April 6, 2016

BURNCO AGGREGATE PROJECT

Reclamation and Effective Closure Plan

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REPORT

Report Number: 1114220046-577-R-Rev1-3150

Distribution:

2 Copies - BURNCO Rock Products Ltd.
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Golder Associates

Table of Contents

1.0 INTRODUCTION 1

2.0 SCOPE 1

3.0 INFORMATION REQUIREMENTS 4

3.1 Application Information Requirements (AIR) 4

3.2 Effects Assessment Requirements 5

4.0 PRE-MINE CONDITIONS AND PROPOSED END LAND USE 5

4.1 Proposed End Land Use 6

5.0 SOIL SUITABILITY FOR RECLAMATION 7

5.1 Suitability Rating Evaluation Methods 7

5.2 Soil Suitability Ratings Results 8

5.3 Soil Salvage Volumes 9

5.4 Soil Erosion Susceptibility 9

6.0 CONCEPTUAL SOIL MANAGEMENT PLAN 12

6.1 McNab Creek Flood Protection Dyke and Fines Storage Area 12

6.2 Pit Lake Containment Berm 13

6.2.1 Western and Northern Banks and Shorelines 14

6.3 Aggregate Pit 14

6.4 Processing Area 15

6.5 Fines Storage Area and Fines Management 15

6.6 Soil Management Sequencing 21

7.0 SOIL MANAGEMENT PROCEDURES 22

7.1 On-Site Supervision 22

7.2 Segregation and Stripping Methods 23

7.3 Movement and Storage of Soils 23

7.4 Soil Handling 23

7.5 Stockpile Construction and Protection 24

7.6 Revegetation of Stockpiles 24

7.6.1 Fertilizer and Seeding Recommendations 25

7.6.2 Weed Control 25
7.7 Final Soil Replacement 25
8.0 MONITORING 26
9.0 SUMMARY 27
10.0 CLOSURE 27
11.0 REFERENCES 28

TABLES

Table 1: Selected Criteria for Evaluating Suitability of Soil for Use in Reclamation 7
Table 2: Soil Reclamation Suitability in the Pre-Disturbance Project Area 9

FIGURES

Figure 1: Location Plan 2
Figure 2: Project Area and Test Pit Locations 3
Figure 3: Soil Suitability Ratings for Reclamation 10
Figure 4: Soil Management Areas – Overview 11
Figure 5: Soil Management - Northern 16
Figure 6: Soil Management - Southern 17
Figure 7: Soil Management – Aggregate Pit 18
Figure 8: Soil Management – Processing Area 19
Figure 9: Soil Management – Fines Storage Area 20

1.0 INTRODUCTION

This Reclamation and Effective Closure Plan has been prepared for the aggregate extraction project proposed by BURNCO Rock Products Ltd. (BURNCO) at Howe Sound BC. The proposed BURNCO Aggregate Project (hereafter referred to as the Proposed Project) is situated in the McNab Creek Valley on the western shore of Howe Sound's Thornbrough Channel, north of Gambier Island and approximately 22 kilometres (km) southwest of Squamish and 35 km northwest of Vancouver (Golder 2011). The Proposed Project site's geographic coordinates are 49º 34' 00" N 123º 23' 20"W. The Proposed Project is located west of the main channel of McNab Creek and north of the Howe Sound shoreline (Figure 1).

Proposed Project site soils are derived from fluvial and glaciofluvial materials associated with a glaciofluvial fan-delta complex. The sands and gravels from these deposits are intended to be mined and barged from the Proposed Project Area to BURNCO-owned facilities located in the Greater Vancouver area (Golder 2011).

The scope, relevant Proposed Project information requirements, pre-mine soil conditions and end land use objectives for soils, soil suitability assessment, conceptual soil management plan, soil management procedures and recommended monitoring are presented below in the following sections.

2.0 SCOPE

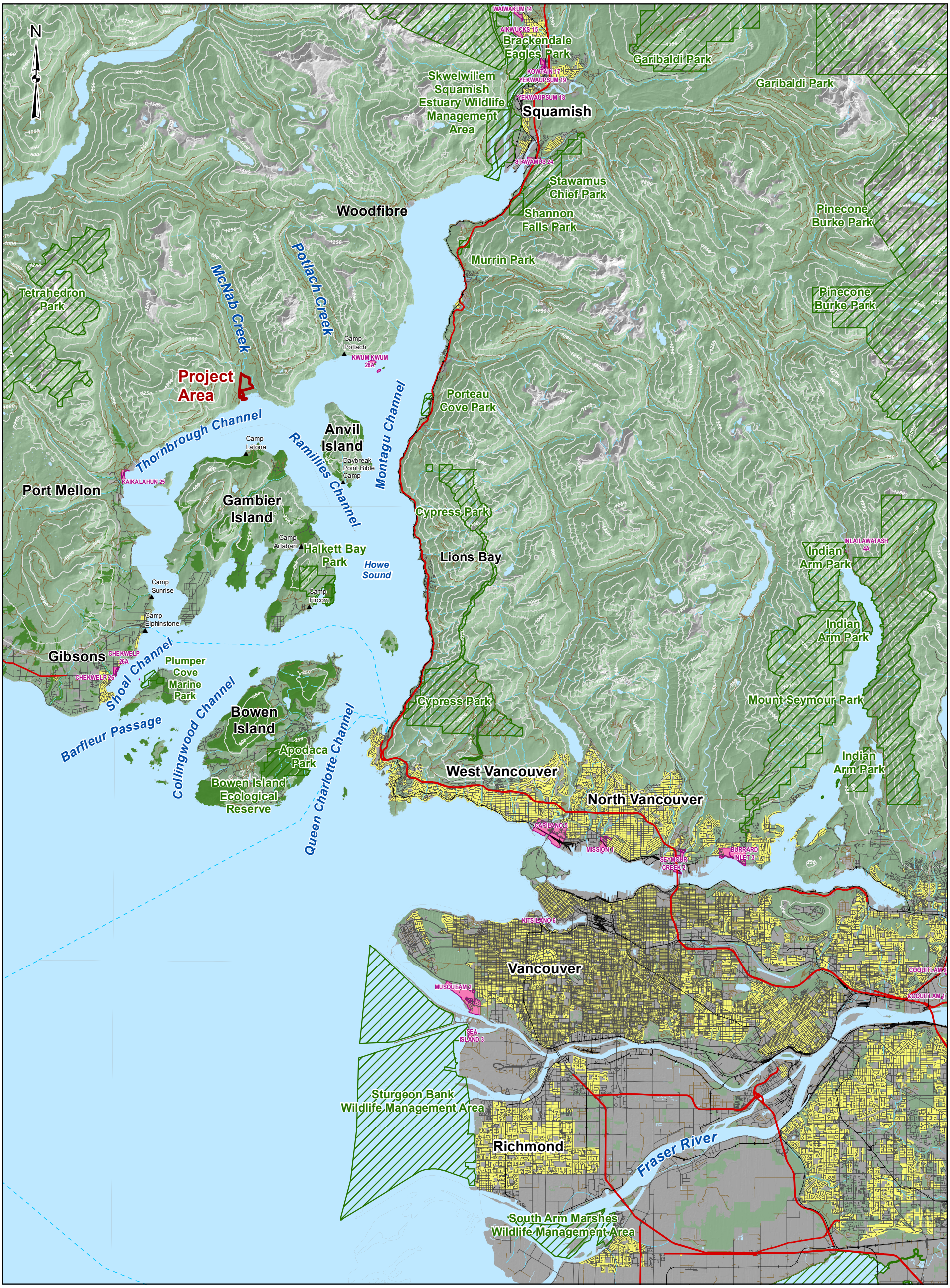
This Reclamation and Effective Closure Plan addresses soil reclamation recommendations stated in the Approved Application Information Requirements/Environmental Impact Statement Guidelines (BCEAO 2014).

The scope consists of identifying soils suitable for reclamation, and preparing a preliminary soil management plan to create a suitable growing medium at the site, prepared in the context of anticipated end land use objectives.

The purpose of this plan is to present soil management plans and procedures that will result in the development of functional ecosystems within the Proposed Project Area. The Proposed Project Area, approximately 60 ha in extent, is shown on Figure 2.

Surface soils management will take place in the following Proposed Project areas:

- McNab Creek Flood Protection Dyke
- Pit Lake Containment Berm
- Fines Storage Area
- Processing Area Dirt Berm The aggregate pit
- The processing area
- Proposed soil deposit areas



LEGEND

- Project Area
- Park / Protected Area
- Sensitive Environmental Area
- Vegetation
- Indian Reserve
- Residential Area
- Waterbody
- Highway
- Road
- Resource Road
- Railway
- Watercourse
- Ferry
- Contour (250m)
- Camp

8 0 8

SCALE 1:230,000 KILOMETRES

REFERENCE

Parks/protected areas and sensitive areas from the Province of British Columbia. Elevation and indian reserves from Geobase. Base data from CanVec. Projection: UTM Zone 10 Datum: NAD 83

PROJECT

BURNCO ROCK PRODUCTS LTD.
BURNCO AGGREGATE PROJECT, HOWE SOUND, B.C.

TITLE

LOCATION OF BURNCO AGGREGATE PROJECT

Golder Associates

PROJECT NO. 11-1422-0046			PHASE No.	
DESIGN	WM	15 Feb. 2016	SCALE AS SHOWN	REV. 1
GIS	DL	31 Mar. 2016		
CHECK	WM	23 Feb. 2016		
REVIEW	JF	23 Feb. 2016		

FIGURE 1

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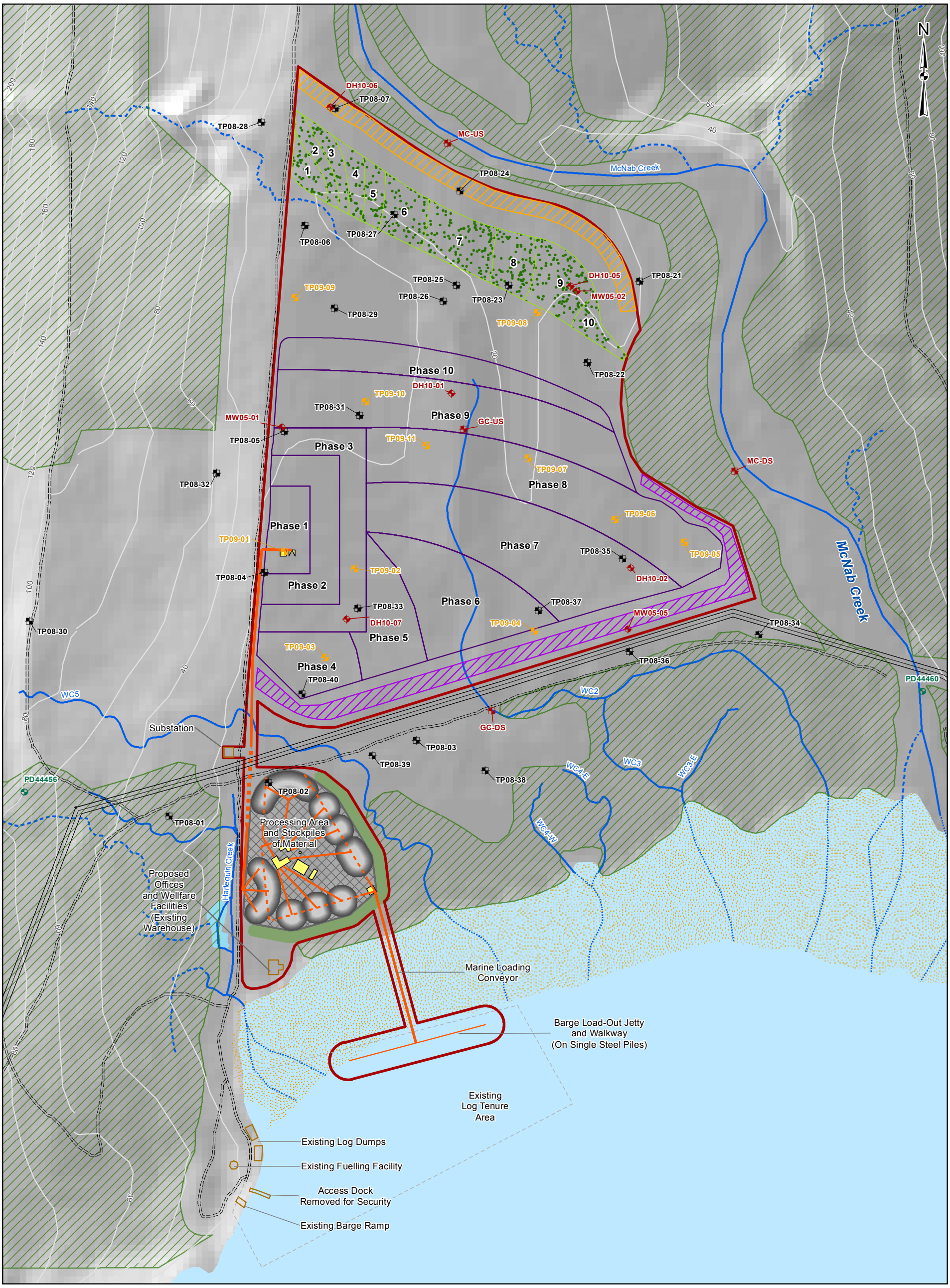

LEGEND

Test Pit Locations
- Monitoring Well (Golder 2012)
- Surface Water Monitoring Station (Golder 2012)
- Test Pit (Golder 2009)
- Test Pit (Thurber 2008)
- Current Water Licence (POD)

Proposed Project Sites & Infrastructure
- Project Area
- Proposed Aggregate Pit Phase
- Product Stockpiles
- Processing Area
- Fines Storage Area
- McNab Creek Flood Protection Dyke
- Pit Lake Containment Berm
- Processing Area Dirt Berm
- Possible Processing Plant Configuration
- Elevated Conveyor
- Underground Conveyor
- Barge Load-out

Base Map Data & Existing Features
- Existing Feature
- Existing Log Tenure Area
- Mature Forest
- Intertidal Zone
- Road (Existing)
- Transmission Line
- Permanent / Perennial Watercourse
- Intermittent Watercourse
- Intertidal Watercourse
- Contour (20m)

REFERENCE

Test Pits from Thurber, 2008 and Golder Associates Ltd, 2009. Monitoring wells and surface monitoring stations from Golder Associates Ltd, 2012. DEM from Geobase. Base data from the Province of British Columbia. Contours from TRIM positional data. Additional detailed site features provided by McElhanney. Projection: UTM Zone 10 Datum: NAD 83

200 0 200

SCALE 1:6,000 METRES

PROJECT

BURNCO ROCK PRODUCTS LTD.
BURNCO AGGREGATE PROJECT, HOWE SOUND, B.C.

TITLE

PROJECT AREA AND TEST PIT LOCATIONS

PROJECT NO. 11-1422-0046			PHASE No.		
DESIGN	AC	30 Jan. 2015	SCALE AS SHOWN	REV. 1	
GIS	DL	01 Apr. 2016	FIGURE 2		
CHECK	WM	23 Feb. 2016			
REVIEW	JF	23 Feb. 2016			

Golder Associates

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3.0 INFORMATION REQUIREMENTS

The draft Application Information Requirements which are relevant to reclamation are summarized below.

3.1 Application Information Requirements (AIR)

Section 2.2.5 of the Approved Application Information Requirements/Environmental Impact Statement Guidelines (BCEAO 2014) describes the information requirements for reclamation, closure and monitoring. This report addresses the soil related components of the Reclamation, Closure and Monitoring AIR/EIS Guidelines sections and the Health and Safety and Reclamation Code for Mines in BC, as noted in the AIR/EIS Guidelines. These components have been abbreviated and summarized below:

- From the BCEAO 2014 AIR/EIS Guidelines:
  - A preliminary Reclamation and Effective Closure Plan will be prepared as part of the EAC Application / EIS, and will describe the proposed measures and commitments to manage, maintain and monitor water management structures, remove surface facilities, and reclaim areas and develop a functional ecosystem in the freshwater pit. Research required to assess closure plans will be considered.
  - The Reclamation and Closure Plan will be described in the context of anticipated end land use objectives and land capability. Plans for progressive reclamation will include a schedule of disturbance and reclamation for the first five years of mine life. Plans for final closure will be conceptual.
  - Reclamation and closure activities will be identified as measures to mitigate potential adverse effects on selected Valued Components (VCs) (e.g., use of native species, habitat composition targets, planting densities, soil salvage and amendment planning, and landform design). Key ecological linkages and timeframes for successful reclamation outcomes will be identified.
  - Site planning will include landscaping, further design and development of the existing training berm (now called the McNab Creek Flood Protection Dyke) along the north edge logging road of the pit area, along with the development of the southern pit containment berm (now called the Pit Lake Containment Berm), surface water features, fisheries habitats and revegetation throughout the site consistent with the operational extraction schedule. Ongoing monitoring will be conducted for relevant noise and dust, water quality parameters, along with fish and wildlife resources. The Proponent proposes to provide interim monitoring reports summarizing the progress of ongoing reclamation activities.
  - The EAC Application/EIS will describe how the Reclamation and Closure Plan will result in successful reclamation as per the Reclamation Standards outlined in Section 10 of the Health and Safety and Reclamation Code for Mines in BC.

- From Section 10 of the Health and Safety and Reclamation Code for Mines in BC:
  - HSRC Section 10.1.10
    - Reclamation program be designed to protect the land and watercourses.
  - HSRC Section 10.7.5
    - Excluding lands that re not to be reclaimed, the average land capability to be achieved on the remaining lands shall not be less that the average that existed prior to mining, unless the land capability is not consistent with the approved end land use.
  - HSRC Section 10.7.8
    - On all lands to be re-vegetated, the growth medium shall satisfy land use, capability, and water quality objectives. All surficial soil materials removed for mining purposes shall be saved for use in reclamation programs unless these objectives can be otherwise achieved.

3.2 Effects Assessment Requirements

Soil disturbance can change soil properties that in turn can decrease the landscapes capacity to support growth and development of plant communities. Soil disturbance is anticipated to have a potential residual effect on Proposed Project Valued Components (VCs) related to Environmentally Sensitive Ecosystems (VC1) and the Ecosystems at Risk (VC2).

To mitigate potential adverse effects on identified VCs caused by potential soil disturbance, a soil suitability assessment and reclamation plans were recommended.

4.0 PRE-MINE CONDITIONS AND PROPOSED END LAND USE

This Reclamation and Effective Closure Plan is designed to conserve soil resources, through appropriate salvage and storage, and to result in the development of a landscape that can be re-vegetated and be capable of supporting the end land use objective. In order to achieve this, an understanding of the pre-mine conditions of the soils and the proposed end land use for soils is necessary.

Surface soil discussed in this report includes topsoil and subsoil available for reclamation. It is assumed that up to 0.3 m of surface soils are organically enriched and these soils are referred to as topsoil. The underlying soils, which are not suitable for processing as aggregate and that will be available for reclamation, are referred to as subsoil. Pre-Mine Conditions

The Proposed Project is located in an area that would naturally host listed ecosystems. However, due to logging activities, these ecosystems have been substantially modified and there is now a broad range of structural stages in the Proposed Project Area. As a result of the past disturbance to ecosystems, Proposed Project-related effects are reduced.

The Proposed Project Area consists of unvegetated or sparsely vegetated areas; small pockets of shrub dominated, sapling forest, and young forest structural stages. Mature forest is located to the north and east, outside of the Proposed Project Area.

The Proposed Project Area is situated primarily within existing cleared areas, with highly disturbed surface soils with varying and discontinuous amounts of organic matter. Therefore, pre-reclamation land capability ratings are based in part, on this partially disturbed, pre-mine state.

As soil mapping for the Proposed Project Area is not available, soils mapping for adjacent areas (Luttmerding 1980) was reviewed to infer expected soil series within the Proposed Project Area. Anticipated soil series for the Proposed Project Area include Capilano and Delta, and possibly in small areas, Banford soils. Capilano soils are described as gravelly glacial outwash deposits that are well to rapidly drained, dominated by Ortstein Humo-Ferric Podzols. Delta soils are medium to moderately fine-textured deltaic deposits varying from non-stony to excessively stony, with poor drainage, high groundwater tables, and are commonly occurring Orthic Humic Gleysols. Banford soils are described as 0.4 to 0.6 m of well decomposed organic material overlying medium and moderately fine textured floodplain deposits. Drainage is poor to very poor, with high ground water tables and commonly occurring Terric Humisols. If Banford or similar soils exist at the site, it is likely that the continuous organic materials have been heavily disturbed.

A review of the existing forest capability map for the area (Serryk and Perry 1984) indicates that the Proposed Project Area has a rating of $1a^{4}1b^{3}3^{3}$. This rating assumes no disturbance has occurred at the site. The non-disturbed Class 1 ratings are described as land having no important limitations to growth of commercial forests with deep, medium textured soils with good water holding capacity that are naturally high in fertility. Class 3 ratings are noted as having moderate limitations with medium to fine textures, are low in fertility, and are low in soil moisture with occasional inundations.

Given the current cleared landscape conditions and the generally coarse texture nature of fluvial and glaciofluvial deposits in the Proposed Project Area, the existing capability for forestry is estimated to be Class 3.

4.1 Proposed End Land Use

The goal of the reclamation plan is develop soil management sequencing and procedures (stripping, salvage, storage and placement) to achieve a post-reclamation land capability that is similar to or better than the pre-disturbance conditions in areas outside of the gravel pit, which will be an area of open water after closure.

The proposed end land use for the Proposed Project is to have functional terrestrial ecosystems in the Proposed Project Area outside of the pit.

Without reclamation, the projected changes to land capability as a result of the gravel pit operations include an increase in open water in the pit bottom and disturbance to surface soil conditions that could alter the ability of vegetation communities to be returned to pre-mine conditions or better. Without adequate reclamation, the post forest land capability may be less than that which exists now.

With reclamation, the reclaimed areas will have a land capability at least as good as the pre-mine capability.

Reclamation will create ecological units similar to those present before Proposed Project construction. Approved native vegetation and trees will be used to reclaim disturbed areas and re-establish forest. Due to the uncertainty regarding the nature of the reclaimed soil profiles, additional field studies will be conducted to assess reclaimed soil characteristics and inform vegetation prescriptions.

5.0 SOIL SUITABILITY FOR RECLAMATION

To carry out the reclamation plan, soil suitability for end land use objectives (e.g., growing medium) were evaluated.

5.1 Suitability Rating Evaluation Methods

Soil suitability ratings for reclamation planning were developed using the criteria for physical characteristics (texture and coarse fragment content) recommended by the Ministry of Energy and Mines (BCMEMPR 1996), as summarized in Table 1 below. Soil chemical characteristics were not assessed in evaluating soil suitability ratings for this Reclamation and Effective Closure Plan.

Table 1: Selected Criteria for Evaluating Suitability of Soil for Use in Reclamation

Example Criteria for Evaluating Suitability of Soil for Use in Reclamation				
Limitation\Property	**Good (G)**	**Fair (F)**	**Poor (P)**	**Unsuitable (U)**
Reaction (pH)	6.5 - 7.5	5.5 - 6.4 or 7.6 - 8.4	4.5 - 5.4 or 8.5 - 9.0	<4.5 and >9.0
Salinity(EC) (dS\m)	<2	3 to 4	4 to 8	>8
Sodicity (SAR)	<4	4 to 8	8 to 12	>12
AWSC (mm\cm\50 cm)	>45	25 to 44	10 to 24	<10
% Coarse Fragments (+2 mm)	<30	31 to 50	51 to 70	>70
Texture	sl, l, sil	cl, ls, si,	s, sic, scl, sicl, c, hc	Unconsolidated Bedrock
Moist Consistency	very friable, friable	loose	firm, very firm	extremely firm
% Organic Carbon	2-30	1 to 2, or >30 (soil amendment only)	<1	
$CaCO_3$ Equivalent (%)	<2	2 to 20	20 to 70	>70

Notes:

This table was developed for forest production and is a modification of 'Criteria for evaluating the suitability of surface material (upper lift) for revegetation in the Eastern Slopes Region', Alberta Agriculture, 1987.

EC = electrical conductivity; dS/m = deciSiemens per metre; SAR = sodium adsorption ratio; AWSC = available water storage capacity; $CaC0_3$ = calcium carbonate

[A] fSL = fine sandy loam; vfSL = very fine sandy loam; L = loam; SL =sandy loam; SiL = silty loam; CL = clay loam; SCL = sandy clay loam; SiCL = silty clay loam; S = sand; LS = loamy sand; SC = sandy clay; SiC = silty clay; C = clay; HC = heavy clay

Soil suitability ratings were based on the following:

- Soil texture and depths, and coarse fragment content data from available test pit and borehole logs for the Proposed Project Area (Golder 2012; Golder 2014; Thurber 2008);
- Review of select soil degradation parameters as described by Ministry of Forests Soil Hazards (BCMF 1999) and Soil Conservation (BCMF 2001) guidebook recommendations;
- Qualitative interpretation of field notes; and
- Professional experience.

The locations of existing test pits and boreholes are noted on Figure 2.

The available information indicates that within the Proposed Project Area, soils with the following unfavourable characteristics (BCMF 1999) are not present:

- Dense parent material (compact till or glaciomarine with silt or clay dominant textures) that cannot be readily dug with shovel;
- Dense clayey Bt horizons, clay enriched Luvisols greater than 5 cm thick;
- Sandy or loamy sand textures, low water-holding and nutrient storing capacity;
- Greater than 70% coarse fragments (greater than 2 mm diameter); and
- Coarse fragment content exceeding 50% volume in soils when the matrix texture is sandy loam or coarser and 70%, or when the matrix texture is finer than sandy loam.

Recommendations as outlined in the Hazards Assessment Keys for Evaluating Site Sensitivity to Soil Degrading processes Guidebook (MOF 1999) were used to evaluate soil erosion potential.

Available test pit information indicates that organic soils are not present within the Proposed Project Area. If organic soils are encountered, it is expected that they would be suitable for the top layer of the reclaimed soil profile when incorporated into the salvaged topsoil.

5.2 Soil Suitability Ratings Results

Site soils were rated as having fair or poor suitability for use in reclamation. Interpolation of the extent of soil suitability ratings between each test pit and borehole location was completed to create soil suitability units of similar ratings as shown on Figure 3. No soils were identified that would warrant a Good rating.

Estimates of the extent of the different suitability rating classes for the Proposed Project Area are summarized in Table 2 below.

Table 2: Soil Reclamation Suitability in the Pre-Disturbance Project Area

Soil Suitability Rating	Area (ha)	Percent (%)
Fair	26	43%
Poor	32	54%
Unsurveyed	2	3%
Total[1]	**60**	**100%**

These Fair and Poor ratings are attributable to relatively coarse texture of the soils. Coarse fragment content in the surface soils does not appear to further reduce suitability ratings.

Soils rated as Poor are typically derived from sand and silty sand textured sediments. Soils with Fair ratings were finer textured, but still of only Fair suitability.

Inclusion of coarse fragments during soil salvage has the potential to decrease soil suitability. Determination of the depths of topsoil and subsoil to salvage during operations should be determined by qualified on-site monitoring personnel.

5.3 Soil Salvage Volumes

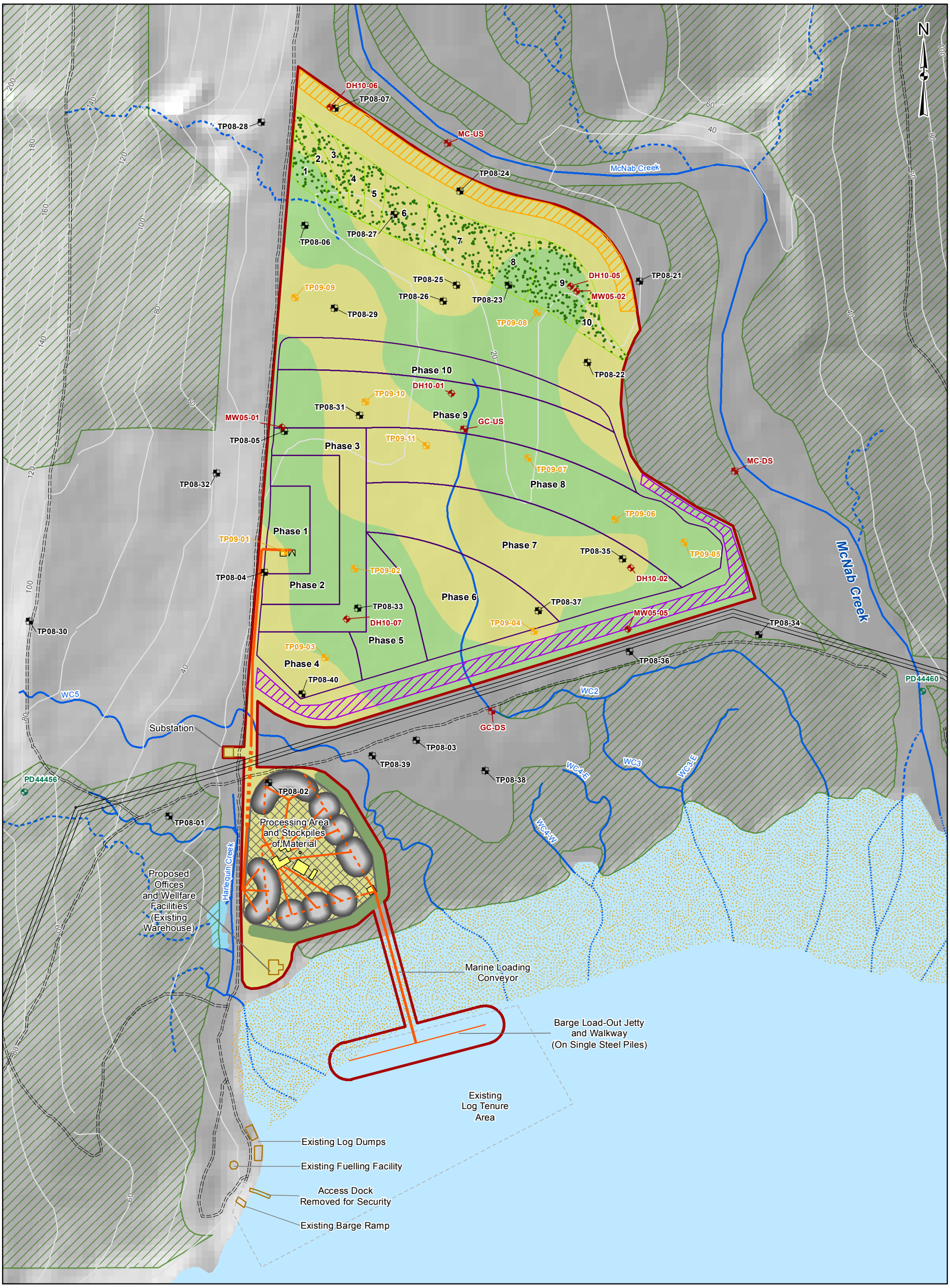
An overview of the soil management areas where soil salvage volumes are assessed is presented on Figure 4. The average depth of surface soil to be salvaged from the 28.2 ha aggregate pit area is estimated to 0.80 m. Successful salvage would result in 225,600 m^3 of salvaged soil. The area on which salvaged soil will be placed include the northern McNab Creek Flood Protection Dyke and Fines Storage Area, the southern Pit Lake Containment Berm, the Processing Area Dirt Berm , the main soil deposit area, and the post closure pit lake perimeter. The total area for the salvaged soil sites is approximately 22.1 ha. Placing the surface soil salvaged from the pit area over this area will result in an average depth of 1.0 m, which would be in addition to existing surface soils in those areas.

Although the surface soils at the site have fair to poor suitability for reclamation, the added depth of soil over the underlying sands and gravels will provide an improved growing environment to that which exists now.

5.4 Soil Erosion Susceptibility

Soil erosion is the loss of surface soils mainly by water and wind action. Erosion can be accelerated by changes in runoff patterns, loss of vegetative cover and storage of soil with inadequate erosion protection. This can result in onsite effects such as the physical loss of soil and loss of soil nutrients, resulting in lower productivity of the reclaimed areas. Soil erosion can also result in degradation of water quality and loss of aquatic habitat (BCMF 1999).

Due to the relatively coarse textured nature of the site soils, it is expected that they will be mainly susceptible to erosion by water (precipitation, changes in drainage patterns) and, to a lesser degree, by wind. Stockpiled soils may take a number of years to regain characteristics required to support the targeted post closure ecosystems. Soil erosion prevention on reclaimed slopes typical includes revegetation using temporary native seed mix with fast-growing grasses and legumes or applying protective matting. A detailed Erosion and Sediment Control Plan (ESCP) for the Proposed Project will be provided in the Mine Permit application document.



LEGEND

Soil Suitability Rating
- Fair
- Poor
- Monitoring Well (Golder 2012)
- Surface Water Monitoring Station (Golder 2012)
- Test Pit (Golder 2009)
- Test Pit (Thurber 2008)
- Current Water Licence (POD)

Proposed Project Sites & Infrastructure
- Project Area
- Proposed Aggregate Pit Phase
- Product Stockpiles
- McNab Creek Flood Protection Dyke
- Pit Lake Containment Berm
- Processing Area
- Fines Storage Area
- Processing Area Berm
- Possible Processing Plant Configuration
- Elevated Conveyor
- Underground Conveyor
- Barge Load-out

Base Map Data & Existing Features
- Existing Feature
- Existing Log Tenure Area
- Mature Forest
- Intertidal Zone
- Road (Existing)
- Transmission Line
- Permanent / Perennial Watercourse
- Intermittent Watercourse
- Intertidal Watercourse
- Contour (20m)

REFERENCE

Soil suitability ratings from Golder Associates Ltd (2015). Monitoring wells and surface monitoring stations from Golder Associates Ltd (2012). Test pit locations from Thurber (2008) and Golder Associates Ltd (2009). Current water licenses from BC Ministry of Forests, Lands and Natural Resource Operations Water Management Branch. DEM from Geobase. Base data from the Province of British Columbia. Contours from TRIM positional data. Additional detailed site features from McElhanney. Projection: UTM Zone 10 Datum: NAD 83

200 0 200

SCALE 1:6,000 METRES

PROJECT

BURNCO ROCK PRODUCTS LTD.
BURNCO AGGREGATE PROJECT, HOWE SOUND, B.C.

TITLE

SOIL SUITABILITY RATINGS FOR RECLAMATION

Golder Associates

PROJECT NO. 11-1422-0046			PHASE No.	
DESIGN	WM	18 Mar. 2015	SCALE AS SHOWN	REV. 1
GIS	DL	01 Apr. 2016		
CHECK	WM	23 Feb. 2016		
REVIEW	JF	23 Feb. 2016		

FIGURE 3

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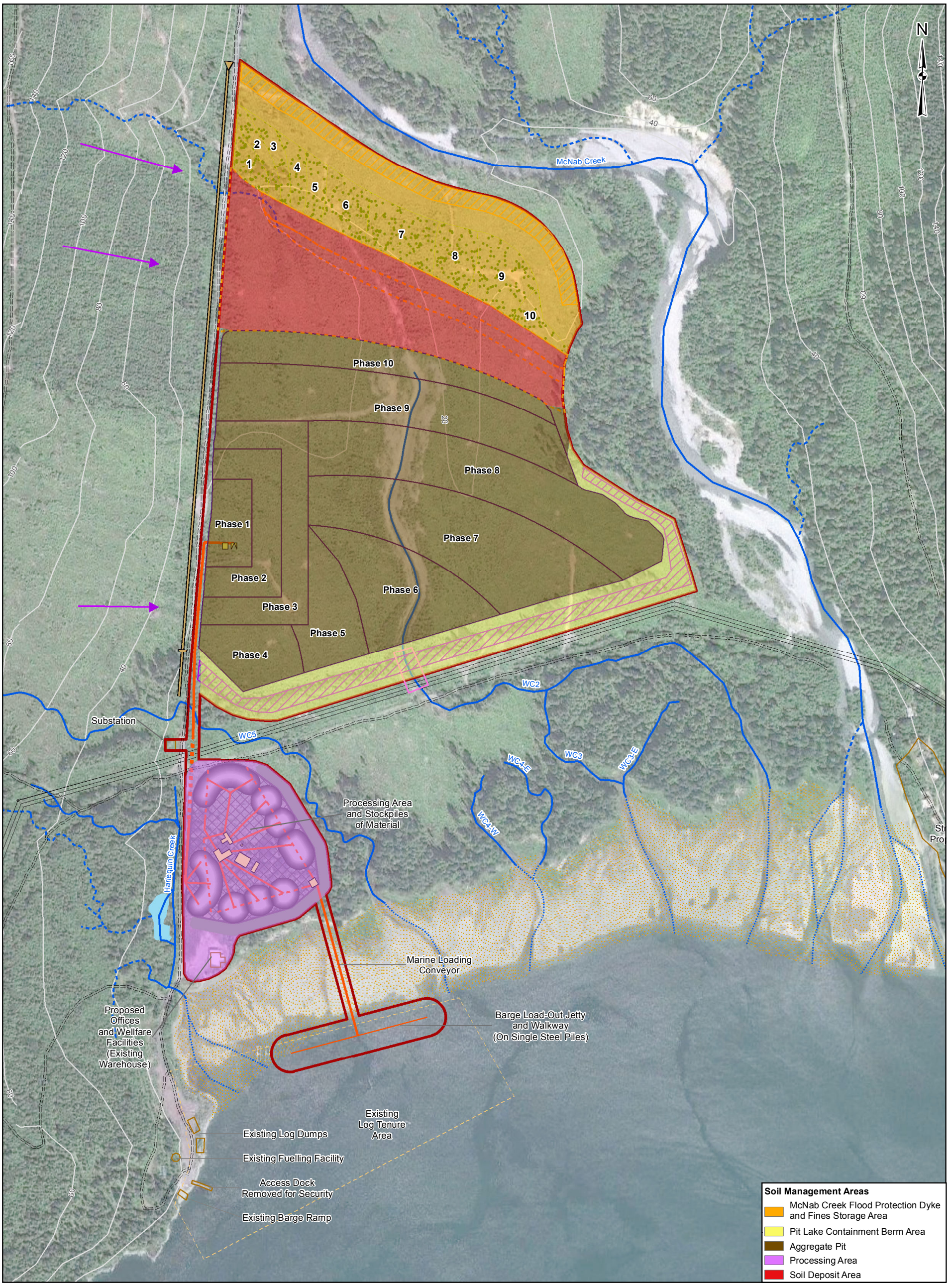

LEGEND

Reclamation and Soil Management

- McNab Creek Flood Protection Dyke
- Pit Lake Containment Berm
- Fines Storage Area
- Soil Deposit Area
- Non-Contact Water Diversion Ditch
- Direction of Flow / Runoff

Proposed Project Sites & Infrastructure

- Project Area
- Proposed Aggregate Pit Phase
- Processing Area
- Product Stockpiles
- Processing Area Dirt Berm
- Channel Infill, Riprap and Filter Zone (WC2 Plug)
- Possible Processing Plant Configuration
- Elevated Conveyor
- Underground Conveyor
- Barge Load-out

Base Map Data & Existing Features

- Existing Log Tenure Area
- Existing Feature
- Intertidal Zone
- Road (Existing)
- Transmission Line
- Permanent / Perennial Watercourse
- Intermittent Watercourse
- Intertidal Watercourse
- Contour (20m)

REFERENCE

Watercourses from the Province of British Columbia and field data. Base data from the Province of British Columbia. Contours from TRIM positional data. Imagery from Google Earth Pro. Additional detailed site features provided by McElhanney.
Projection: UTM Zone 10 Datum: NAD 83

200 0 200
SCALE 1:6,000 METRES

PROJECT
BURNCO ROCK PRODUCTS LTD.
BURNCO AGGREGATE PROJECT, HOWE SOUND, B.C.

TITLE
SOIL MANAGEMENT AREAS OVERVIEW

Golder Associates

PROJECT NO. 11-1422-0046			PHASE No.	
DESIGN	WM	28 Jan. 2016	SCALE AS SHOWN	REV. 1
GIS	DL	01 Apr. 2016		
CHECK	WM	23 Feb. 2016		
REVIEW	JF	23 Feb. 2016		

FIGURE 4

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6.0 CONCEPTUAL SOIL MANAGEMENT PLAN

The following outlines the proposed soil management strategy and reclamation plan for the Proposed Project. Surface soils will be stripped, transported and stored in designated soils deposit areas. All soil management activities will take place within the Proposed Project Area as shown on the attached Figure 4 to Figure 9. Surface soils management will take place in the following Proposed Project areas:

- McNab Creek Flood Protection Dyke;
- Pit Lake Containment Berm;
- Fines Storage Area;
- Processing Area Dirt Berm;
- The aggregate pit;
- The processing area; and
- Proposed soil deposit areas.

Management of the fines produced during operation and reclamation of the proposed pit lake are also discussed. Soil deposit areas have been designated to store material throughout the different phases of the Proposed Project. A summary of the conceptual soil management and the five year sequencing plan is provided in the following sections of this report.

Management of surface soils has been planned so as to limit site disturbance and minimize impacts to natural drainage systems. This includes utilizing existing roads, minimizing activity during wet and dry periods, and protecting stored material from erosion and sedimentation effects. Surface water and sediment in the Proposed Project Area will be managed onsite. An existing watercourse in the southern portion of the Proposed Project Area will be plugged during operations. The gravel and soils underlying the site are highly permeable; therefore, the proposed stormwater management approach will involve diversion, collection and infiltration of surface water to ground. No point sources discharges of surface water are being proposed. Surface water runoff from slopes above the western Proposed Project boundary will be collected in the existing ditch and will not reach the soil management sites. Runoff within soil management areas will be directed away from the stockpile and berm areas and collected within the Proposed Project Area, with excess stormwater being directed to the aggregate washing system or into the pit lake.

6.1 McNab Creek Flood Protection Dyke and Fines Storage Area

The McNab Creek Flood Protection Dyke and Fines Storage Area are located along the northern boundary of the Proposed Project Area, immediately north of the soil deposit area (Figure 5).After construction of the McNab Creek Flood Protection Dyke is complete, the fines produced during each phase of aggregate processing from the Processing Area will be stockpiled in the Fines Storage Area (see Section 6.5).

Surface soil that is not suitable for the base of the McNab Creek Flood Protection Dyke and surface soil within the Fines Storage Area will be stripped, salvaged and placed in two temporary stockpiles along the northern side of the soil deposit area adjacent to the Fines Storage Area (Figure 5). The stockpiled soils will be utilized for resurfacing in final reclamation. Subsoil, then topsoil will be placed on the surface of the McNab Creek Flood Protection Dyke to provide erosion protection and to be used as a growing medium (Figure 5). Topsoil will also be used as cover for the materials in the Fines Storage Area.

Soil will be salvaged in two lifts; topsoil and subsoil. First topsoil from the soil deposit area will be stripped, and then topsoil from the McNab Creek Flood Protection Dyke area will be stripped. This will be followed by subsoil salvage. All stockpiles will be covered or vegetated for erosion control.

The Fines Storage Area will be stockpiled in phases after the construction of the McNab Creek Flood Protection Dyke; and will therefore not obstruct access and transport to and from the soil deposit stockpile site. A temporary access route between the Fines Storage Area and soil deposit areas may be required during construction and operations for ongoing stockpiling and routine maintenance.

Erosion prevention and sediment control measures such as installation of silt fencing or erosion control fabrics or application of soil surface tackifiers will be carried out as appropriate to minimize erosion of stockpiled soil materials.

6.2 Pit Lake Containment Berm

Soils in the Pit Lake Containment Berm along the southern and eastern Property boundaries will be stripped, salvaged, stockpiled and used for resurfacing. Soils here will be used for eventual reclamation as forested areas and riparian areas adjacent to the proposed offset habitat extension of the lower segment of WC 2.

Surface soil from the Pit Lake Containment Berm will first be stripped and salvaged. Soils will be segregated into topsoil and subsoil where possible and stockpiled in the soil deposit area between the berm and the edge of the aggregate pit area (Figure 6). To avoid potential wet zones and potential degradation of topsoil, stockpiles will not be placed within or immediately adjacent to the proposed plug within the WC 2 (Figure 6).

Material for construction of the Pit Lake Containment Berm will be excavated from Phase 1 of the pit area (Figure 6). Excavated material will be transported to the western portion of the berm along the existing road. The eastern portion of the berm will likely be accessed across the proposed pit area. To avoid disturbance of salvageable soils located in future phases of the pit, temporary access routes and wet area crossings may be required (Figure 6). Appropriate ground condition assessments will be undertaken (e.g., susceptibility to compaction and rutting) to minimize site disturbance.

After construction, stockpiled soils will be used to cover the berm, and if excess soil is available, it will be used for riparian/forest area reclamation. The stockpiled soil will be covered or vegetated until final placement to protect against erosion.

6.2.1 Western and Northern Banks and Shorelines

Once the final grading of each phase of the western and northern pit lake perimeter areas have been completed, some of the subsoil and topsoil salvaged from the next phase of pit opening will be placed on the pit perimeter and vegetated. Erosion protection during vegetation establishment may be required.

It is anticipated that soil salvaged from Phase 3 of the pit area will be used on perimeter of the Phase 1 area of the pit lake. Surface soil for the banks and shoreline of Phases 9 and 10 will come from soils that have previously been stockpiled in the Soil Deposit Area

The pit lake perimeter will be constructed to facilitate wildlife habitat, a noise buffer, and ecological reclamation plans. This includes constructing appropriate banks and shorelines that will be vegetated and treed around the pit lake. Vegetation will include suitable elk browse species and will be designed to allow wildlife escape routes and travel. Ecological units will be created during the reclamation phase similar to those present prior to Proposed Project construction. Approved native vegetation and trees will be used to reclaim disturbed areas and re-establish mature forest.

6.3 Aggregate Pit

Soil management for the aggregate pit involves three general stages: sequential clearing in the northern soil deposit area for the ten phases of pit development; aggregate pit excavation; and storage and maintenance of salvaged pit materials on the cleared sites in the soil deposit area.

Prior to aggregate pit excavation, localized areas within the soil deposit area will be cleared and stripped in preparation for material deposition (Figure 7). Topsoil will be salvaged from the cleared site and placed in temporary stockpiles adjacent to the cleared site; the subsoil will be left in place. For example, the cleared site for Phase 1 excavation will be located along the western edge of the soil deposit area (Figure 6). Subsequent sites will be cleared progressively to the east to accommodate Phases 2 through 10 of pit excavation.

Next, surface soils from aggregate pit phases will be salvaged in two lifts, topsoil and subsoil. Topsoil will be stripped and windrowed within the aggregate pit phase areas, exposing the subsoil (Figure 7). Exposed aggregate pit subsoil will be salvaged and placed in the phase designated cleared site within the soil deposit area. The subsoil will be contoured with a smooth transition to adjacent topography. The windrowed topsoil from the aggregate pit phase areas will then be placed on the subsoil in the soil deposit area. Topsoil from the aggregate pit phases will be mixed with the previously stockpiled topsoil from the cleared sites as required.

This process will be continued until all of the surface soil has been salvaged from the pit area and placed in the soil deposit area. These portions of the soil deposit area will be vegetated with an approved mix of native plant species.

Soil salvage and storage for subsequent phases of pit development will be conducted in a similar manner.

6.4 Processing Area

Surface soils will be stripped in two lifts and stockpiled around the perimeter of the soil processing area to create a Processing Area Dirt Berm (Figure 8). First, topsoil will be stockpiled in the outer portion of the Processing Area Dirt Berm. Next the subsoil will be excavated and stockpiled in the inner portion of the Processing Area Dirt Berm (Figure 8).

To protect against erosion, the stockpiled soil will be covered and vegetated with an approved mix of native plant species until final placement at closure. The stockpiled soils will be used for reclaiming the processing area after the processing area is no longer required.

6.5 Fines Storage Area and Fines Management

Fines produced during each phase of aggregate processing will be dewatered, transported and stored in corresponding phase locations in the Fines Storage Area (Figures 9). Fines processed from Phase 1 of the Aggregate Pit area will be placed in Phase 1 of the Fines Storage Area. As the Proposed Project progresses, placed fines will be contoured to the desired reclaimed topography. The top layer of the placed fines will be assessed for compaction and any excess compaction relieved by scarification or ripping, if required.

Subsoil and topsoil from the previously stored stockpiles in the northern portion of the soil deposit area will be placed over the fines to provide a growing medium (Figure 9). The placed soils will be vegetated with the desired mix of native species and erosion control protection put in place.

This reclamation of the Fines Storage Area will occur progressively through each phase of pit development. The depth of material in the Fines Storage Area is anticipated to vary up to a maximum of 7.5 m in vertical thickness. This includes the processed fines materials and reclaimed subsoil and topsoil (assuming 0.5 m minimum thickness).

#1 - STRIP FINES STORAGE AREA

#2 - STOCKPILE SALVAGED SOIL FROM FINES STORAGE AREA

#3 - CONSTRUCT MCNAB CREEK FLOOD PROTECTION DYKE AREA WITH REMAINING MATERIAL FROM FINES STORAGE AREA

#4 - COVER AND VEGETATE MCNAB CREEK FLOOD PROTECTION DYKE WITH STOCKPILED SOILS

STOCKPILE FINES STORAGE AREA SUBSOIL

STOCKPILE FINES STORAGE AREA TOPSOIL

McNab Creek

Phase 1

Phase 2

Phase 3

Phase 4

Phase 5

Phase 6

Phase 7

Phase 8

Phase 9

Phase 10

Substation

Harlequin Creek

WC2

WC3

WC3-E

WC4-E

WC4-W

WC5

Processing Area and Stockpiles of Material

Marine Loading Conveyor

Barge Load-Out Jetty and Walkway (On Single Steel Piles)

Proposed Offices and Wellfare Facilities (Existing Warehouse)

Existing Log Tenure Area

Existing Log Dumps

Existing Fuelling Facility

Access Dock Removed for Security

Existing Barge Ramp

N

LEGEND

Reclamation and Soil Management

- McNab Creek Flood Protection Dyke
- Pit Lake Containment Berm
- Fines Storage Area
- Soil Deposit Area
- Non-Contact Water Diversion Ditch
- Direction of Flow / Runoff

Proposed Project Sites & Infrastructure

- Project Area
- Proposed Aggregate Pit Phase
- Processing Area
- Product Stockpiles
- Processing Area Dirt Berm
- Channel Infill, Riprap and Filter Zone (WC2 Plug)
- Possible Processing Plant Configuration
- Elevated Conveyor
- Underground Conveyor
- Barge Load-out

Base Map Data & Existing Features

- Existing Log Tenure Area
- Existing Feature
- Intertidal Zone
- Road (Existing)
- Transmission Line
- Permanent / Perennial Watercourse
- Intermittent Watercourse
- Intertidal Watercourse
- Contour (20m)

REFERENCE

Watercourses from the Province of British Columbia and field data. Base data from the Province of British Columbia. Contours from TRIM positional data. Imagery from Google Earth Pro. Additional detailed site features provided by McElhanney.
Projection: UTM Zone 10 Datum: NAD 83

200 0 200

SCALE 1:6,000 METRES

PROJECT

BURNCO ROCK PRODUCTS LTD.
BURNCO AGGREGATE PROJECT, HOWE SOUND, B.C.

TITLE

SOILS MANAGEMENT - MCNAB CREEK FLOOD PROTECTION DYKE & FINES STORAGE AREA

Golder Associates

PROJECT NO. 11-1422-0046			PHASE No.	
DESIGN	WM	28 Jan. 2016	SCALE AS SHOWN	REV. 1
GIS	DL	01 Apr. 2016		
CHECK	WM	23 Feb. 2016		
REVIEW	JF	23 Feb. 2016		

FIGURE 5

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N

McNab Creek

1
2
3
4
5
6
7
8
9
10

STOCKPILE FINES STORAGE AREA SUBSOIL

STOCKPILE FINES STORAGE AREA TOPSOIL

Phase 10

Phase 9

Phase 8

Phase 7

Phase 6

Phase 5

Phase 4

Phase 3

Phase 2

Phase 1

#3 - EXCAVATE MATERIAL FOR RECLAMATION

#3

TRANSPORT ROUTE

EXAMPLE OF TEMPORARY ROUTES AND CROSSING

#1 - STRIP PIT LAKE CONTAINMENT BERM

#2

#2 - STOCKPILE SEGREGATED SOILS

Substation

WC2

WC5

WC4-E

WC3

WC3-E

WC4-W

Processing Area and Stockpiles of Material

Harlequin Creek

Marine Loading Conveyor

Proposed Offices and Welfare Facilities (Existing Warehouse)

Barge Load-Out Jetty and Walkway (On Single Steel Piles)

Existing Log Tenure Area

Existing Log Dumps

Existing Fuelling Facility

Access Dock Removed for Security

Existing Barge Ramp

LEGEND

Reclamation and Soil Management

- McNab Creek Flood Protection Dyke
- Pit Lake Containment Berm
- Fines Storage Area
- Soil Deposit Area
- Non-Contact Water Diversion Ditch
- Direction of Flow / Runoff

Proposed Project Sites & Infrastructure

- Project Area
- Proposed Aggregate Pit Phase
- Processing Area
- Product Stockpiles
- Processing Area Dirt Berm
- Channel Infill, Riprap and Filter Zone (WC2 Plug)
- Possible Processing Plant Configuration
- Elevated Conveyor
- Underground Conveyor
- Barge Load-out

Base Map Data & Existing Features

- Existing Log Tenure Area
- Existing Feature
- Intertidal Zone
- Road (Existing)
- Transmission Line
- Permanent / Perennial Watercourse
- Intermittent Watercourse
- Intertidal Watercourse
- Contour (20m)

REFERENCE

Watercourses from the Province of British Columbia and field data. Base data from the Province of British Columbia. Contours from TRIM positional data. Imagery from Google Earth Pro. Additional detailed site features provided by McElhanney.
Projection: UTM Zone 10 Datum: NAD 83

200 0 200

SCALE 1:6,000 METRES

PROJECT

BURNCO ROCK PRODUCTS LTD.
BURNCO AGGREGATE PROJECT, HOWE SOUND, B.C.

TITLE

SOILS MANAGEMENT - PIT LAKE CONTAINMENT BERM

Golder Associates

PROJECT NO. 11-1422-0046			PHASE No.	
DESIGN	WM	28 Jan. 2016	SCALE AS SHOWN	REV. 1
GIS	DL	01 Apr. 2016		
CHECK	WM	23 Feb. 2016		
REVIEW	JF	23 Feb. 2016		

FIGURE 6

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#1 - STRIP AND STOCKPILE TOPSOIL ON SITE

#2 - STRIP AND WINDROW TOPSOIL ON SITE

#3 - STRIP TOPSOIL AND PLACE IN SOIL DEPOSIT AREA

#3

#4 - TRANSPORT WINDROWED TOPSOIL AND PLACE IN SOIL DEPOSIT AREA

#5 - REPLACE STOCKPILED TOPSOIL

1 2 3 4 5 6 7 8 9 10

STOCKPILE FINES STORAGE AREA SUBSOIL

STOCKPILE FINES STORAGE AREA TOPSOIL

Phase 1
Phase 2
Phase 3
Phase 4
Phase 5
Phase 6
Phase 7
Phase 8
Phase 9
Phase 10

McNab Creek

WC2
WC3
WC3-E
WC4-E
WC4-W
WC5

Substation

Processing Area and Stockpiles of Material

Harlequin Creek

Proposed Offices and Wellfare Facilities (Existing Warehouse)

Marine Loading Conveyor

Barge Load-Out Jetty and Walkway (On Single Steel Piles)

Existing Log Tenure Area

Existing Log Dumps

Existing Fuelling Facility

Access Dock Removed for Security

Existing Barge Ramp

N

LEGEND

Reclamation and Soil Management
- McNab Creek Flood Protection Dyke
- Pit Lake Containment Berm
- Fines Storage Area
- Soil Deposit Area
- Temporary Topsoil Stockpiles
- Temporary Topsoil Windrows (Approximate Location)
- Non-Contact Water Diversion Ditch
- Direction of Flow / Runoff

Proposed Project Sites & Infrastructure
- Project Area
- Proposed Aggregate Pit Phase
- Processing Area
- Product Stockpiles
- Processing Area Dirt Berm
- Channel Infill, Riprap and Filter Zone (WC2 Plug)
- Possible Processing Plant Configuration
- Elevated Conveyor
- Underground Conveyor
- Barge Load-out

Base Map Data & Existing Features
- Existing Log Tenure Area
- Existing Feature
- Intertidal Zone
- Road (Existing)
- Transmission Line
- Permanent / Perennial Watercourse
- Intermittent Watercourse
- Intertidal Watercourse
- Contour (20m)

REFERENCE

Watercourses from the Province of British Columbia and field data. Base data from the Province of British Columbia. Contours from TRIM positional data. Imagery from Google Earth Pro. Additional detailed site features provided by McElhanney.
Projection: UTM Zone 10 Datum: NAD 83

200 0 200
SCALE 1:6,000 METRES

PROJECT
BURNCO ROCK PRODUCTS LTD.
BURNCO AGGREGATE PROJECT, HOWE SOUND, B.C.

TITLE
SOILS MANAGEMENT - AGGREGATE PIT (PHASE 1 EXAMPLE)

Golder Associates

PROJECT NO. 11-1422-0046			PHASE No.	
DESIGN	WM	28 Jan. 2016	SCALE AS SHOWN	REV. 1
GIS	DL	01 Apr. 2016		
CHECK	WM	23 Feb. 2016		
REVIEW	JF	23 Feb. 2016		

FIGURE 7

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N

McNab Creek

STOCKPILE FINES STORAGE AREA SUBSOIL

STOCKPILE FINES STORAGE AREA TOPSOIL

1 2 3 4 5 6 7 8 9 10

Phase 1
Phase 2
Phase 3
Phase 4
Phase 5
Phase 6
Phase 7
Phase 8
Phase 9
Phase 10

WC2
WC3
WC3-E
WC4-E
WC4-W
WC5

Substation

#1 - STRIP SURFACE SOILS (2 LIFTS)

#2 - STOCKPILE TOPSOIL WITH EROSION PROTECTION

#3 - STOCKPILE SUBSOIL WITH EROSION PROTECTION

#4 - RECLAIM AREA WITH SURFACE SOIL

#1

Processing Area and Stockpiles of Material

Harlequin Creek

Marine Loading Conveyor

Proposed Offices and Wellfare Facilities (Existing Warehouse)

Barge Load-Out Jetty and Walkway (On Single Steel Piles)

Existing Log Tenure Area

Existing Log Dumps

Existing Fuelling Facility

Access Dock Removed for Security

Existing Barge Ramp

LEGEND

Reclamation and Soil Management
- McNab Creek Flood Protection Dyke
- Pit Lake Containment Berm
- Fines Storage Area
- Soil Deposit Area
- Non-Contact Water Diversion Ditch
- Direction of Flow / Runoff

Proposed Project Sites & Infrastructure
- Project Area
- Proposed Aggregate Pit Phase
- Processing Area
- Product Stockpiles
- Processing Area Dirt Berm
- Channel Infill, Riprap and Filter Zone (WC2 Plug)
- Possible Processing Plant Configuration
- Elevated Conveyor
- Underground Conveyor
- Barge Load-out

Base Map Data & Existing Features
- Existing Log Tenure Area
- Existing Feature
- Intertidal Zone
- Road (Existing)
- Transmission Line
- Permanent / Perennial Watercourse
- Intermittent Watercourse
- Intertidal Watercourse
- Contour (20m)

REFERENCE

Watercourses from the Province of British Columbia and field data. Base data from the Province of British Columbia. Contours from TRIM positional data. Imagery from Google Earth Pro. Additional detailed site features provided by McElhanney.
Projection: UTM Zone 10 Datum: NAD 83

200 0 200
SCALE 1:6,000 METRES

PROJECT
BURNCO ROCK PRODUCTS LTD.
BURNCO AGGREGATE PROJECT, HOWE SOUND, B.C.

TITLE
SOILS MANAGEMENT - PROCESSING AREA

Golder Associates

PROJECT NO. 11-1422-0046			PHASE No.	
DESIGN	WM	28 Jan. 2016	SCALE AS SHOWN	REV. 1
GIS	DL	01 Apr. 2016		
CHECK	WM	23 Feb. 2016		
REVIEW	JF	23 Feb. 2016		

FIGURE 8

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#2 - FINES CONTOURED AND ASSESSED FOR COMPACTION (UP TO 7.5m HIGH)

#1 - PROCESSED FINES TRANSPORTED TO SEQUENTIAL STORAGE AREAS

#3 - PREVIOUSLY STOCKPILED SUBSOIL, THEN TOPSOIL PLACED ON FINES (MINIMUM 0.5m THICKNESS)

N

McNab Creek

Phase 1
Phase 2
Phase 3
Phase 4
Phase 5
Phase 6
Phase 7
Phase 8
Phase 9
Phase 10

WC2
WC3
WC3-E
WC4-E
WC4-W
WC5

Substation

Processing Area and Stockpiles of Material

Harlequin Creek

Marine Loading Conveyor

Proposed Offices and Wellfare Facilities (Existing Warehouse)

Barge Load-Out Jetty and Walkway (On Single Steel Piles)

Existing Log Tenure Area

Existing Log Dumps

Existing Fuelling Facility

Access Dock Removed for Security

Existing Barge Ramp

LEGEND

Reclamation and Soil Management
- McNab Creek Flood Protection Dyke
- Pit Lake Containment Berm
- Fines Storage Area
- Soil Deposit Area
- Temporary Topsoil Stockpiles
- Temporary Topsoil Windrows (Approximate Location)
- Non-Contact Water Diversion Ditch
- Direction of Flow / Runoff

Proposed Project Sites & Infrastructure
- Project Area
- Proposed Aggregate Pit Phase
- Processing Area
- Product Stockpiles
- Processing Area Dirt Berm
- Channel Infill, Riprap and Filter Zone (WC2 Plug)
- Possible Processing Plant Configuration
- Elevated Conveyor
- Underground Conveyor
- Barge Load-out

Base Map Data & Existing Features
- Existing Log Tenure Area
- Existing Feature
- Intertidal Zone
- Road (Existing)
- Transmission Line
- Permanent / Perennial Watercourse
- Intermittent Watercourse
- Intertidal Watercourse
- Contour (20m)

REFERENCE

Watercourses from the Province of British Columbia and field data. Base data from the Province of British Columbia. Contours from TRIM positional data. Imagery from Google Earth Pro. Additional detailed site features provided by McElhanney.
Projection: UTM Zone 10 Datum: NAD 83

200 0 200
SCALE 1:6,000 METRES

PROJECT
BURNCO ROCK PRODUCTS LTD.
BURNCO AGGREGATE PROJECT, HOWE SOUND, B.C.

TITLE
FINES STORAGE AREA AND FINES MANAGEMENT

Golder Associates

PROJECT NO. 11-1422-0046			PHASE No.	
DESIGN	WM	28 Jan. 2016	SCALE AS SHOWN	REV. 1
GIS	DL	01 Apr. 2016		
CHECK	WM	23 Feb. 2016		
REVIEW	JF	23 Feb. 2016		

FIGURE 9

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6.6 Soil Management Sequencing

The following is a summary of the proposed sequencing of soil management activities:

- **Year 1**
  - Strip and stockpile surface soils from McNab Creek Flood Protection Dyke and Fines Storage Area (Figure 4 and 5);
  - Construct McNab Creek Flood Protection Dyke (Figure 5);
  - Strip and stockpile topsoil from Phase 1 of Soil Deposit Area (Figure 5);
  - Cover and vegetate McNab Creek Flood Protection Dyke (Figure 5);
  - Strip surface soils from Phase 1 of pit area and place in Phase 1 of Soil Deposit Area. Contour and vegetate Phase 1 of Soil Deposit Area (Figure 6);
  - Strip and stockpile surface soils from Pit Lake Containment Berm (southern and eastern Property boundary area)(Figure 4);
  - Construct Pit Lake Containment Berm with material from Phase 1 of aggregate pit area (Figure 7);
  - Cover and vegetate Pit Lake Containment Berm (Figure 7);
  - Extract and process aggregate from Phase 1 of pit area (Figure 8); and
  - Place fines in Phase 1 of Fines Storage Area, contour and cover with surface soils, vegetate (Figure 9).

- **Year 2**
  - Strip surface soils from Phase 2 of pit area and place in Phase 2 of Soil Deposit Area. Contour and vegetate Phase 2 of Soil Deposit Area;
  - Extract and process aggregate from Phase 2 of pit area; and
  - Place fines in the Phase 2 portion of the Fines Storage Area, contour, cover with surface soils and vegetate.

- **Year 3**
  - Strip surface soils from Phase 3 of pit area and place in Phase 3 of Soil Deposit Area and on the perimeter of the Phase 1 portion of the pit lake. Contour and vegetate Phase 2 of Soil Deposit Area and vegetate the perimeter of the Phase 1 portion of the pit lake;
  - Extract and process aggregate from Phase 3 of pit area; and
  - Place fines in Phase 3 of Fines Storage Area, contour and cover with surface soils, vegetate.

- **Year 4**
  - Strip surface soils from Phase 4 of pit area and place in Phase 4 of Soil Deposit Area and on the perimeter of the Phase 2 portion of the pit lake. Contour and vegetate Phase 4 of Soil Deposit Area and vegetate the perimeter of the Phase 1 portion of the pit lake;
  - Extract and process aggregate from Phase 4 of pit area; and
  - Place fines in Phase 4 of Fines Storage Area, contour and cover with surface soils, vegetate.

- **Year 5**
  - Strip surface soils from Phase 5 of pit area and place in Phase 5 of Soil Deposit Area and on the perimeter of the Phase 3 portion of the pit lake. Contour and vegetate Phase 5 of Soil Deposit Area and vegetate the perimeter of the Phase 3 portion of the pit lake;
  - Extract and process aggregate from Phase 5 of pit area; and
  - Place fines in Phase 5 of Fines Storage Area, contour and cover with surface soils, vegetate.

Subsequent Years

Operations in subsequent years will proceed in a similar fashion for Phases 6 to 10 of the pit area.

7.0 SOIL MANAGEMENT PROCEDURES

The following are recommended procedures for soil management (stripping and salvage, stockpiling and placing) during the life of the Proposed Project.

7.1 On-Site Supervision

On-site supervision of soil salvage and stockpiling will be conducted by qualified professionals. Prior to site activities, applicable soil management training for appropriate operation staff including construction contractors will be undertaken. Where required, soil management monitors will work with machine operators to differentiate subsoil and topsoil, and provide direction on the depth of stripping in the field.

At progressively reclaimed sites, the effectiveness of vegetation covers, presence of invasive species, and soil erosion control measurements will be routinely monitored and adjusted to ensure establishment of a self-sustaining cover capable of meeting end land use objectives.

7.2 Segregation and Stripping Methods

Due to the disturbed nature of the Proposed Project site, and the natural variability of soil horizons, stripping along the interface between the subsoil and the underlying gravels will be challenging. Where possible, topsoil and subsoil should be salvaged and stockpiled separately. In areas where the surface soils have been disturbed due to land clearing, topsoil and subsoil may already have been mixed and will have to be salvaged together. Stripping should attempt to salvage as much of the finer textured subsoil as possible while minimizing the incorporation of coarse fragments greater than 25 mm. Soil management monitors will provide direction on the depth of stripping in the field.

Soil stripping and salvage should also attempt to prevent the inadvertent burying of soils in the underlying gravels.

7.3 Movement and Storage of Soils

Surface soils should be carefully stripped using a track mounted excavator equipped with a sharp cleanout bucket, as this type of equipment is capable of fine soil layer differentiation. The stripped materials, separated into topsoil and subsoil where possible, should be sidecast or trucked to the soil storage areas and placed in uniform lifts using an excavator or bulldozer.

For the north and south berm areas, stripped materials can be sidecast from the excavation site to the deposition area. An onsite excavator and small bulldozer are typically used to place and contour soils, minimizing multi-vehicle passes and site disturbance.

Temporary access roads may be required to access successive stockpile sites between the fines berm area and the soil deposition area. Potential access routes will be assessed to avoid or minimize the potential for compaction, rutting and erosion before and during use, and will be utilized under appropriate soil moisture conditions. Surface water in the stockpile sites and the fines berm area will be directed along natural drainage pathways leading to the pit area.

Salvaged surface soil materials should be spread only when soil moisture is below field capacity and not under high wind conditions.

Soil removal equipment operators will receive training on soil salvage including identification of soil layer characteristics, salvage depths, and review of the soil management plan. Soil salvage operations will be monitored and directed by qualified personnel familiar with the soil management plan and knowledgeable in soil identification and characteristics.

7.4 Soil Handling

Soil handling should only be done when soil moisture is below field capacity (when there is no free drainage of water from the soil). Drier soils are lighter and easier to handle and are less susceptible to compaction and severe rutting. The more favourable times for handling soil materials are spring and early summer, late summer and early fall, when it will be easier to achieve the optimal moisture conditions.

No soil handling should be done within at least 24 hours of a rainfall that results in soil moisture exceeding field capacity. There should be no handling of frozen soils. Weather and ground conditions will be reviewed and the environmental supervisor/monitor will have a protocol in place for when to suspend or restart salvage operations.

During year-round movement of soils, surface water will be managed primarily through infiltration and collection; with onsite erosion control methods such as vegetation of stockpiles and fabric matting. Access surface water will remain on site, with eventual drainage to the proposed pit lake. Erosion will be monitored and mitigated.

7.5 Stockpile Construction and Protection

Salvaged topsoil can be placed directly on the existing soils. As the textural characteristics of the topsoil and subsoil are similar, some mixing of the different soil materials when soils are removed from the stockpiles will be acceptable.

Soil stockpiles should be constructed with 3H:1V (horizontal: vertical) side slopes to maintain stability. Stockpiles should be constructed in lifts of 75 cm maximum thickness. Stockpiles should be contoured so that ponding or puddling of water does not occur on or near the piles.

Areas adjacent to the stockpiles should be graded such that there will be no flow of surface water to the base of the soil stockpiles. For longer term stockpiles, stockpiles should be vegetated or covered to help prevent erosion and invasive plant establishment. If vegetated, the stockpiles should be fertilized and seeded within 30 days of their construction to limit erosion and weed problems. Vegetation with native species is preferred. If a vegetative cover cannot be established on salvaged material, the soil should be covered with an appropriate cover or with incorporated straw mulch, applied at a rate of 1.5 to 2 t/ha.

7.6 Revegetation of Stockpiles

Re-vegetation activities will proceed as Proposed Project areas become available for reclamation. The primary objective of the re-vegetation activities is to establish a successional native plant community that will meet end land use objectives for wildlife habitat and ecological succession, while minimizing soil losses to erosion.

7.6.1 Fertilizer and Seeding Recommendations

For stockpiles that are to be vegetated, laboratory analyses of stockpiled soil materials should be carried out to determine the appropriate rates of fertilizer and soil amendment applications to support the desired vegetation.

A mix of native species is preferred for this site. An appropriate mix of species for vegetation will be recommended by a vegetation specialist. Vegetation Management Plans for adaptive mitigation and reclamation planning will be presented in the *Mines Act* Permit Application for the Proposed Project. Details regarding this plan are provided in Volume 3, Part E – Section 16.0.

Vegetation of the stockpiles should be monitored periodically. If there are areas of poor growth, re-fertilization and/or reseeding will be required. Soil fertility should be monitored every two years and soil amendments applied as required.

7.6.2 Weed Control

Weed problems will be reduced with the early covering or establishment of vegetation on stockpiled soil material and on reclaimed areas. If weed problems develop, appropriate mechanical or chemical control should be undertaken in a timely fashion according to accepted management practices.

7.7 Final Soil Replacement

Prior to placing subsoil and topsoil in a reclaimed soil profile, the surface of the area where the soil is to be placed should be evaluated for compaction and, if required, preparation of soils should be carried out using techniques such as ripping. Such work should only be conducted under appropriate soil moisture conditions. Sites subject to wind or water erosion will be seeded as soon as operationally feasible following soil placement. This will maximize soil stability between soil placements and seeding/fertilizing.

Salvaged surface soil materials should be spread only when soil moisture is below field capacity and not under high wind conditions. No soil handling should be done within 24 hours of a rainfall that results in soil moisture exceeding field capacity. Preferred timing for soil handling operations is late spring, summer and early fall, when extended dry periods are likely to occur.

Previously salvaged soils should be spread in two lifts, subsoil and then topsoil. Spreading should be done with a low ground pressure dozer or by end dumping and spreading with a bulldozer or backhoe. Grade stakes, at appropriate spacing, should be used to ensure that target thicknesses are achieved.

After soil placement, an assessment by a qualified professional should be conducted to determine if any unacceptable compaction has occurred during soil placement. Ripping of the placed soil, under appropriate moisture conditions, will be conducted if required.

Prior to seeding and planting, soil fertility should be assessed and soil amendments (including fertilizer) applied as required. Seed mixes and plants are to be recommended by a vegetation specialist.

8.0 MONITORING

A monitoring and reporting program acceptable to the BC Ministry of Energy and Mines will need to be implemented. The Proposed Project features created during operations will be reclaimed progressively prior to the aggregate pit operations closure. Frequency of monitoring will decline as activity on site diminishes. Following closure, regular monitoring is expected to continue until sustainability of the vegetative cover is confirmed. Longer term infrequent monitoring will continue until a self-sustaining vegetation cover that meets end land use objectives. A proposed monitoring program includes:

- To determine suitability for use as a growth medium in reclamation, site soil analytical data will be required as representative sites (e.g., pH, salinity, sodicity, saturation percentage or available water storage capacity (AWSC), and base line metals). Soil deficiencies can be addressed at the time of material replacement, using soil amendments.
- Monitoring of soil salvage and stockpiling operations:
  - Soil salvage operations will be monitored and directed by qualified personnel familiar with the soil handling plan and knowledgeable in soil identification and characteristics.
- Weather and ground conditions will be reviewed and the environmental supervisor/monitor will have a protocol in place for when to suspend or restart soil management operations.
- Periodic monitoring of soil placement operations.
- Monitoring of erosion and sediment control measures:
  - Erosion and sediment control for the soil management areas will be mitigated and monitored as stated in the forthcoming ESCP; and
  - Interim monitoring will be conducted to evaluate the effectiveness of erosion control will involve water quality monitoring as recommended, visual inspection of ground condition such as presence of rills, visual inspection of sites seeded to verify establishment and maintenance of a the erosion protection vegetative cover.
- Monitoring vegetation growth after seeding and planting:
  - Identification of poor growth, and where re-fertilization and/or reseeding, and trace element uptake in soils will be required (soil fertility is typically monitored every two years with soil amendments applied as required; and as required based on the Proposed Project ESCP); and
  - Growth measurement / documentation of forage browse species and the maintenance vegetation covers.
- Annual progress reports.
- A closure report after reclamation has been completed.

9.0 SUMMARY

This report outlines a Reclamation and Effective Closure Plan for the BURNCO Aggregate Project located near Howe Sound, BC. Soils will be stripped, salvaged, stored and placed as required to facilitate reclamation of the Proposed Project Area.

Although the soils that will be salvaged are rated as having fair to poor suitability for reclamation, successful completion of the reclamation plan will result in a higher capability of reclaimed areas than exists now to support the desired post reclamation vegetation objectives.

At closure, the pit area where aggregate will be extracted will be an open body of water. Soils salvaged from the pit area will be placed elsewhere in the Proposed Project Area, increasing the depth of surface soils in those areas. For areas reclaimed for terrestrial habitat, the average depth of surface soils (the depth of soil above gravel) will increase from approximately 80 cm to approximately 180 cm. This will provide a better growing medium and improved water storage capacity than exists now, particularly for deeper rooted vegetation.

10.0 CLOSURE

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

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