

Technical Summary

January 2024

Pit Name: Columbia Gardens Pit

Provincial Pit Number: 2729

Location: The pit is located southeast of Trail, approximately 5.1 km south of the junction of Highways 3B and 22A via Highway 22A (Waneta Hwy). The geographic coordinates for the pit are UTM Zone 11, 5433530 Northing, 456080 Easting. (Figure 1).

Legal Land Description: L 3C, L4C, L5D DL 205A KOOTENAY DISTRICT PL 800 EXC PT INCLUDED IN SRW PL 15510. The layout of the Map Reserve boundary is shown in the legal plan (Figure 2).

Subsurface Investigation: Subsurface investigations at Columbia Gardens Pit were carried out in 2005 by the Ministry of Transportation & Infrastructure.

In 2005 twenty (20) test pits were excavated to depths ranging from 4.6 to 7.7m. During the test pitting, subsurface soil and groundwater conditions were logged and representative samples of the granular materials were collected for laboratory testing and future reference. Laboratory testing was carried out on eleven (11) of these samples to assess the gradation and durability characteristics for Areas C and D on the pit development plan. The tests completed were wet sieve analysis, micro deval, sand equivalent, relative density, and absorption.

Based on the results of the 2005 investigations, two (2) granular areas - Areas C and D have been defined. The detailed results of the subsurface testing are provided in the Test Pit Summaries and test pit locations are shown on the Pit Plan (Figure 3).

Material Gradation: Table 1 shows the gradation as a percentage by weight of the fines (silts and clays), sand and gravel components as well as the Unified Soil Classification (USC [included after test pit summary]) for the samples tested from Areas C and D.

Table 1: Pit Run Gradation

Test Pit	Depth (m)	Fines (%)* <0.075mm	Sand (%)* 0.075-4.75mm	Gravel (%)* 4.75-75mm	USC
Area C					
TP05-01	0-7.5	0.9	32.8	66.3	GP

TP05-02	0-7.7	0.9	27.5	71.6	GW
TP05-06	3.1-7.7	3.1	34.2	62.7	GW
TP05-07	0-4.6	1.4	34.2	62.7	GW
TP05-08	1.2-7.4	5.2	41.9	52.8	GP-GM
TP05-09	0.6-7.4	1.9	34.0	64.1	GP
TP05-10	1.3-5.6	1.9	34.0	64.1	GW
Average – Area C		2.5	34.4	63.1	-
Area D					
TP05-04	0.0-5.2	6.4	93.4	0.2	SP-SM
TP05-07	4.6-7.7	3.1	67.6	29.3	SP
TP05-11	0.9-7.2	8.6	89.4	2.0	SP-SM
TP05-12	0.5-7.2	12.5	86.5	1.0	SM1
Average – Area D		7.7	84.2	8.1	-

* Values are rounded to the nearest whole number so may not add exactly to 100%

Table 2: Oversize Estimates

Classification:	Average (%)	Range (%)
Boulders (>375mm)	0	0-1
Cobbles (150-375mm)	6	2-10
Cobbles (75-150mm)	13	10-15

Material Durability: Table 3 shows the results of durability tests taken from the rock stockpile in the Pit. Table 4 shows the results of durability tests taken from the 1987 testing program. Table 5 shows the specifications as required in the Standard Specifications for Highway Construction.

Table 3: Rock Stockpile Durability Tests

TEST	AVERAGE	RANGE
Bulk Relative Density (coarse)	2.768	2.761 – 2.781
Absorption (coarse)	0.55	0.45 – 0.67
Micro-Deval (coarse)	6.862	5.8784 – 7.384

Table 4: 1987 Test Pit Durability Tests

TEST	AVERAGE	RANGE
Degradation	77	72-82
Sand Equivalent	77	74-80
Specific Gravity (coarse)	2.623	N/A
Specific Gravity (fine)	2.603	N/A
Absorption (coarse)	0.105	N/A
Absorption (fine)	1.082	N/A
Soundness – Magnesium Sulphate (coarse)	1.9	N/A
Soundness – Magnesium Sulphate (fine)	6.6	N/A
Soundness – Sodium Sulphate (coarse)	1.0	N/A
Soundness – Sodium Sulphate (fine)	1.4	N/A

Table 5: Specifications

BC MoTI Specifications	
Sand Equivalent	≥ 40 for base coarse and fine asphalt mix aggregate ≥ 20 for surfacing, sub-base and bridge end fill aggregates
Micro Deval	$\leq 30\%$ for sub-base and bridge end fill aggregates $\leq 25\%$ for surfacing & base course aggregates $\leq 18\%$ for Class 1 Pavement asphalt mix aggregates $\leq 20\%$ for Class 2 Pavement asphalt mix aggregates
Absorption	$< 2.0\%$ for coarse paving aggregates $\leq 1.0\%$ for coarse and $\leq 1.5\%$ for fine graded aggregate seals
Relative Density	~ 2.65 for all aggregate products

Material Suitability: Based on the 2005 and 2020 investigation results, the material in Area C is judged to be suitable for the following purposes:

Table 6: Suitability

	Pit Run	Crush
Area C	Bridge End Fill SGSB	25mm WGB Asphalt Mix Aggregates

The samples tested meet the gradation, sand equivalent, and micro-deval specifications for base course, bridge end fill and asphalt mix aggregate. Based on the absorption results the samples meet the specification for coarse paving aggregates.

Volume Estimates: Table 7 shows the volume estimates that can be expected for topsoil, overburden and gravel from Areas C and D. This is based on the measured depths encountered during the subsurface investigation. The potential volumes of granular material were calculated by averaging the total thickness of granular material encountered in test pits and multiplying by the estimated surface area.

Table 7: Volume Estimates

Area C	Topsoil	Overburden	Granular Material
Average Layer Thickness (m)	0	0	5.9
Volume (m ³)	0	0	144,000
Area D	Topsoil	Overburden	Granular Material
Average Layer Thickness (m)	0.3	0	5.2
Volume (m ³)	6,600	0	386,100

1987 investigation: Gradation summaries, stick logs, and test pit logs from the 1987 exploration program are available as a separate reference document under the name 'Beaver Creek Investigation'.

Pit Development Notes

- All development must be carried out in accordance with the most recent Health, Safety, and reclamation Code for Mines in British Columbia, BC Ministry of Energy and Mines, the Standard Specifications for Highway Construction, BC Ministry of Transportation and Infrastructure (2020, or later edition) and the Aggregate Operators Best Management Practices Handbook for BC.
- The water table was not encountered during the test pitting program.
- The crusher should be set up on the south side of the rock stockpile with development proceeding in a northerly direction.
- Due to the high quantity of oversize present, it will be necessary to utilize a primary crusher capable of reducing material as large as 375mm x 450mm.
- All trees, vegetation, and overburden are to be removed within 2m of the top of the pit faces. Topsoil, overburden, and aggregate cannot be removed within five meters of the reserve boundary.
- No dumping of debris or petroleum products will be permitted, and the site must be left in a clean and safe condition.
- At the completion of the pit development operations, but prior to the depletion of the pit, the sides of the pit faces, waste piles, and overburden stockpiles must be trimmed to a 1.5H:1V slope. Active pit faces must be reshaped with native granular materials.
- Upon depletion of the pit, all disturbed areas are to be reclaimed. The minimum reclamation procedure should include re-sloping of the pit faces and waste piles to a 2H:1V slope, contouring the area for appropriate drainage, spreading of overburden followed by topsoil, and seeding.
- Should any of the above conditions conflict with the Health, Safety, and Reclamation Code for Mines in British Columbia, then the Code will prevail.

Closure

The findings of this report and the soil conditions noted above are inferred from the extrapolation of limited surface and subsurface data collected during the site investigation. It should be noted that different and possibly poorer soil conditions may exist between the test pit locations and volume estimates may vary from those reported in this report.

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Enclosures

Figures:

Figure 1 - Location Plan

Figure 2 - Legal Plan

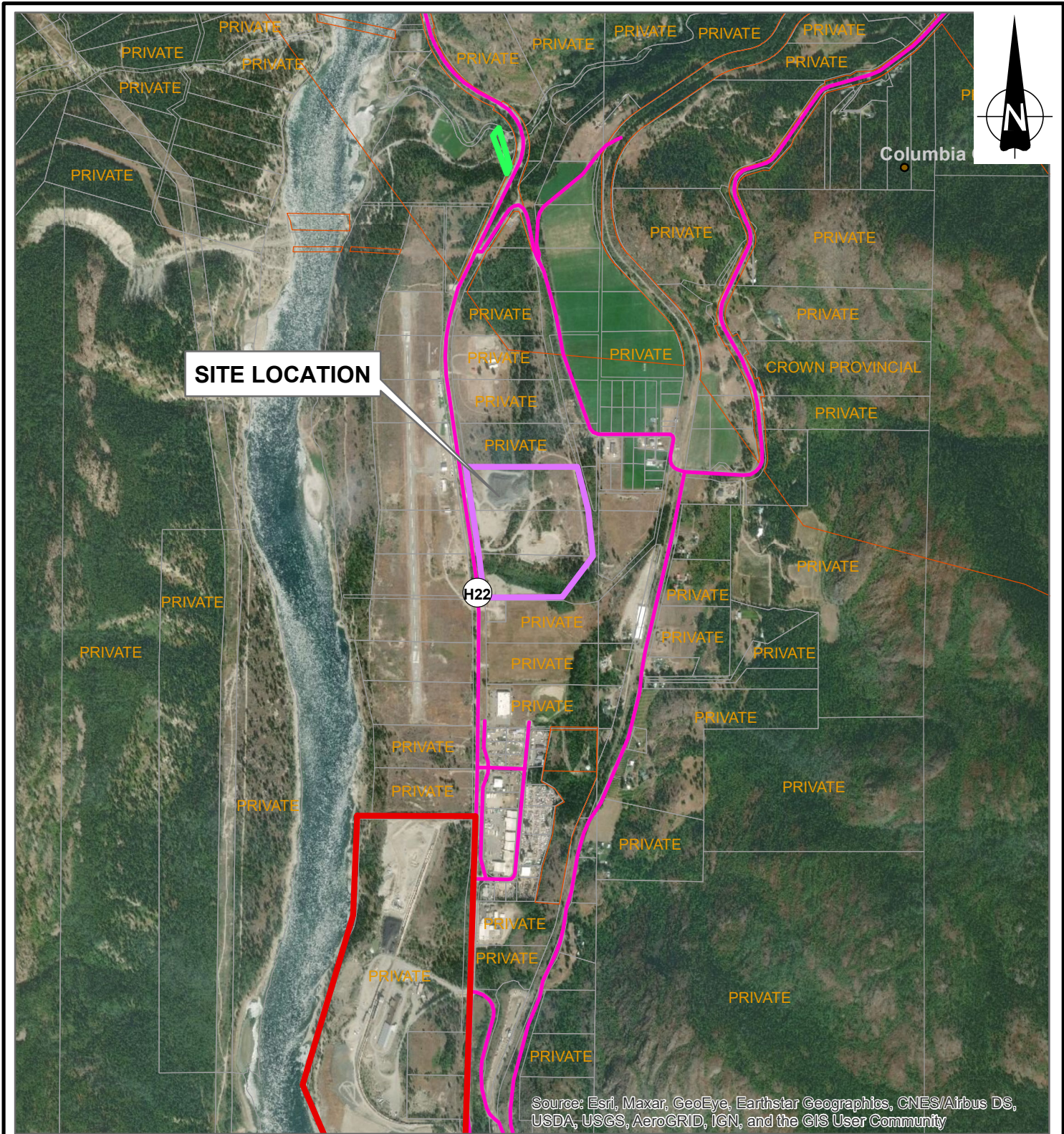
Figure 3 - Development Plan

Test Pit Summary

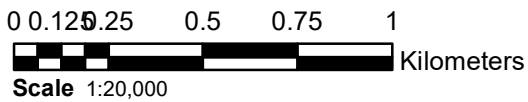
USC Legend

Photos



Figures



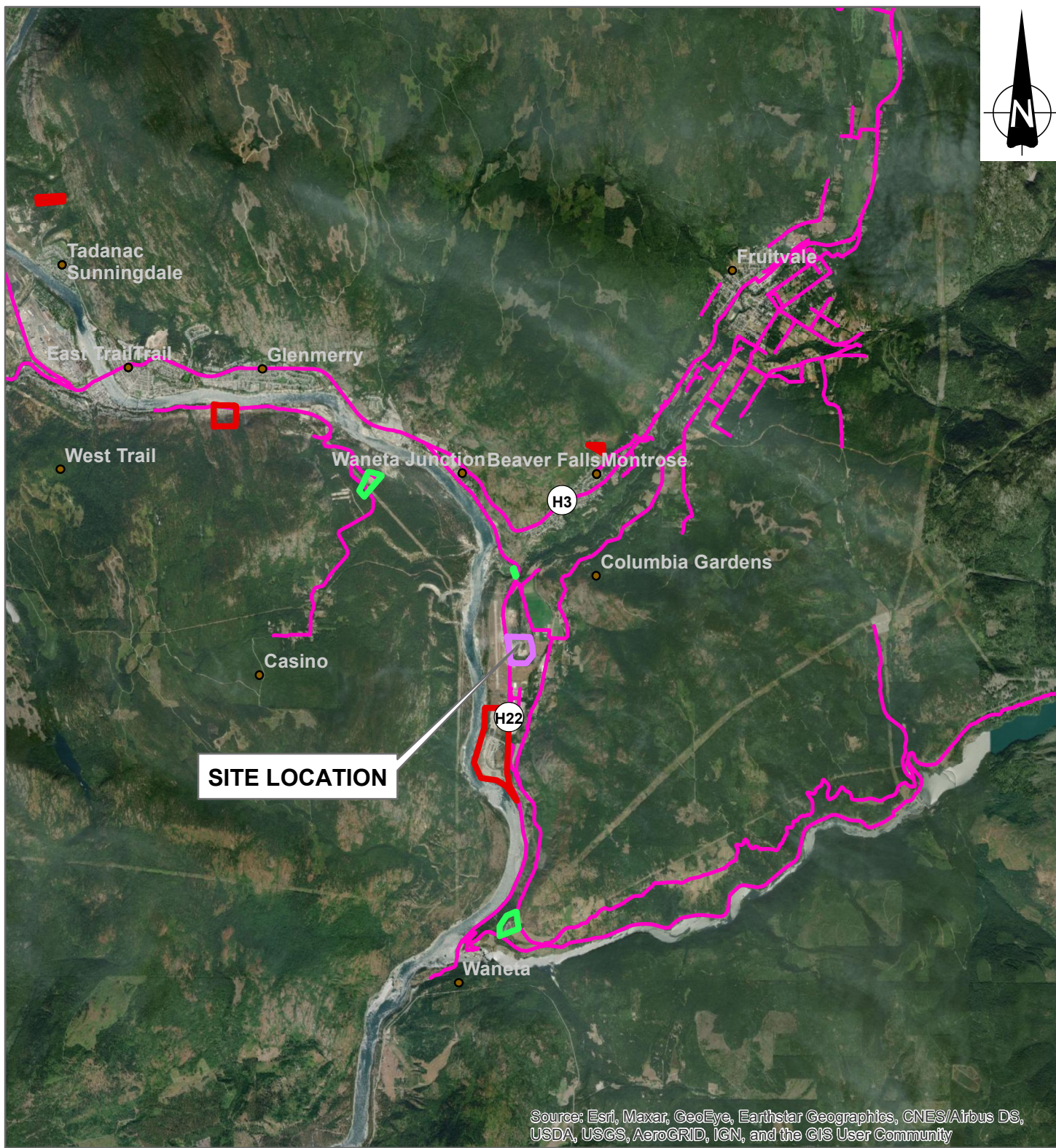
Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community



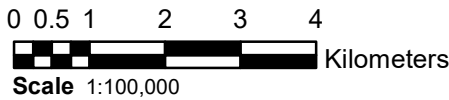
This drawing was originally produced in colour.

 Ministry of Transportation and Infrastructure Geotechnical and Materials Branch 			
LEGAL PLAN (2021) Columbia Gardens Pit No. 2729 SA09 - West Kootenay District			
DRAWN BY: lacourte	PROJECTION: NAD 1983 UTM Zone 11N	SCALE: As Shown	
CHECKED BY: A.Mitchell	DATUM: NAD 1983 UTM Zone 11N	DATE: 2021-03-22	
FileName: GISTemplate_Gravel_R2_2020-12-09_SISV8	Geotech Project No: SISV8	Reg: 2	Drawing No: FIGURE 2



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Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community






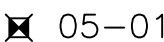

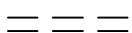




This drawing was originally produced in colour.

 Ministry of Transportation and Infrastructure Geotechnical and Materials Branch			
LOCATION PLAN (2021) Columbia Gardens Pit No. 2729 SA09 - West Kootenay District			
DRAWN BY:	lacourte	PROJECTION:	NAD 1983 UTM Zone 11N
CHECKED BY:	A.Mitchell	DATUM:	NAD 1983 UTM Zone 11N
Scale:	As Shown	DATE:	2021-03-22
File Name:	Geotech Project No:	Reg:	Drawing No:
GISTemplate_Gravel_R2_2020-12-09_SISV8	SISV8	2	FIGURE 1

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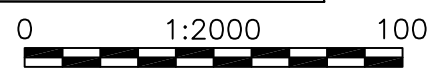


LEGEND

-  PROCESSING PLANT LOCATION
-  DEVELOPMENT DIRECTION
-  SUITABILITY BOUNDARY
-  05-01 TEST PIT 05-01, EXCAVATED IN 2005.
-  PROPERTY BOUNDARY
-  ACCESS ROAD
-  PROCESSED AGGREGATE STOCKPILE AREA
-  EXISTING ROCK STOCKPILE
-  FENCE
-  LAMPSTAND

- ### MINING NOTES
- All vegetation, topsoil and overburden is to be stripped a minimum of 2 metres back from active pit faces.
 - Topsoil and overburden is to be stockpiled and seeded with grass. Removal of this material is not permitted.
 - At the completion of mining activities, all pit faces are to be sloped to a minimum of 1 1/2 to 1 with native granular material.
 - For projects mining in excess of 1,000 cubic metres, the Ministry of Energy Mines (Mines Division) must be notified (approximately 14 days prior to the commencement of mining).
 - All reject material, resulting from aggregate production, is to be placed in neat, easily accessible stockpiles free of deleterious material (i.e. wood waste).
 - No dumping of Demolition, Land Clearing and Construction debris is permitted without prior written approval of the Ministry of Transportation.

"INFORMATION PROVIDED HEREIN IS INTENDED TO BE USED BY THE MINISTRY OF TRANSPORTATION IN CONJUNCTION WITH ALL OTHER DATA RELEVANT TO THE SITE. THE SOIL AND GROUND WATER CONDITIONS SHOWN ARE REPRESENTATIVE AT THE TESTHOLE LOCATIONS ON THE DATES INDICATED. CONDITIONS ARE SUBJECT TO CHANGE WITH TIME. THE MINISTRY OF TRANSPORTATION SHALL NOT BE HELD LIABLE FOR ANY CLAIMS OR ACTIONS ARISING FROM THE USE OR INTERPRETATION OF THE DATA HEREIN PROVIDED."



Date	Updated	REVISIONS Description	Initial
JAN 2023			

REVIEWED BY:		Date
A.T.A.		
APPROVED BY:		Date
G.R.M.		

SCALE: 1:2000
DRAWN: IWTS
DATE: DEC2009
AutoCAD: F3P2729

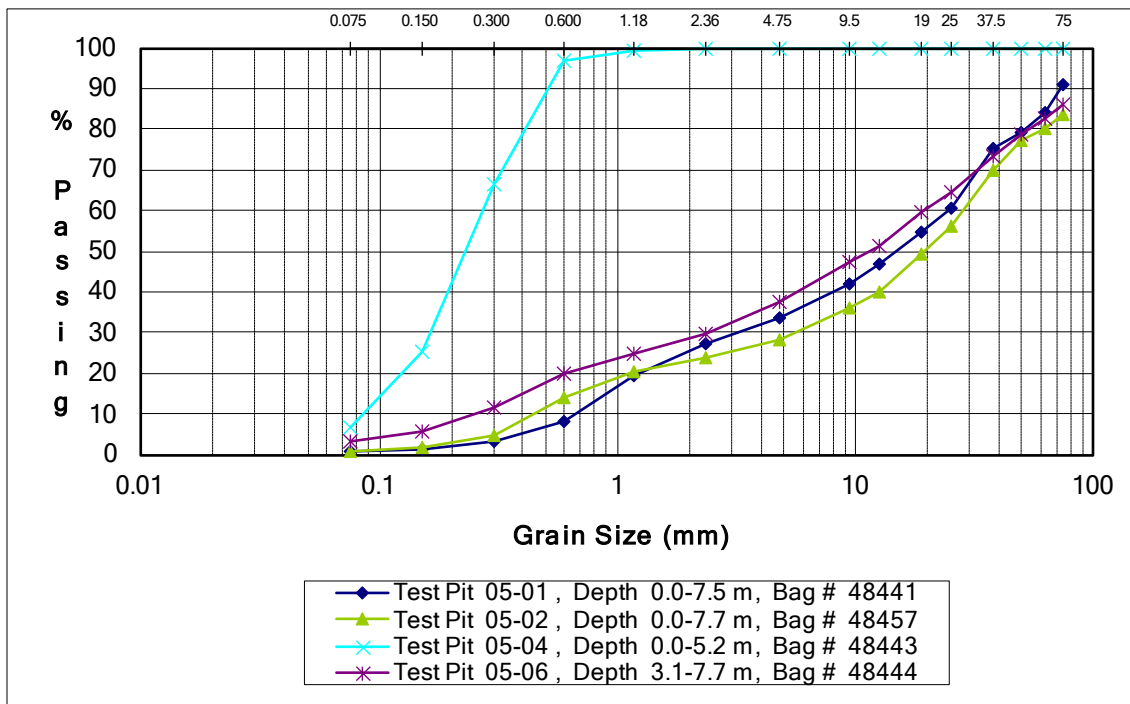
Test Pit Summaries

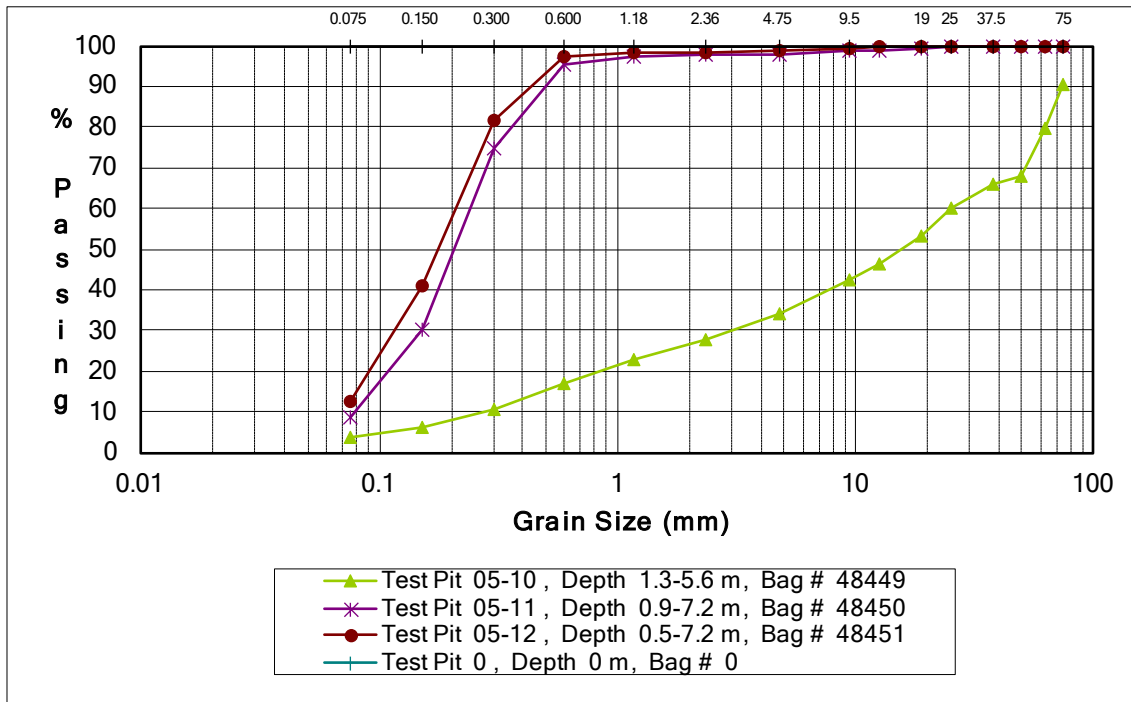
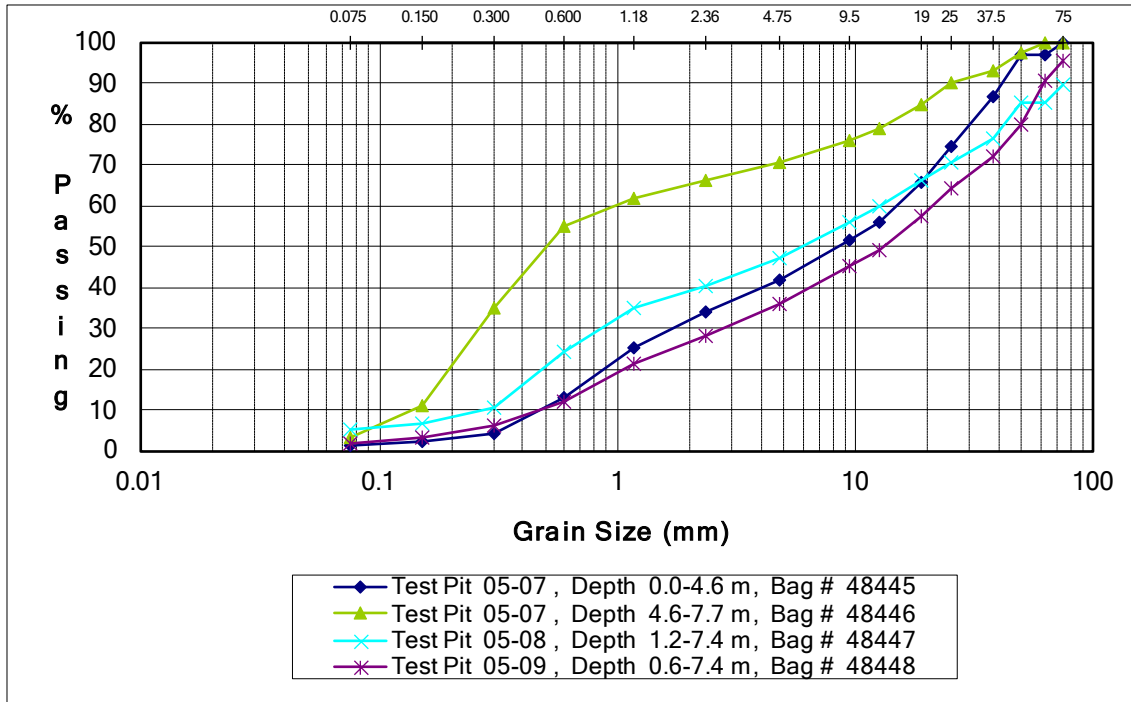
**PROJECT REPORT OF
SIEVE ANALYSIS SUMMARIES**

PERCENT PASSING

Project: Gravel Investigation Project No.: 0
 Sample Source: Columbia Gardens Client: Sitkum Consulting Ltd
 Material: PIT RUN Date: Feb 21/05

Sample Information			Percent Passing														
Test Pit	Depth (m)	Bag #	Pit Run Sieve Sizes (mm)														
			75	63	50	37.5	25	19	12.5	9.5	4.75	2.36	1.18	0.6	0.3	0.15	0.075
05-01	0.0-7.5	48441	90.9	84.2	79.3	75.3	60.7	54.9	46.6	41.7	33.7	27.1	19.6	7.8	3.2	1.4	0.9
05-02	0.0-7.7	48457	83.4	80.2	77.4	69.8	56.3	49.3	39.9	35.9	28.4	23.6	20.2	13.8	4.4	1.5	0.9
05-04	0.0-5.2	48443	100.0	100.0	100.0	100.0	100.0	100.0	100.0	99.9	99.8	99.6	99.4	96.7	66.4	25.2	6.4
05-06	3.1-7.7	48444	85.9	82.4	78.7	73.2	64.2	59.7	51.4	47.2	37.3	29.8	24.9	20.1	11.3	5.6	3.1
05-07	0.0-4.6	48445	100.0	97.0	97.0	86.6	74.3	65.7	56.0	51.4	41.6	33.9	25.2	13.1	4.2	2.3	1.4
05-07	4.6-7.7	48446	100.0	100.0	97.5	93.1	90.0	84.7	79.0	75.9	70.7	66.2	61.7	54.7	35.0	11.2	3.1
05-08	1.2-7.4	48447	89.4	85.2	85.2	76.2	70.6	65.9	59.6	55.8	47.2	40.2	34.7	24.0	10.4	6.7	5.2
05-09	0.6-7.4	48448	95.1	90.6	79.7	72.2	64.3	57.2	49.0	45.0	35.9	28.3	21.0	12.0	6.1	3.3	1.9
05-10	1.3-5.6	48449	90.3	79.9	67.7	65.9	59.9	53.3	46.5	42.4	34.0	27.8	22.6	16.9	10.5	6.3	3.9
05-11	0.9-7.2	48450	100.0	100.0	100.0	100.0	100.0	99.5	98.9	98.6	98.0	97.7	97.3	95.4	74.8	30.1	8.6
05-12	0.5-7.2	48451	100.0	100.0	100.0	100.0	100.0	99.6	99.6	99.4	99.0	98.5	98.1	97.4	81.4	41.0	12.5





USC Legend

MATERIALS CLASSIFICATION LEGEND

MAJOR DIVISIONS	SYMBOL	SOIL TYPE					
COARSE GRAINED SOILS	GRAVEL AND GRAVELLY SOILS	GW	WELL GRADED GRAVELS OR GRAVEL-SAND MIXTURES, < 5% FINES				
		GP	POORLY-GRADED GRAVELS OR GRAVEL-SAND MIXTURES, < 5% FINES				
		GM*	SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES				
		GC*	CLAYEY GRAVELS, GRAVEL-SAND-CLAY MIXTURES				
	SAND AND SANDY SOILS	SW	WELL-GRADED SANDS OR GRAVELLY SANDS, < 5% FINES				
		SP	POORLY-GRADED SANDS OR GRAVELLY SANDS, < 5% FINES				
		SM*	SILTY SANDS SAND-SILT MIXTURES				
		SC*	CLAYEY SANDS SAND-CLAY MIXTURES				
FINE GRAINED SOILS	SILTS AND CLAYS $w_L < 50$	ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY				
		CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS				
		OL	ORGANIC SILTS AND ORGANIC SILT-CLAYS OF LOW PLASTICITY				
	SILTS AND CLAYS $w_L > 50$	MH	INORGANIC SILTS, MICACEOUS OR DIATOM-ACEOUS FINE SANDY OR SILTY SOILS, PLASTIC SILTS				
		CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS				
		OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS				
ORGANIC SOILS	Pt	PEAT AND OTHER HIGHLY ORGANIC SOILS					
TOPSOIL	TS	TOPSOIL WITH ROOTS, ETC.					
COBBLES	SB	ROCK FRAGMENTS AND COBBLES, PARTICLE SIZE 75mm TO 300mm					
LARGE BOULDERS	LB	BOULDERS, PARTICLE SIZE OVER 300mm					
BEDROCK	BR	BEDROCK					
FOR SOILS HAVING 5 - 12% PASSING .075 SIEVE, USE DUAL SYMBOL							
<table style="border: none;"> <tr> <td style="border: none;">*GM1; GC1; SM1; SC1; 12 - 20%</td> <td rowspan="4" style="border: none; vertical-align: middle;">} PASSING .075mm SIEVE</td> </tr> <tr> <td style="border: none;">GM2; GC2; SM2; SC2; 20 - 30%</td> </tr> <tr> <td style="border: none;">GM3; GC3; SM3; SC3; 30 - 40%</td> </tr> <tr> <td style="border: none;">GM4; GC4; SM4; SC4; 40 - 50%</td> </tr> </table>		*GM1; GC1; SM1; SC1; 12 - 20%	} PASSING .075mm SIEVE	GM2; GC2; SM2; SC2; 20 - 30%	GM3; GC3; SM3; SC3; 30 - 40%	GM4; GC4; SM4; SC4; 40 - 50%	
*GM1; GC1; SM1; SC1; 12 - 20%	} PASSING .075mm SIEVE						
GM2; GC2; SM2; SC2; 20 - 30%							
GM3; GC3; SM3; SC3; 30 - 40%							
GM4; GC4; SM4; SC4; 40 - 50%							

REV. 90-04-26

PROVINCE OF BRITISH COLUMBIA MINISTRY OF TRANSPORTATION & HIGHWAYS Geotechnical & Materials Engineering
UNIFIED SOIL CLASSIFICATION LEGEND
Drawn: LU Date: JULY'97 Scale: File No.: ACAD File: <small>AGADSTDS</small> <small>100mm, soil - .acx</small>

Photos



Lower floor (Area C) facing rock stockpile (2023).



View of pit entrance and lower floor with rock stockpile on right side of photo (2023).



View of southern part of lower floor (2023).



Upper pit area, shown as Area A on pit development plan (2023).