maintained to McKay Brook and WC19 through the duration of the project. Flow measurements will be conducted prior to the expansion to obtain a baseline of flow readings. Flow rates will be monitored through the duration of the project.
- Water quality must be maintained within streams through the duration of the project. Water quality monitoring should be conducted prior to the expansion and through the duration of

the project to verify that water quality is not being negatively affected by non-permitted quarrying activities.

### **Vegetation and Wildlife**

The following recommendations, if required, should be implemented by a QEP.

### ***Vegetation and Ecological Communities***

The following recommendations should be implemented to protect habitat for sensitive vegetation species and ecosystems:

- Where possible protect the Blue-listed Western Redcedar / Sword Fern Dry Maritime (Site Series 05) and the Blue-listed Western Redcedar – Foamflower (Site Series 07) of the MMFVT and provide a buffer (RAR setback to McKay Brook will be utilized), agreed to with the regulatory agencies, from MB to protect the vegetation and ecosystem values. Since retention of ecological community is not possible within the mine site, habitat compensation will be afforded in conjunction with the fish habitat compensation.

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- Ensure that any cleared trees or vegetation are felled away from all setback areas in order to protect the setback areas from disturbance.

### ***Terrestrial Wildlife***

The following recommendations should be implemented if required, to protect and improve habitat for the above mentioned species as well as all other terrestrial wildlife species:

- Conduct a follow-up survey for mountain beavers and their dens prior to clearing or mining. If active dens are detected prior to planned clearing and mining activities then a mountain beaver management plan may be required. The management plan should follow the practices agreed to with the regulatory agencies. If active dens are detected and a 50 m buffer cannot be implemented due to project constraints then, upon discussion with officials from MFLNRO, investigate the potential of mountain beaver relocation to suitable, offsite, habitats.

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- Place CWD, where practical, to improve habitat for many wildlife species within all setback areas.
- Install fencing where practical and as required by regulatory agencies to prevent access into the setback areas to protect vegetation and habitat values.

### ***Birds and Bats***

Within the subject area the following recommendations should be implemented to protect and improve habitat for the above mentioned species as well as other bird species:

- A stewardship initiative to install wildlife trees within setback areas to improve habitat for cavity nesting birds and roosting bats would be desirable. The installation of bird and bat boxes will also improve habitat for many other bird and bat species.
- Avoid vegetation removal in all vegetation types during the breeding season (April 1-July 31) to protect breeding birds and roosting bats and to avoid contravention of Section 34 of the *Wildlife Act*.
- Conduct a raptor nest survey prior to any clearing.

### ***Monitoring***

- Seasonal monitoring should be conducted to ensure objectives in Sections 6.4.4 and 7 and any requirements of the mining permit are respected.

### **Fish Habitat Compensation**

As mentioned, offsite fish habitat compensation has been negotiated with DFO to address the impacts from the first phase of mining down to the 200m elevation. DFO has authorized the HADD for Phase 1. The proponents are currently negotiating an addendum to the Authorization to address Phase 2 (down to 170m) impacts. The addendum will address the 17,650 m<sup>2</sup> of fish habitat impact associated with Phase 2 of the project, to achieve no net loss to the productive capacity of the watershed.

## 8. FIGURES

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**Figure 1** Map of the assessment location (from Appendix 1 of SRS assessment, images from Google Earth & Google Map, 2011).

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**Figure 2** Property boundaries showing the assessment location (from Appendix 1 of SRS assessment, image from City of Abbotsford Webmap, 2011).

**Figure 3** Locations of the subject quarries (from Appendix 1 of SRS assessment, image from City of Abbotsford Webmap, 2011).

**Figure 4** Approximate locations of watercourses (from attachment 4 of SRS assessment, image from City of Abbotsford Webmap, 2011).

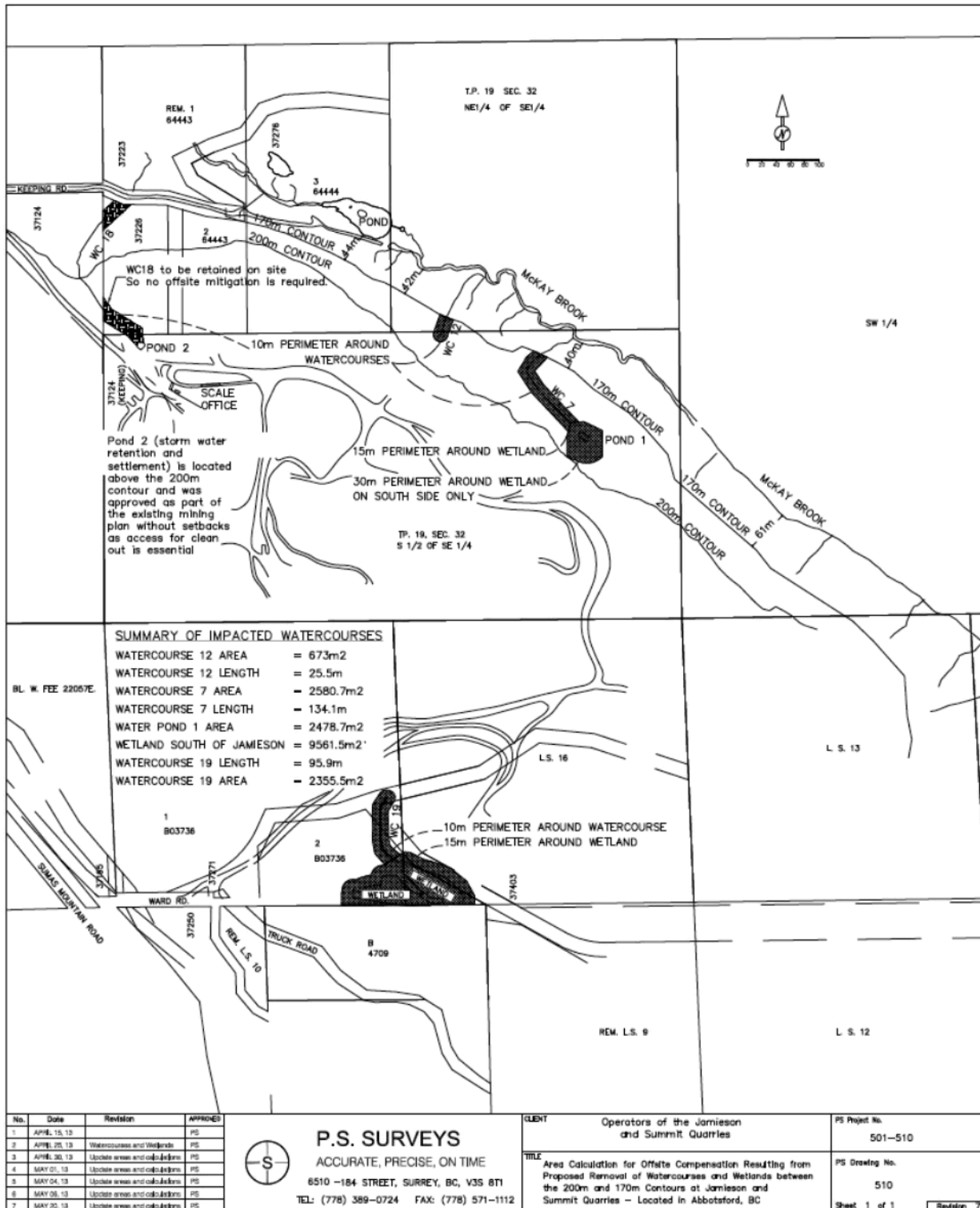


Figure 5 Approximate of fish habitat impacts (from SRS assessment).

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**Figure 6 Water Well Location Plan (from Levelton's desktop hydrogeological assessment).**

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