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Geotechnical Data
Water Treatment Plant
Faro Mine Remediation Project

PREPARED FOR:	Government of Yukon
PREPARED BY:	CH2M HILL Canada Limited
COPIES:	Internal
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PROJECT NUMBER:	436662.07.05.01

Introduction

Purpose and Scope of Work

This Geotechnical Data Technical Memorandum (TM) presents the data and findings from the site-specific geotechnical field exploration performed in support of the proposed Faro Water Treatment Plant (WTP) design. The proposed WTP will treat contaminated water at the site and is anticipated to be comprised of a 30 m by 65 m process building, two 50-m diameter thickeners, and a 30 m by 85 m filter building. Appurtenant features include one or more storage silos and a cut-and-cover tunnel connecting the process building and the thickeners. Sumps will underlie the filter banks in the filter building. The structure construction is anticipated to be reinforced concrete.

The scope of work is defined in Task Authorization Request (TAR) 007(A), *Field Planning and Investigation*, Subtask 07.01.04.20–101.1, *Construct New Faro Water Treatment Plant and Piping* (CH2M HILL, 2012k), and includes the following:

- Drill 10 shallow soil boreholes
- Complete two shallow soil boreholes as open standpipe piezometers
- Observe and document subsurface conditions encountered during drilling of soil boreholes
- Collect soil samples for geotechnical field classification and laboratory testing
- Direct laboratory testing of selected soil samples to evaluate index properties
- Prepare final logs of exploration
- Summarize the laboratory testing
- Prepare this Geotechnical Data TM

This TM has been prepared in accordance with Subtask FA.02.07.01.05 – *Field Work Summary Reporting* of TAR 007(A) (CH2M HILL, 2012k). A separate geotechnical design criteria report being prepared under TAR 013(A), *WTP Design* will include specific evaluations and recommendations for the proposed WTP.

Geotechnical Investigation

A geotechnical field investigation was performed during the period June 18–24, 2012, at the site of the proposed WTP. The proposed site location is presented with a vicinity map in Figure 1. The field investigation consisted of advancing soil boreholes, collecting soils and rock samples, and constructing open standpipe piezometers. Laboratory testing of selected soils samples was completed in July 2012. The field investigation and laboratory testing were completed in accordance with *Construct New Faro and Vangorda Grum Water Treatment Plant and Piping – 2012 Field Sampling Plan Addendum 1* (CH2M HILL, 2012l).

Soil Boreholes

Ten soil boreholes were drilled by Tervita Corp., under subcontract to CH2M HILL Canada Limited (CH2M HILL), using a Gus Peche sonic drill rig. The boreholes are numbered CH12-101-BH001 through CH12-101-BH008, CH12-101-PZ001, and CH12-101-PZ002. The borehole locations are shown in Figure 2.

The boreholes were drilled in accordance with Standard Operating Procedure (SOP) INV001, *Drilling* (CH2M HILL, 2012b). The boreholes were advanced through overburden using a nominal 100-mm (4-inch) inside diameter (I.D.) sonic drill barrel inside of a nominal 150-mm (6-inch) I.D. casing. Upon encountering bedrock, all of the boreholes except for CH12-101-BH002 were advanced using HQ (63.5-mm [2.5-inch]) diamond core drilling methods. Borehole CH12-101-BH002 was advanced into bedrock using the sonic drill barrel. The boreholes were logged by a CH2M HILL engineer in accordance with SOP PCS001, *Boring Logs Completion, Soil Classification, and Logging* (CH2M HILL, 2012f).

A summary of the boreholes is presented in Table 1. The borehole logs are presented in Appendix A.

TABLE 1
WTP Boreholes
Faro Mine Remediation Project

Borehole Number	Ground Surface Elevation (m)	Thickness of Fill and Topsoil [a] (m)	Depth to Bedrock (m)	Completion Depth (m)	Depth to Groundwater (m)
CH12-101-BH001	1,137.0	3.2	3.8	7.6	None encountered
CH12-101-BH002	1,136.4	1.9	4.6	7.5	None encountered
CH12-101-BH003	1,134.7	4.3	6.1	10.6	None encountered
CH12-101-BH004	1,135.0	1.2	2.6	7.5	None encountered
CH12-101-BH005	1,130.6	2.4	5.5	9.1	None encountered
CH12-101-BH006	1,129.8	0.9	0.9	6.1	None encountered
CH12-101-BH007	1,134.9	0.6	1.6	4.6	None encountered
CH12-101-BH008	1,130.1	1.5	1.9	4.6	None encountered
CH12-101-PZ001	1,135.7 TOC 1,136.6	4.0	5.1	9.1	None encountered
CH12-101-PZ002	1,132.6 TOC 1,133.4	2.8	2.8	10.7	None encountered

[a] Where present, native topsoil is included in the estimated thickness of fill.
m – metres
TOC = Top of well casing

Soil samples were collected in accordance with SOP INV003, *Borehole Sampling and Testing* (CH2M HILL, 2012c). Disturbed soil samples were obtained from the boreholes at nominal 1.5-m intervals in soil using a 50-mm (2-inch) outside diameter split-spoon drive sampler in general accordance with the methods described in ASTM D1586, *Standard Test Method for Standard Penetration Test (SPT) and Split-Barrel Sampling of Soils* (ASTM, 2012). The result of the SPT is a blow count, or N-value. The N-value is the number of blows from a 63.5-kg (140-pound) hammer free-falling from a height of 750 mm (30 inches) required to drive the split-spoon sampler in the interval from 150 to 450 mm (6 to 18 inches) of a 610-mm (24-inch) sampling interval. The split-spoon sampler was driven by an automatic hammer.

The N-value provides an estimate of the in-situ relative density of sandy materials. However, the N-value only provides an indication of the relative stiffness, or consistency, of cohesive materials because the penetration resistance of these soils may vary with moisture content. Also, the SPT is not reliable in gravelly soil, particularly where the size of the gravel particles exceeds the I.D. of the sampling spoon.

Split-spoon samples and bulk (grab) samples were labelled in accordance with SOP PSM011, *Sample Nomenclature* (CH2M HILL, 2012i), and shipped to the testing laboratory in accordance with SOP PCS002, *Sample Packing and Shipping – Environmental* (CH2M HILL, 2012g), and SOP PCS016, *Sample Packing, Shipping, and Storage (Geotechnical)* (CH2M HILL, 2012h). Relatively undisturbed samples of fine-grained soils could not be collected from the WTP boreholes using a thin-walled steel tube (Shelby tube) because the soils encountered were either hard, contained large gravel particles, or were in layers too thin to sample.

After completion, the as-built locations of the boreholes were surveyed by Challenger Geomatrics, Ltd., in accordance with SOP MSR006, *Geographic Land Surveying and Field Surveying Procedures* (CH2M HILL, 2012d). The surveyed coordinates (northings and eastings) and elevations are provided in the borehole logs.

Groundwater was not encountered in any of the WTP boreholes.

Rock cores obtained by diamond core drilling were logged and placed into wooden core boxes in accordance with SOP PCS016. Photographs of the rock core are presented in Appendix B. Rock core was not recovered from borehole CH12-101-BH002 because the sonic drilling method pulverized most of the rock.

Boreholes CH12-101-PZ001 and CH12-101-PZ002 were completed as open standpipe piezometers for the purpose of monitoring the possible presence and depth of seasonal groundwater. Each piezometer was constructed using 50-mm (2-inch) Schedule 40 polyvinyl chloride (PVC) well casing and completed with an aboveground protective steel casing in accordance with SOP INL002, *Monitoring Well or Piezometer Installation* (CH2M HILL, 2012a). Well completion diagrams for these piezometers are included in Appendix A.

Boreholes not completed as open standpipe piezometers were abandoned by grouting with non-shrink cement-bentonite grout in accordance with SOP MSR019, *Borehole Abandonment* (CH2M HILL, 2012e).

Laboratory Testing

A limited laboratory testing program was completed by ALS Laboratory Group (ALS), under subcontract to CH2M HILL, on selected soil samples from the WTP boreholes in accordance with *Construct New Faro and Vangorda Grum Water Treatment Plant and Piping – 2012 Field Sampling Plan Addendum 1*(CH2M HILL, 2012i). The laboratory tests performed (and test methods) were:

- Moisture Content (ASTM D2974) (ASTM, 2012)
- Atterberg Limits (Carter CSSS 58 [McKeague, 1978])
- Gradation Analysis (Canadian Society of Soil Science [CSSS] [1993] Method 47.2 and Soil Survey Investigations Report No. 5, Method 3.2.1 [Burt, 2009])

A laboratory test summary table and the laboratory test reports are presented in Appendix C of this report. Soil pH and metals analysis testing were also performed, and the results are included in Appendix C, but these analytical test results will be presented and evaluated in a separate report currently being drafted by CH2M HILL.

Moisture contents measured in the laboratory may not represent actual in-situ conditions because the sonic drilling method heated the harder soils, potentially altering the moisture content. Water was also used to advance the outer drill casing and may have altered the sample moisture content. Dry bulk density testing of soils was not performed because undisturbed soil samples were not recovered due to the hard consistency and the presence of gravel in the site soils. Unconfined compressive strength testing of rock core was not performed because no rock core pieces meeting the minimum test sample length criterion were recovered due to the poor rock quality of the bedrock.

Surface and Subsurface Conditions

The proposed WTP site is located on three stepped levels of an equipment and material storage yard on a sloping hillside east of the existing Faro Mill facilities. The aerial photograph in Figure 2 shows the site features. The Faro Mine Complex (FMC) office and main security gate are located to the north. According to site personnel, an old mill building was previously located at the south end of the site but was reportedly demolished decades ago. Piping, broken-down equipment, and debris are scattered across the surface. Small trees and brush are growing at

the south end of the site. Active overhead and underground power lines run east-west across the site. A belowgrade timber-lined chute or channel with a concrete cover and oriented approximately east-west was observed between boreholes CH12-101-PZ002 and CH12-101-BH005.

The subsurface profile at the proposed WTP site comprises fill and native soils overlying slightly to highly weathered phyllite bedrock. The fill consists of sands and gravels with varying cobble and fines content. The thickness of the fill encountered in the soil boreholes ranges from 0.2 to 4.3 m. The native soils encountered include organic topsoil and silty to clayey sands and gravels. The native soils are medium dense to very dense. Some of the soils are interpreted to be glacial till. Residual soils comprising completely weathered phyllite bedrock were also encountered in several of the boreholes. Depth to bedrock ranged from 0.9 to 6.1 m. There is a bedrock surface outcrop on the hillside south of borehole CH12-101-BH004. The phyllite bedrock coring yielded Rock Quality Designation (RQD) values ranging from 0 to 26 percent. This is very low rock quality. The rock quality did not consistently increase with depth in the limited depths explored in the WTP borings.

Neither permafrost nor groundwater were encountered in any of the WTP boreholes. Open standpipe piezometers CH12-101-PZ001 and CH12-101-PZ002 were constructed targeting potential seasonal groundwater that might occur near the soil-bedrock interface. These piezometers will be monitored periodically. No frozen soils were encountered.

Deviations from Field Sampling Plan

Deviations from CH2M HILL's *Construct New Faro and Vangorda Grum Water Treatment Plant and Piping – 2012 Field Sampling Plan Addendum 1* (2012i):

- Gradation Analysis test method was CSSS (1993) Method 47.2 and Soil Survey Investigations Report No. 5, Method 3.2.1 (Burt, 2009) in place of ASTM D422 - 63(2007), *Standard Test Method for Particle-Size Analysis of Soils* (ASTM, 2012).
- Atterberg Limits test method was Carter CSSS 58 (McKeague, 1978) in place of ASTM D4318, *10 Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils* (ASTM, 2012).
- Moisture Content test method was ASTM D2974, *Standard Test Methods for Moisture, Ash, and Organic Matter of Peat and Other Organic Soils* in place of ASTM D2216, *10 Standard Test Methods for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass* (ASTM, 2012).

References

ASTM International (ASTM). 2012. *Annual Book of Standards.* West Conshohocken, PA: ASTM International.

Burt, R. 2009. "Soil Survey Investigations Report No. 5. Method 3.2.1.2.2." *Soil Survey Field and Laboratory Methods Manual.* United States Department of Agriculture, Natural Resources Conservation Service.

Canadian Society of Soil Science (CSSS). 1993. *Soil Sampling and Methods of Analysis*. First Edition. M.R. Carter, ed. Boca Raton, FL: Lewis Publishers and CRC Press.

CH2M HILL Canada Limited (CH2M HILL). 2012a. Standard Operating Procedure (SOP) INL002, *Monitoring Well or Piezometer Installation*. Prepared for Government of Yukon. March 31.

CH2M HILL Canada Limited (CH2M HILL). 2012b. Standard Operating Procedure (SOP) INV001, *Drilling*. Prepared for Government of Yukon. March 31.

CH2M HILL Canada Limited (CH2M HILL). 2012c. Standard Operating Procedure (SOP) INV003, *Borehole Sampling and Testing.* Prepared for Government of Yukon. March 31.

CH2M HILL Canada Limited (CH2M HILL). 2012d. Standard Operating Procedure (SOP) MSR006, *Geographic Land Surveying and Field Surveying Procedures*. Prepared for Government of Yukon. March 31.

CH2M HILL Canada Limited (CH2M HILL). 2012e. Standard Operating Procedure (SOP) MSR019, *Borehole Abandonment*. Prepared for Government of Yukon. March 31.

CH2M HILL Canada Limited (CH2M HILL). 2012f. Standard Operating Procedure (SOP) PCS001, *Boring Logs Completion, Soil Classification, and Logging*. Prepared for Government of Yukon. March 31.

CH2M HILL Canada Limited (CH2M HILL). 2012g. Standard Operating Procedure (SOP) PCS002, *Sample Packing and Shipping – Environmental.* Prepared for Government of Yukon. March 31.

CH2M HILL Canada Limited (CH2M HILL). 2012h. Standard Operating Procedure (SOP) PCS016, *Sample Packing, Shipping, and Storage (Geotechnical)*. Prepared for Government of Yukon. March 31.

CH2M HILL Canada Limited (CH2M HILL). 2012i. Standard Operating Procedure (SOP) PSM011, *Sample Nomenclature.* Prepared for Government of Yukon. March 31.

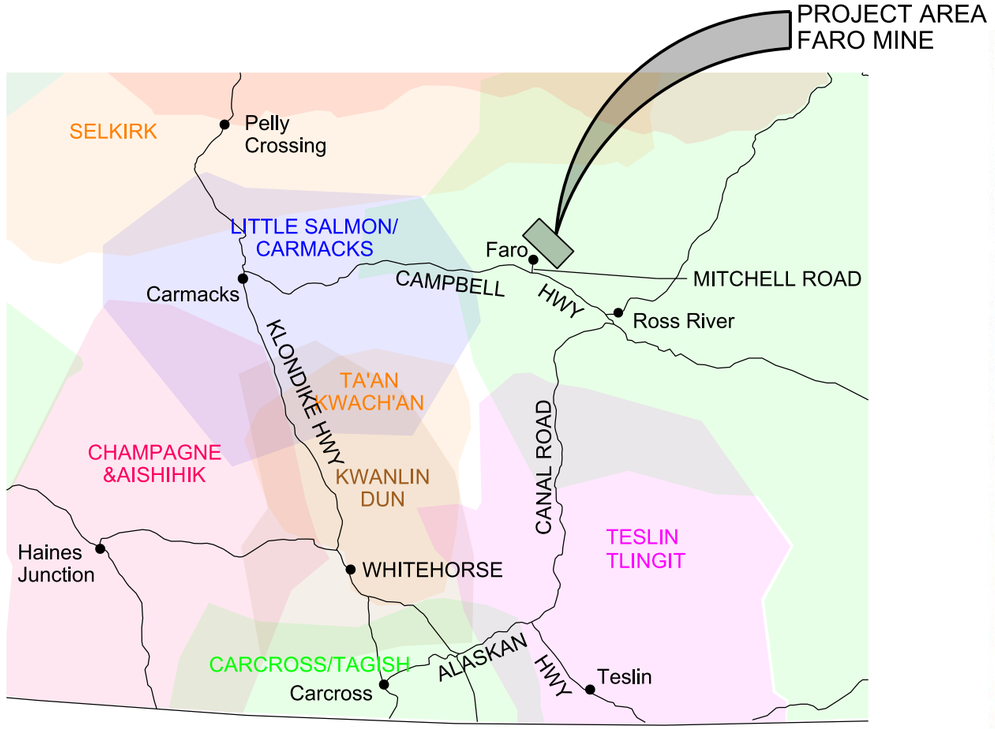
CH2M HILL Canada Limited (CH2M HILL). 2012j. *Task Authorization Request (TAR) 013(A), WTP Design. Project Design Team for Faro Mine Remediation.* Contract Number C00010250. Prepared for Government of Yukon. May 14.

CH2M HILL Canada Limited (CH2M HILL). 2012k. *Task Authorization Request (TAR) 007(A), Field Planning and Investigation*. Contract Number C00010250. Prepared for Government of Yukon. May 18.

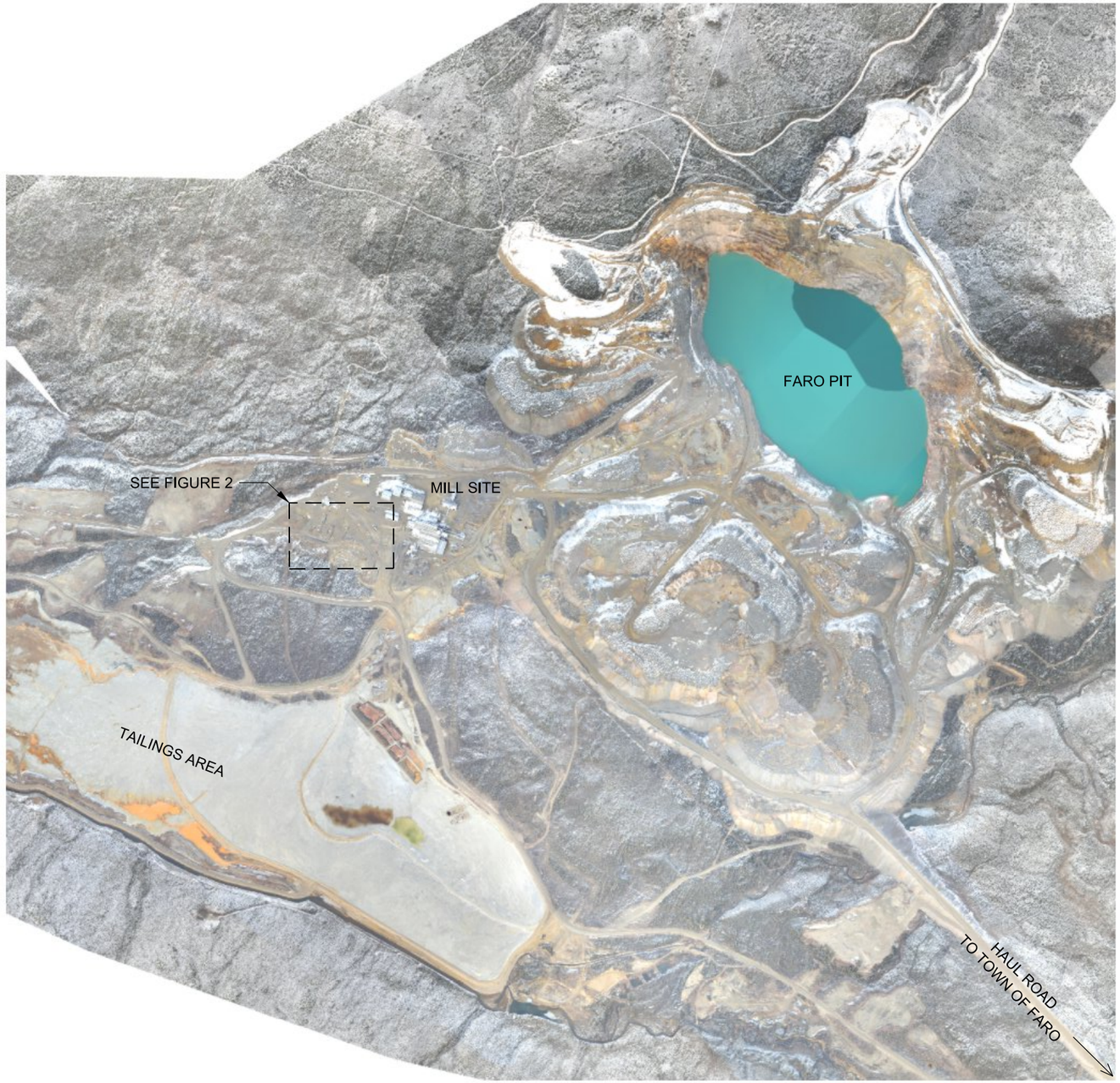
CH2M HILL Canada Limited (CH2M HILL). 2012l. *Construct New Faro and Vangorda Grum Water Treatment Plant and Piping – 2012 Field Sampling Plan Addendum 1*. Prepared for Government of Yukon. June 12.

McKeague, J.A. 1978. “Atterberg Limits. Soil Sampling and Methods of Analysis.” *Can. Soc. Soil Sci*. pp. 50-55.

Figures



VICINITY MAP
NOT TO SCALE



LOCATION MAP
1:20,000 METRES

FIGURE 1
VICINITY AND LOCATION MAP

CH2MHILL®

N

0 20 40

METRES

LEGEND

- BOREHOLE
- PIEZOMETER LOCATION
- PROPOSED WATER TREATMENT PLANT STRUCTURE

NOTES:
1. TOPOGRAPHY AND AERIAL PHOTO PREPARED FROM LIDAR DATED 10-03-11.
   HORIZONTAL DATUM: NAD83 CSRS EPOCH 2002.
   VERTICAL DATUM:CGVD28 (HTV2.0)

2. SAMPLE LOCATIONS FIELD SURVEYED BY CHALLENGER GEOMATRICS LTD.
   DATED 08-17-12.

CH12-101-BH002
CH12-101-BH001
CH12-101-PZ001
CH12-101-BH004
CH12-101-BH007
CH12-101-BH003
CH12-101-PZ002
CH12-101-BH006
CH12-101-BH008
CH12-101-BH005
1136
1134
1132
1130
1128

FIGURE 2
BOREHOLE LOCATION PLAN

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PLOT TIME: 3:37:55 PM
PLOT DATE: 20120907
FILENAME: 2012_Surveyed_101_301_FIGURE01.dgn

Appendix A

Boring Logs and Well Completion Diagrams

SHEET 1 of 1

PROJECT NUMBER: 436662

BORING NUMBER: *CH12-101-BH001*

SOIL BORING LOG

PROJECT NAME: Faro Mine Remediation Project		**HOLE DEPTH (m):** 7.6	**DRILLING CONTRACTOR:** Tervita	
SURFACE ELEVATION: 1137.0 m MSL	**NORTHING (NAD83 UTM Z8N):** 6914408.3	**EASTING (NAD83 UTM Z8N):** 582583.1	**DATE STARTED:** 6/21/2012	**DATE COMPLETED:** 6/21/2012
WATER LEVEL: NE	**DRILLING METHOD:** Sonic		**DRILLING EQUIPMENT:** Gus Pech Sonic, 4" I.D. Core barrel, 6" casing, HQ Diamond Core	
LOCATION: Water Treatment Plant			**LOGGED BY:** K. Ohsiek	

DEPTH (m bgs)	INTERVAL (m)	RECOVERY (%)	FIELD SAMPLE NO.	SPT RESULTS (N)	SIZE DISTRIBUTION %G	%S	%F	SOIL DESCRIPTION	LAB DATA	COMMENTS (e.g.: DRILLING FLUID LOSS, TESTS, OR DRILLER COMMENTS, ETC.)
1		84	SS-1	28-50 (>50)				**FILL - SILTY GRAVEL WITH SAND (GM)**, brownish gray (10YR 4/1), fine to coarse, moist, very dense, angular particles, subrounded to angular gravel and cobbles to 100 mm, slight plasticity.	CH12-101-BH001_SOa MC = 10	Damaged shoe on rock, sampler taken out of service, blowcounts are not representative.
2		83	SS-2	12-11-11-19 (22)	7	65	28	**FILL - CLAYEY SAND (SC)**, brownish gray (10YR 4/1), fine to coarse, moist, medium dense, angular particles, subrounded to angular gravel and cobbles to 100 mm, slight plasticity.	CH12-101-BH001_SOb MC = 7 LL = 34 PI = 11	4:50 pm
3		100	SS-3	50 (>50)				**CLAYEY SAND (SC)**, silvery gray (GLEY1 5/N),dry, platy grave, very dense.		Native contact.
			GB-4		31	47	22		CH12-101-BH001_SOc MC = 3 LL = 32 PI = 10	
4		66	Run-1					**BEDROCK - PHYLLITE**, olive black (5Y 2/1), moderately weathered, moderate hardness, foliated, smooth to rough joints/bedding planes, quartzite filling, 5 to 100 mm, some iron oxide staining in some joints, some localized dip (45 degrees), most are horizontal, very close to close fracture spacing.		5:35 pm: Switch to Diamond Core, start Run-1. RQD = 0% HCL reaction to calcareous quartzite
5										
6		50	Run-2							5:50 pm: End Run-1 6:40 pm: Start Run-2. RQD = 18% Driller reports interbedded soft zones in rock. Possible weathered zones.
7								*Boring Terminated at 7.6 metres bgs*		6:47 pm: End Run-2.

LL = Liquid Limit
MC = Moisture Content
NE = Groundwater Not Encountered
PI = Plasticity Index
GB = Grab

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SHEET 1 of 1	PROJECT NUMBER: 436662	BORING NUMBER: *CH12-101-BH002*

SOIL BORING LOG

PROJECT NAME: Faro Mine Remediation Project		**HOLE DEPTH (m):** 7.5	**DRILLING CONTRACTOR:** Tervita	
SURFACE ELEVATION: 1136.4 m MSL	**NORTHING (NAD83 UTM Z8N):** 6914427.8	**EASTING (NAD83 UTM Z8N):** 582518.4	**DATE STARTED:** 6/19/2012	**DATE COMPLETED:** 6/19/2012
WATER LEVEL: NE	**DRILLING METHOD:** Sonic		**DRILLING EQUIPMENT:** Gus Pech Sonic, 4" I.D. Core barrel, 6" casing	
LOCATION: Water Treatment Plant			**LOGGED BY:** K. Ohsiek	

DEPTH (m bgs)	INTERVAL (m)	RECOVERY (%)	FIELD SAMPLE NO.	SPT RESULTS (N)	SIZE DISTRIBUTION %G	%S	%F	SOIL DESCRIPTION	LAB DATA	COMMENTS (e.g.: DRILLING FLUID LOSS, TESTS, OR DRILLER COMMENTS, ETC.)
0		88	SS-1	7-17-20-26 (37)				**FILL - SILTY SAND WITH GRAVEL (SM)**, brownish gray (7YR 3/2), dry, dense, max particle size 25 mm, angular.	CH12-101-BH002_SOa MC = 7	
1								With gravel and cobbles to 100 mm, angular to subangular.		Casing is advanced with water.
		100	SS-2	10-14-15-20 (29)				**SILT (ML)**, black (GLEY1 2.5/N), moist, hard, trace gravel, trace wood fragments, nonplastic.	CH12-101-BH002_SOb MC = 6	Native topsoil. 3:35 pm
2					33	52	15	**SILTY SAND (SM)**, olive (2.5Y 3/2), moist, medium dense, trace fine gravel to 10 mm.		
								Increasing clay and gravel content (up to 100 mm particles), angular to subangular.		
3		87	SS-3	7-11-20-19 (31)				Increasing clay content, low plasticity.	CH12-101-BH002_SOc MC = 20 LL = 38 PI = 14	Large cobble 3.4 to 3.6 metres.
					9	54	37	**SILTY SAND WITH GRAVEL (SM)**, reddish brown (7.5YR 3/2), dense, angular, platy/foliated gravel to 25 mm.		
4								**POORLY GRADED GRAVEL WITH SILT AND SAND (GP-GM)**, white gray (GLEY1 4/N), very dense, angular particles.		
		100	SS-4	50 (>50)				**(POSSIBLE) BEDROCK - CLAYEY GRAVEL (GC)**, white (8.5N), dry, very dense, foliated gravel (phyllite), angular up to 100 mm.		4:45 pm
5										
			GB-5							
6		100	SS-6							
								Clay content varies. Medium plasticity, clayey seams up to 0.3 metres.		Slow drilling.
7								*Boring Terminated at 7.5 metres bgs*		5:45 pm: Groundwater not encountered.

LL = Liquid Limit
MC = Moisture Content
NE = Groundwater Not Encountered
PI = Plasticity Index
GB = Grab

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SHEET 1 of 1

PROJECT NUMBER: 436662

BORING NUMBER: *CH12-101-BH003*

SOIL BORING LOG

PROJECT NAME: Faro Mine Remediation Project		**HOLE DEPTH (m):** 10.6	**DRILLING CONTRACTOR:** Tervita	
SURFACE ELEVATION: 1134.7 m MSL	**NORTHING (NAD83 UTM Z8N):** 6914336.6	**EASTING (NAD83 UTM Z8N):** 582566.4	**DATE STARTED:** 6/21/2012	**DATE COMPLETED:** 6/21/2012
WATER LEVEL: NE	**DRILLING METHOD:** Sonic		**DRILLING EQUIPMENT:** Gus Pech Sonic, 4" I.D. Core barrel, 6" casing, HQ Diamond Core	
LOCATION: Water Treatment Plant			**LOGGED BY:** K. Ohsiek/A. Campbell	

DEPTH (m bgs)	INTERVAL (m)	RECOVERY (%)	FIELD SAMPLE NO.	SPT RESULTS (N)	SIZE DISTRIBUTION %G	%S	%F	SOIL DESCRIPTION	LAB DATA	COMMENTS (e.g.: DRILLING FLUID LOSS, TESTS, OR DRILLER COMMENTS, ETC.)
		83	SS-1	18-19-18-22 (37)				**FILL - SILTY SAND WITH GRAVEL (SM)**, brown-gray (7.5YR 4/1), dry to moist, dense, fine gravel to 20 mm, fine to coarse sand, angular.	CH12-101-BH003_SOa MC= 7	
1								**FILL - CLAYEY SAND (SC)**, brown (5YR 3/3), moist, trace gravel to 50 mm, low plasticity.		
		65	SS-2	6-5-9-9 (14)						
2					10	49	41		CH12-101-BH003_SOb MC = 7 LL = 25 PI = 8	
3		67	SS-3	16-23-39-31 (62)				**FILL - POORLY GRADED GRAVEL WITH SILT AND SAND (GP-GM)**, fine to coarse, (10YR 6/4), moist, angular.		Quartzite cobble 100 millimetres.
								FILL - CLAYEY SAND (SC) lenses, gravel to 25 mm, dense to very dense.		10:05 am: Gravel in catcher, N-value may not be representative, bent shoe edge.
4										
		75	SS-4	18-13-15-1 (28)				**CLAYEY SAND WITH GRAVEL (SC)**, fine to coarse, brown-gray (10YR 5/1), moist, medium dense, gravel to 50 mm, subangular to angular, slight plasticity.		Native till. 10:30 am. Appears to include highly weathered rock with residual structure.
5										
					6	65	29		CH12-101-BH003_SOc MC = 3 LI = 31 PI = 11	
6		0	SS-5	50 (>50)				**BEDROCK - PHYLLITE**, dark gray (N4), moderately weathered, moderate hardness, foliated, very close to close fracture spacing, smooth joints, laminated, carbonaceous filling up to 4 cm, tight joints, 45 degree dip.		
7			GB-6							11:10 am.
		63	Run-1							Switch to diamond core drilling. 1: 30 pm: Start Run 1. RQD = 26% Strong HCL reaction. 1.5 metres/12 minutes.
8										
9										
		89	Run-2					Veritical joint with calcareous infilling <5 mm.		1:42 pm: Stop Run-1. 2:00 pm: Start Run-2. RQD = 0% 1.5 metres/10 minutes.
10										
								Boring Terminated at 10.6 metres bgs		2:10 pm: Stop Run-2.

LL = Liquid Limit
MC = Moisture Content
NE = Groundwater Not Encountered
PI = Plasticity Index
GB = Grab

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SHEET 1 of 1

PROJECT NUMBER: 436662

BORING NUMBER: *CH12-101-BH004*

SOIL BORING LOG

PROJECT NAME: Faro Mine Remediation Project		**HOLE DEPTH (m):** 7.5	**DRILLING CONTRACTOR:** Tervita	
SURFACE ELEVATION: 1135.0 m MSL	**NORTHING (NAD83 UTM Z8N):** 6914355.1	**EASTING (NAD83 UTM Z8N):** 582491.4	**DATE STARTED:** 6/20/2012	**DATE COMPLETED:** 6/20/2012
WATER LEVEL: NE	**DRILLING METHOD:** Sonic		**DRILLING EQUIPMENT:** Gus Pech Sonic, 4" I.D. Core barrel, 6" casing, HQ Diamond Core	
LOCATION: Water Treatment Plant			**LOGGED BY:** K. Ohsiek	

DEPTH (m bgs)	INTERVAL (m)	RECOVERY (%)	FIELD SAMPLE NO.	SPT RESULTS (N)	SIZE DISTRIBUTION %G	%S	%F	SOIL DESCRIPTION	LAB DATA	COMMENTS (e.g.: DRILLING FLUID LOSS, TESTS, OR DRILLER COMMENTS, ETC.)
		76	SS-1	6-8-7-6 (15)				**FILL - SILTY SAND WITH GRAVEL (SM)**, fine to coarse, reddish brown (7.5YR 4/3), moist, medium dense, gravel to 25 mm.	CH12-101-BH004_SOa MC = 15	2:35 pm
1								**FILL - SILTY CLAYEY SAND (SC-SM)**, fine to coarse, reddish brown (7.5YR 4/6), moist, slight plasticity.		Trash piece in soil. Native, till unit.
		100	SS-2	50 (>50)	16	52	32	**SILTY CLAYEY SAND (SC-SM)**, gray white (GLEY1 8/N), dry, very dense, angular gravel to 25 mm, low plasticity fines.	CH12-101-BH004_SOb MC = 1 LL = 26 PI = 7	3:05 pm: Phyllite rock fragment in shoe. Hard drilling. Continuous sampling. HCL reaction is vigorous.
2								Angular gravel and cobbles to 100 mm.		
			GB-3		12	51	37		CH12-101-BH004_SOc MC = 1 LL = 27 PI = 7	
		58	Run-1					**BEDROCK - PHYLLITE**, greenish black (5GY 2/1), moderately weathered, moderate hardness, foliated, very close to close fracture spacing, calcareous infilling, slight iron oxide staining of vertical joints.		3:20 pm: Sonic (dry), drill refusal. Start drilling with water. Poor recovery, discs, chips, up to 100 millmetres diameter, 50 millimeter thick. Rate=1.9 metres/35 minutes.
3										
4										RQD = 0%
		57	Run-2					Siliceous infilling with carbonate component		4:55 pm: Start Run-2. Switch to diamond core drilling. 5:13 pm: End Run-2. 5:30 pm: Start Run-3.
5										RQD = 0% Rate=1.5 metres/18 minutes.
6		60	Run-3							Rate=1.5 metres/25 minutes. RQD = 0%
7								*Boring Terminated at 7.5 metres bgs*		5:55 pm: End Run-3.

LL = Liquid Limit
MC = Moisture Content
NE = Groundwater Not Encountered
PI = Plasticity Index
GB = Grab

CH2MHILL

SHEET 1 of 1

PROJECT NUMBER: 436662

BORING NUMBER: *CH12-101-BH005*

SOIL BORING LOG

PROJECT NAME: Faro Mine Remediation Project		**HOLE DEPTH (m):** 9.1	**DRILLING CONTRACTOR:** Tervita	
SURFACE ELEVATION: 1130.6 m MSL	**NORTHING (NAD83 UTM Z8N):** 6914257.6	**EASTING (NAD83 UTM Z8N):** 582561.2	**DATE STARTED:** 6/24/2012	**DATE COMPLETED:** 6/24/2012
WATER LEVEL: NE	**DRILLING METHOD:** Sonic		**DRILLING EQUIPMENT:** Gus Pech Sonic, 4" I.D. Core barrel, 6" casing, HQ Diamond Core	
LOCATION: Water Treatment Plant			**LOGGED BY:** A. Campbell	

DEPTH (m bgs)	INTERVAL (m)	RECOVERY (%)	FIELD SAMPLE NO.	SPT RESULTS (N)	SIZE DISTRIBUTION %G	%S	%F	SOIL DESCRIPTION	LAB DATA	COMMENTS (e.g.: DRILLING FLUID LOSS, TESTS, OR DRILLER COMMENTS, ETC.)
0		37	SS-1	6-7-5-6 (12)				**FILL - SILTY SAND WITH GRAVEL (SM)**, (5YR 3/1), moist, medium dense.	CH12-101-BH005_SOa MC = 26	
1								Increasing organic content.		
2		0	SS-2	4-6-10-8 (16)	21	32	48		CH12-101-BH005_SOb MC= 29 LL = 56 PI = 13	
3		47	SS-3	3-7-9-12 (16)				**SANDY LEAN CLAY WITH GRAVEL (CL)**, (10YR 4/2), wet, hard, with organics. Gravel to 60 mm with iron oxide staining at 4 metres.		Native.
4								Wet, organics.	CH12-101-BH005_SOc MC = 13 LL = 31 PI = 10	
5		100	SS-4	16-18-18-50 (36)	9	38	52	Increasing gravel, very hard. Cobbles to 90 mm.		
6								**(POSSIBLE) BEDROCK - POORLY GRADED GRAVEL WITH SAND (GP)**, cobbles to 90 mm.		Switch to diamond core drilling. 9:57 am: Start Run-1
7		83	Run-1					**BEDROCK - PHYLLITE**, greenish black (5GY 2/1), moderately to highly weathered, moderate hardness, foliated, very close to close fracture spacing, some vertical fractures, carbonaceous infilling, surface iron oxide staining, planar joints. 20 degree dip.		RQD = 0 %
8		80	Run-2							10:08 am: End Run-1 10:23 am: Start Run-2 RQD = 0 %
9								*Boring Terminated at 9.1 metres bgs*		10:33 am: End Run-2

LL = Liquid Limit
MC = Moisture Content
NE = Groundwater Not Encountered
PI = Plasticity Index
GB = Grab

CH2MHILL

SHEET 1 of 1

PROJECT NUMBER: 436662

BORING NUMBER: *CH12-101-BH006*

SOIL BORING LOG

PROJECT NAME: Faro Mine Remediation Project		**HOLE DEPTH (m):** 6.1	**DRILLING CONTRACTOR:** Tervita	
SURFACE ELEVATION: 1129.8 m MSL	**NORTHING (NAD83 UTM Z8N):** 6914278.2	**EASTING (NAD83 UTM Z8N):** 582468.1	**DATE STARTED:** 6/22/2012	**DATE COMPLETED:** 6/23/2012
WATER LEVEL: NE	**DRILLING METHOD:** Sonic		**DRILLING EQUIPMENT:** Gus Pech Sonic, 4" I.D. Core barrel, 6" casing, HQ Diamond Core	
LOCATION: Water Treatment Plant			**LOGGED BY:** M. Franklyne	

DEPTH (m bgs)	INTERVAL (m)	RECOVERY (%)	FIELD SAMPLE NO.	SPT RESULTS (N)	SIZE DISTRIBUTION %G	%S	%F	SOIL DESCRIPTION	LAB DATA	COMMENTS (e.g.: DRILLING FLUID LOSS, TESTS, OR DRILLER COMMENTS, ETC.)
		4	SS-1	3-3-3-2 (6)				**FILL - CLAYEY SAND (SC)**, (2.5YR 3/1), moist, loose. Humus, no soil only organics.	CH12-101-BH006_SOa MC = 11 CH12-101-BH006_SOb MC = 12 LL = 35 PI = 14	Topsoil.
1					12	59	28			
		100	SS-2	50				**BEDROCK - PHYLLITE**, (5Y 4/1), moderate hardness, foliated, moderately weathered, quartzite infilling, iron oxide staining on surface and in laminations, very close to close fracture spacing.		Switch to diamond core drilling. RQD = 0%
2		34	Run-1	(>50)						
3		51	Run-2							12:28 pm: Start Run-1 12:50 pm: End Run-1 13:20 pm: Start Run-2 RQD = 0%
4										
		85	Run-3					Carbonaceous infilling, some vertical and planar fracturing along 10 degree dip.		1:33 pm: End Run-2 1:33 pm: Start Run-3 1:39 pm: End Run-3 RQD = 0%
5										
6								*Boring Terminated at 6.1 metres bgs*		

LL = Liquid Limit
MC = Moisture Content
NE = Groundwater Not Encountered
PI = Plasticity Index

CH2MHILL

SHEET 1 of 1

PROJECT NUMBER: 436662

BORING NUMBER: *CH12-101-BH007*

SOIL BORING LOG

PROJECT NAME: Faro Mine Remediation Project		**HOLE DEPTH (m):** 4.6	**DRILLING CONTRACTOR:** Tervita	
SURFACE ELEVATION: 1134.9 m MSL	**NORTHING (NAD83 UTM Z8N):** 6914348.5	**EASTING (NAD83 UTM Z8N):** 582517.8	**DATE STARTED:** 6/25/2012	**DATE COMPLETED:** 6/25/2012
WATER LEVEL: NE	**DRILLING METHOD:** Sonic		**DRILLING EQUIPMENT:** Gus Pech Sonic, 4" I.D. Core barrel, 6" casing, HQ Diamond Core	
LOCATION: Water Treatment Plant			**LOGGED BY:** A. Campbell	

DEPTH (m bgs)	INTERVAL (m)	RECOVERY (%)	FIELD SAMPLE NO.	SPT RESULTS (N)	SIZE DISTRIBUTION %G	%S	%F	SOIL DESCRIPTION	LAB DATA	COMMENTS (e.g.: DRILLING FLUID LOSS, TESTS, OR DRILLER COMMENTS, ETC.)
		100	SS-1	12-8-7-7 (15)				**FILL - WELL-GRADED SAND WITH SILT AND GRAVEL (SW-SM)**, (5YR 3/4), moist, medium dense.	CH12-101-BH007_SOa MC = 11	
1					22	47	32	**CLAYEY SAND (SC)**, (GLEY1 7/1), dry, cobbles to 90 mm.	CH12-101-BH007_SOb MC = 7 LL = 29 PI = 8	Slow drilling, getting slower with depth.
		0	SS-2	50						Split spoon refusal.
2		88	Run-1	(>50)				**BEDROCK - PHYLLITE**, (5G 4/1), very close to close fracture spacing, moderately weathered, smooth, foliated, planar, smooth, 15 degree dip, moderately tight, some vertical fractures with carbonaceous infilling, iron oxide staining along fractured surfaces.		Start of diamond core. RQD = 8%
3		54	Run-2							10:50 am: Start Run-1 11:02 am: End Run-1 11:23 am: Start Run-2 11:32 am: End Run-2 RQD = 0%
4								*Boring Terminated at 4.6 metres bgs*		

LL = Liquid Limit
MC = Moisture Content
NE = Groundwater Not Encountered
PI = Plasticity Index

CH2MHILL

SHEET 1 of 1

PROJECT NUMBER: 436662

BORING NUMBER: *CH12-101-BH008*

SOIL BORING LOG

PROJECT NAME: Faro Mine Remediation Project		**HOLE DEPTH (m):** 4.6	**DRILLING CONTRACTOR:** Tervita	
SURFACE ELEVATION: 1130.1 m MSL	**NORTHING (NAD83 UTM Z8N):** 6914274.6	**EASTING (NAD83 UTM Z8N):** 582508.3	**DATE STARTED:** 6/22/2012	**DATE COMPLETED:** 6/22/2012
WATER LEVEL: NE	**DRILLING METHOD:** Sonic		**DRILLING EQUIPMENT:** Gus Pech Sonic, 4" I.D. Core barrel, 6" casing, HQ Diamond Core	
LOCATION: Water Treatment Plant			**LOGGED BY:** M. Franklyne	

DEPTH (m bgs)	INTERVAL (m)	RECOVERY (%)	FIELD SAMPLE NO.	SPT RESULTS (N)	SIZE DISTRIBUTION %G	%S	%F	SOIL DESCRIPTION	LAB DATA	COMMENTS (e.g.: DRILLING FLUID LOSS, TESTS, OR DRILLER COMMENTS, ETC.)
		100	SS-1	9-9-6-7 (15)				**FILL - POORLY GRADED SAND WITH GRAVEL (SP)**, (7.5YR 4/3), moist, medium dense.	CH12-101-BH008_SOa MC = 13	3:34 pm. Organic traces.
								Humus, organics.		Topsoil. 3:42 pm. 3:46 pm.
1										
		98	SS-2	14-30-50 (>80)	8	65	27	**SILTY CLAYEY SAND WITH GRAVEL (SC-SM)**, (2.5YR 4/4), moist, very dense.	CH12-101-BH008_SOb MC = 10 LL = 27 PI = 7	3:55 pm.
2								**(POSSIBLE) BEDROCK - LEAN CLAY WITH GRAVEL (CL)**, (GLEY 8/N), dry, very hard, gravels to 75 mm.		Top residual rock.
3		0	SS-3	50 (>50)				Layer of silty clay.		
		70	Run-1					**BEDROCK - PHYLLITE**, fine grained, greenish black (5GY 2/1), moderate hardness, clear fracture planes along length of sample, morphed quartzite infilling, iron oxide staining, very close fractures. Highly fractured along clear planes, 10% from horizontal, moderate to smooth, quartzite infilling.		Reacts with HCL. RQD = 0% 4:14 pm: Switch to diamond. 4:19 pm: Start Run-1 0.5 metres/minute Slow drilling, reacts with HCL. 4:27 pm: End Run-1 4:45 pm: Start Run-2 RQD = 7% 5:00 pm.: End Run-2
		63	Run-2							
4								*Boring Terminated at 4.6 metres bgs*		

LL = Liquid Limit
MC = Moisture Content
NE = Groundwater Not Encountered
PI = Plasticity Index

CH2MHILL

SHEET 1 of 1

PROJECT NUMBER: 436662

BORING NUMBER: *CH12-101-PZ001*

SOIL BORING LOG

PROJECT NAME: Faro Mine Remediation Project		**HOLE DEPTH (m):** 9.1	**DRILLING CONTRACTOR:** Tervita	
SURFACE ELEVATION: 1135.7 m MSL	**NORTHING (NAD83 UTM Z8N):** 6914377.2	**EASTING (NAD83 UTM Z8N):** 582546.1	**DATE STARTED:** 6/22/2012	**DATE COMPLETED:** 6/22/2012
WATER LEVEL: NE	**DRILLING METHOD:** Sonic		**DRILLING EQUIPMENT:** Gus Pech Sonic, 4" I.D. Core barrel, 6" casing, HQ Diamond Core	
LOCATION: Water Treatment Plant			**LOGGED BY:** M. Franklyne	

DEPTH (m bgs)	INTERVAL (m)	RECOVERY (%)	FIELD SAMPLE NO.	SPT RESULTS (N)	SIZE DISTRIBUTION %G	%S	%F	SOIL DESCRIPTION	LAB DATA	COMMENTS (e.g.: DRILLING FLUID LOSS, TESTS, OR DRILLER COMMENTS, ETC.)
1		100	SS-1	20-21-16-24 (37)				**FILL - SILTY SAND WITH GRAVEL (SM)**, (2.5YR 5/4), moist, dense, gravel to 25 mm, fine to coarse sand.	CH12-101-PZ001_SOa MC = 12	10:00 am.
2		59	SS-2	15-14-14-21 (28)				**FILL - SILT WITH GRAVEL (ML)**, (2.5YR 4/3), wet, hard, little fine to coarse sand. Particle size up to 75 mm.		10:06 am.
3		87	SS-3	20-40-45-50 (85)	23	44	33	**FILL - CLAYEY SAND WITH GRAVEL (SC)**, (5Y 4/2), moist, very dense.	CH12-101-PZ001_SOb MC = 9 LL = 24 PI = 8	10:28 am.
4					25	48	28		CH12-101-PZ001_SOc MC = 6 LL = 31 PI = 11	Interface of fill and native. Weathered phyllite.
5		62	SS-4	31-30-50 (>80)				**POORLY GRADED GRAVEL WITH CLAY (GP-GC)**, (5Y 5/2), moist, very dense.		11:01 am: Residual rock fabric.
6								**(POSSIBLE) BEDROCK - SANDY LEAN CLAY WITH GRAVEL (CL)**, (GLEY 8/N), dry, very dense, gravel to 100 mm.		Reacts with HCL.
7		41	Run-1					**BEDROCK - PHYLLITE**, fine grained, (5GY 4/1), moderate weathering, moderate hardness, highly fractured, smooth to rough planar fractures, quartzite infilling, iron oxide staining, very close to close fracture spacing.		11:45 am: End of Run-1. RQD = 0%
8		79	Run-2							1:30 pm: Start Run-2. Green streaks, olive. RQD = 7%
9								Fracture oriented 30 degrees. *Boring Terminated at 9.1 metres bgs*		1:40 pm: End Run-2.

LL = Liquid Limit
MC = Moisture Content
NE = Groundwater Not Encountered
PI = Plasticity Index

CH2MHILL

SHEET 1 of 1

PROJECT NUMBER: 436662

BORING NUMBER: *CH12-101-PZ002*

SOIL BORING LOG

PROJECT NAME: Faro Mine Remediation Project		**HOLE DEPTH (m):** 10.7	**DRILLING CONTRACTOR:** Tervita
SURFACE ELEVATION: 1132.6 m MSL	**NORTHING (NAD83 UTM Z8N):** 6914311.5	**EASTING (NAD83 UTM Z8N):** 582525.7	**DATE STARTED:** 6/24/2012 / **DATE COMPLETED:** 6/24/2012
WATER LEVEL: NE	**DRILLING METHOD:** Sonic		**DRILLING EQUIPMENT:** Gus Pech Sonic, 4" I.D. Core barrel, 6" casing, HQ Diamond Core
LOCATION: Water Treatment Plant			**LOGGED BY:** A. Campbell/K. Ohsiek

DEPTH (m bgs)	INTERVAL (m)	RECOVERY (%)	FIELD SAMPLE NO.	SPT RESULTS (N)	SIZE DISTRIBUTION %G	%S	%F	SOIL DESCRIPTION	LAB DATA	COMMENTS (e.g.: DRILLING FLUID LOSS, TESTS, OR DRILLER COMMENTS, ETC.)
		62	SS-1	14-13-15-14 (28)				**FILL - SILTY SAND WITH GRAVEL (SM)**, reddish brown (7.5YR 4/3), dry.	CH12-101-PZ002_SOa MC = 20	1:00 pm.
1								**FILL - CLAYEY SAND WITH GRAVEL (SC)**, reddish brown (7.5YR 4/3), moist, quartzite and phyllite cobbles to 80 mm.		1:05 pm.
								Residual rock structure apparent in cohesive soil at 1.4 to 1.5 metres. Increasing plasticity.	CH12-101-PZ002_SOb MC = 6 LL = 32 PI = 10	
		53	SS-2	20-14-14-11 (28)	0	65	35	**FILL - SANDY LEAN CLAY (CL)**, hard		1:15 pm.
2					5	40	55		CH12-101-PZ002_SOc MC = 13 LL = 31 PI = 11	1:20 pm.
								SILT (ML), dark gray to black (10YR 2/1) moist, organic.		Native topsoil.
3		100	SS-3	50 (>50)				**BEDROCK - PHYLLITE**, medium dark gray (N4), highly weathered, moderately hard, highly fractured, very close spacing, planar joints and seams, some iron oxide staining.		1: 28 pm: SPT refusal. Switch to diamond core drilling. Possible dip of 45 degrees. RQD = 0%
		12	Run-1							
4										
5		83	Run-2					Some healed quartzite-filled joints.		1:42 pm: End Run-1. 2:07 pm: Start Run-2. RQD = 0%
6										
		91	Run-3					45 degree dip in some localized zones.		2:20 pm: End Run-2. 2:37 pm: Start Run-3. RQD = 0%
7										
		100	Run-4					20 degree dip in some localized zones, some vertical joints.		2:43 pm: End Run-3. 3:15 pm: Start Run-4. RQD =11%
8										
9										
		100	Run-5					Close to very close spacing, few quartzite-filled and healed joints.		3:28 pm: End Run-4. 3:52 pm: Start Run-5. RQD = 13% 4:00 pm: End Run-5.
10										
								Boring Terminated at 10.7 metres bgs		

LL = Liquid Limit
MC = Moisture Content
NE = Groundwater Not Encountered
PI = Plasticity Index

CH2MHILL

PROJECT NUMBER	WELL NUMBER
436662	CH12-101-PZ001

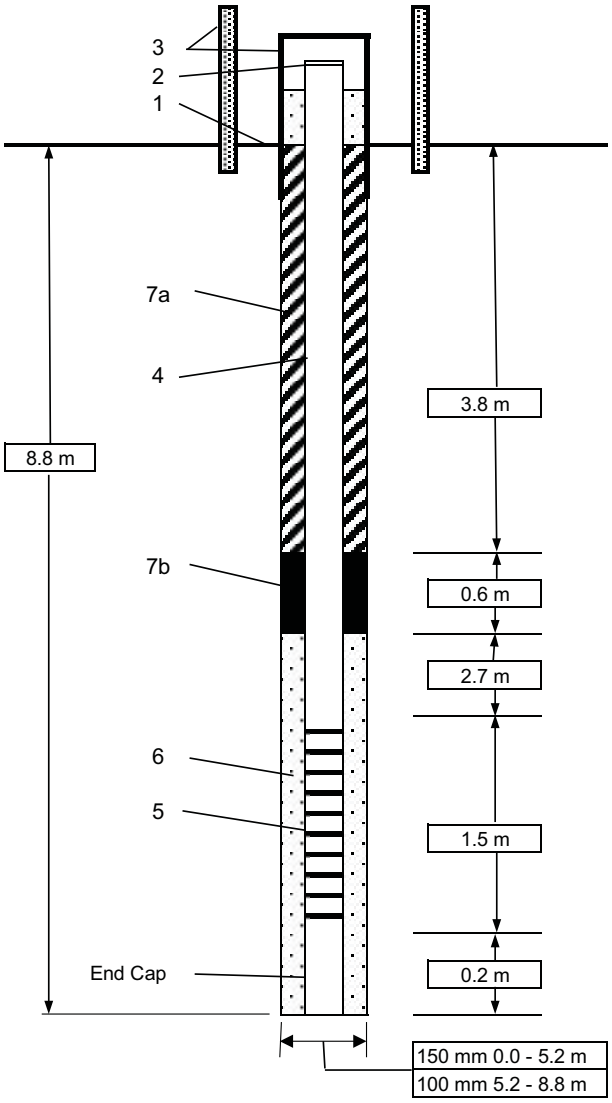
WELL COMPLETION DIAGRAM

PROJECT: Faro Mine Remediation Project LOCATION : Water Treatment Plant N6914377.1 E582546.0

DRILLING CONTRACTOR: Tervita

DRILLING METHOD AND EQUIPMENT USED: Gus Peche Sonic, 4" I.D. / 6" Casing / HQ Diamond Core

WATER LEVELS: None Encountered START: 6/22/2012 FINISH: 6/23/12 LOGGER: M. Franklyne



1- Ground elevation at well (m)	1,135.7
2- Measuring Point elevation (m)	1,136.6
MP cover	Locking plug
3- Wellhead protection	Protective steel casing with locking cover and bollards
4- Dia./type of well casing	2-inch Sch 40 PVC threaded
5- Dia./Type/slot size of screen	2-inch Sch 40 PVC threaded 0.020-inch slot
6- Filter Pack	12/20 sand
7- Annular Seal	
7a - Upper seal	Cement-bentonite grout
7b - Lower seal	3/8-inch Enviroplug coated pellets
Development method:	None
Development volume:	None
Notes:	Not to scale

PROJECT NUMBER	WELL NUMBER
436662	CH12-101-PZ002

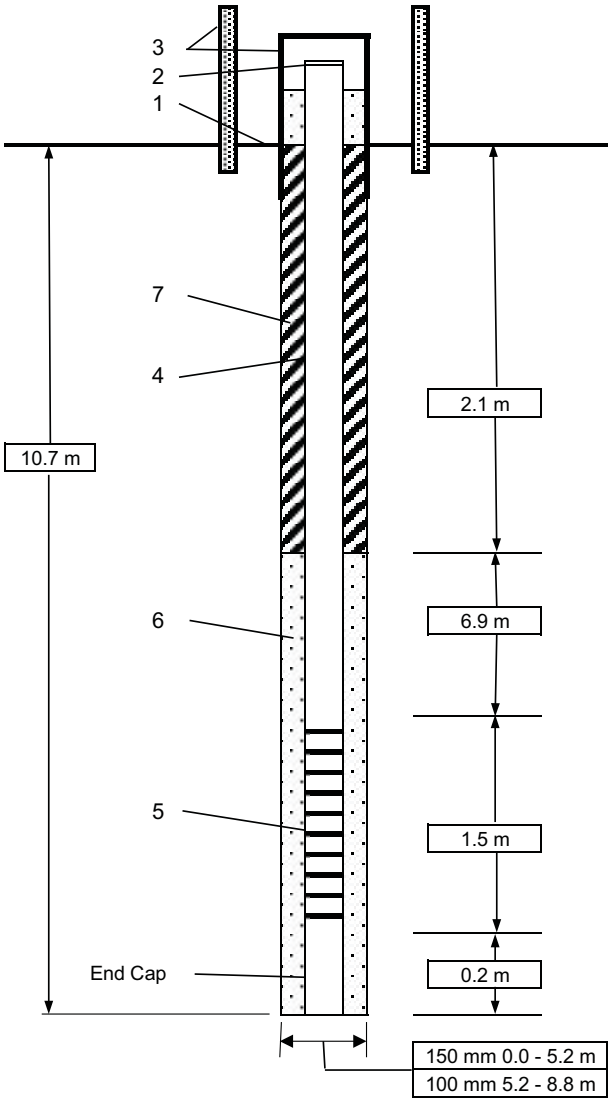
WELL COMPLETION DIAGRAM

PROJECT: Faro Mine Remediation Project LOCATION : Water Treatment Plant N6914311.6 E582525.8

DRILLING CONTRACTOR: Tervita

DRILLING METHOD AND EQUIPMENT USED: Gus Peche Sonic, 4" I.D. / 6" Casing / HQ Diamond Core

WATER LEVELS: None Encountered START: 6/24/2012 FINISH: 6/24/12 LOGGER: K. Ohsiek



1- Ground elevation at well (m)	1,132.6
2- Measuring Point elevation (m)	1,133.4
MP cover	Locking plug
3- Wellhead protection	Protective steel casing with locking cover and bollards
4- Dia./type of well casing	2-inch Sch 40 PVC threaded
5- Dia./Type/slot size of screen	2-inch Sch 40 PVC threaded 0.020-inch slot
6- Filter Pack	12/20 sand
7- Annular Seal	3/8-inch Enviroplug coated pellets
Development method:	None
Development volume:	None
Notes:	Not to scale

Appendix B

Rock Core Photographs

CH12-101-BH001 Rock Core

CH12-101-BH003 Rock Core

CH12-101-BH004 Rock Core

CH12-101-BH005 Rock Core

CH12-101-BH006 Rock Core

CH12-101-BH007 Rock Core

CH12-101-BH008 Rock Core

CH12-101-PZ001 Rock Core

CH12-101-PZ002 Rock Core, 3.2 to 7.7 metres

CH12-101-PZ002 Rock Core, 7.7 to 10.7 metres

Appendix C

Laboratory Test Results

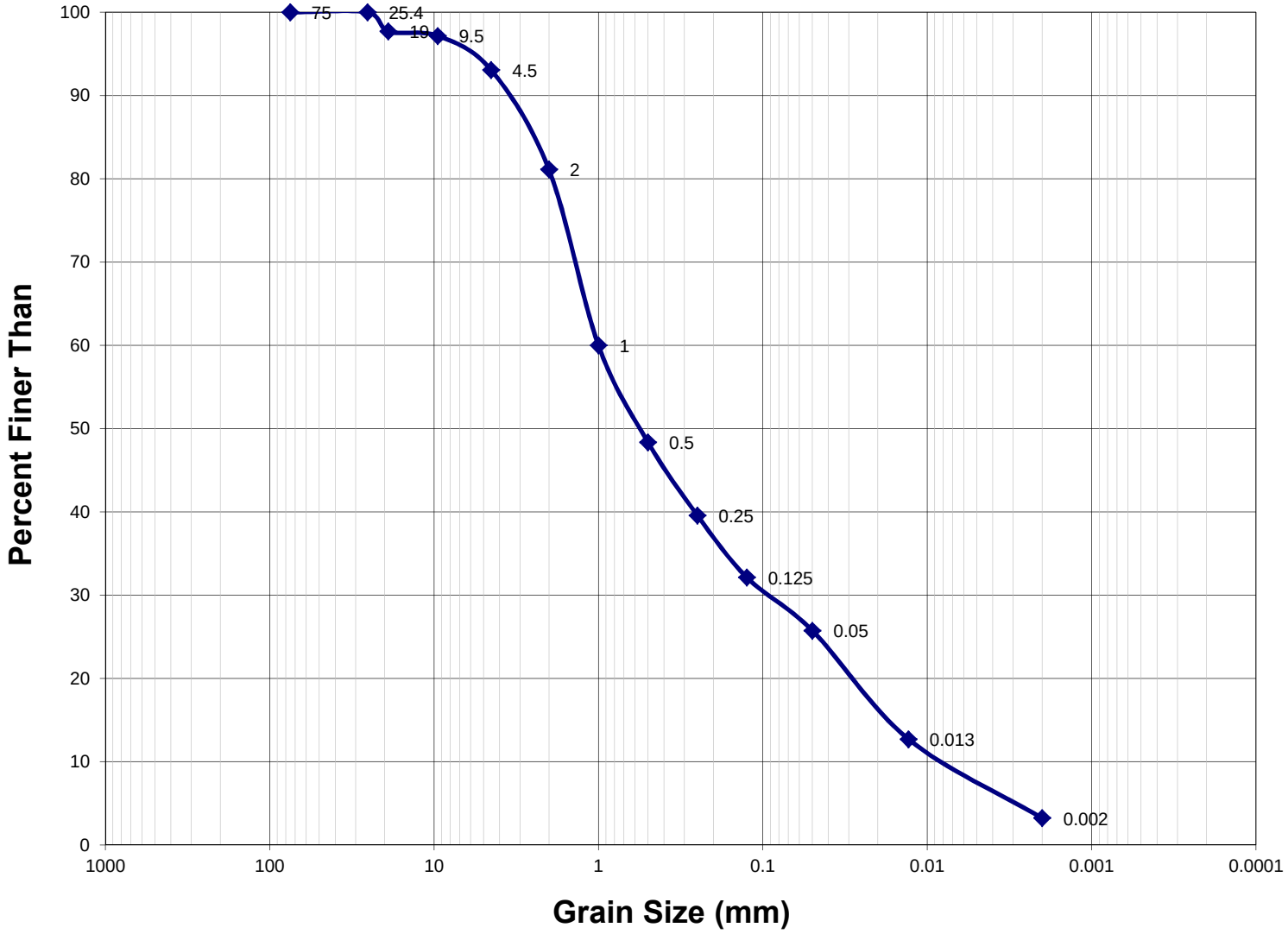
NEW FARO & VANGORDA WTP AND PIPING 2012								
Boring Number	**Sample ID**	**Depth From (m)**	**Depth To (m)**	**Moisture Content (%)**	**Gradation[1] (%) Gravel:Sand:Fines**	**Liquid Limit**	**Plasticity Index**	**USCS Classification[2]**
CH12-101-BH001	CH12-101-BH001_SOa	0.2	0.3	10				
CH12-101-BH001	CH12-101-BH001_SOb	1.9	2.3	7	7:65:28	34	11	SC
CH12-101-BH001	CH12-101-BH001_SOc	3.5	3.8	3	31:47:22	32	10	SC
CH12-101-BH002	CH12-101-BH002_SOa	0.0	0.3	7				
CH12-101-BH002	CH12-101-BH002_SOb	1.5	2.1	6	33:52:15			SM
CH12-101-BH002	CH12-101-BH002_SOc	3.0	3.6	20	9:54:37	38	14	SM
CH12-101-BH003	CH12-101-BH003_SOa	0.1	0.3	7				
CH12-101-BH003	CH12-101-BH003_SOb	1.8	2.0	7	10:49:41	25	8	SC
CH12-101-BH003	CH12-101-BH003_SOc	5.2	5.4	3	6:65:29	31	11	SC
CH12-101-BH004	CH12-101-BH004_SOa	0.0	0.3	15				
CH12-101-BH004	CH12-101-BH004_SOb	1.5	2.0	1	16:52:32	26	7	SC-SM
CH12-101-BH004	CH12-101-BH004_SOc	2.4	2.6	1	12:51:37	27	7	SC-SM
CH12-101-BH005	CH12-101-BH005_SOa	0.1	0.3	26				
CH12-101-BH005	CH12-101-BH005_SOb	1.2	1.5	29	21:32:48	56	13	SM
CH12-101-BH005	CH12-101-BH005_SOc	4.0	4.5	13	9:38:52	31	10	CL
CH12-101-BH006	CH12-101-BH006_SOa	0.0	0.3	11				
CH12-101-BH006	CH12-101-BH006_SOb	0.5	0.9	12	12:59:28	35	14	SC
CH12-101-BH007	CH12-101-BH007_SOa	0.1	0.2	11				
CH12-101-BH007	CH12-101-BH007_SOb	0.4	0.6	7	22:47:32	29	8	SC
CH12-101-BH008	CH12-101-BH008_SOa	0.0	0.3	13				
CH12-101-BH008	CH12-101-BH008_SOb	1.5	1.9	10	8:65:27	27	7	SC-SM
CH12-101-PZ001	CH12-101-PZ001_SOa	0.1	0.2	12				
CH12-101-PZ001	CH12-101-PZ001_SOb	3.5	3.8	9	23:44:33	24	8	SC
CH12-101-PZ001	CH12-101-PZ001_SOc	4.0	4.5	6	25:48:28	31	11	SC
CH12-101-PZ002	CH12-101-PZ002_SOa	0.0	0.3	20				
CH12-101-PZ002	CH12-101-PZ002_SOb	1.1	1.5	6	0:66:35	32	10	SC
CH12-101-PZ002	CH12-101-PZ002_SOc	1.5	2.1	13	4:40:55	31	11	CL
Notes:								
1. Gradation totals may not equal 100 due to rounding.								
2. USCS Classification is based on lab sample and may not reflect larger particle sizes observed in the field.								

ALS Laboratory Group
ANALYTICAL CHEMISTRY & TESTING SERVICES
Environmental Division

819-58th Street, Saskatoon, SK S7K 6X5

Client Name: CH2M HILL, INC
Project: CHM400-CHM200-VA
Sample ID: CH12-101-BH001_SOB
Lab ID: L1169182-10

Particle Size Distribution Curve



Summary of Results

Unified Soil Classification System (USCS)

Size Class	Size Range	Wt. (%)
Cobbles	> 3"	0
Gravel	4.75mm - 3"	7
Coarse Sand	2.0mm - 4.75mm	12
Medium Sand	0.425mm - 2.0mm	35
Fine Sand	0.075mm - 0.425mm	18
Fines	< 0.075mm	28

Canadian Soil Survey Committee (CSSC)

Size Class	Size Range	Wt. (%)
Cobbles	> 3"	0
Gravel	2mm - 3"	19
Sand	0.05mm - 2mm	55
Silt	0.002mm - 0.05mm	23
Clay	< 0.002mm	3

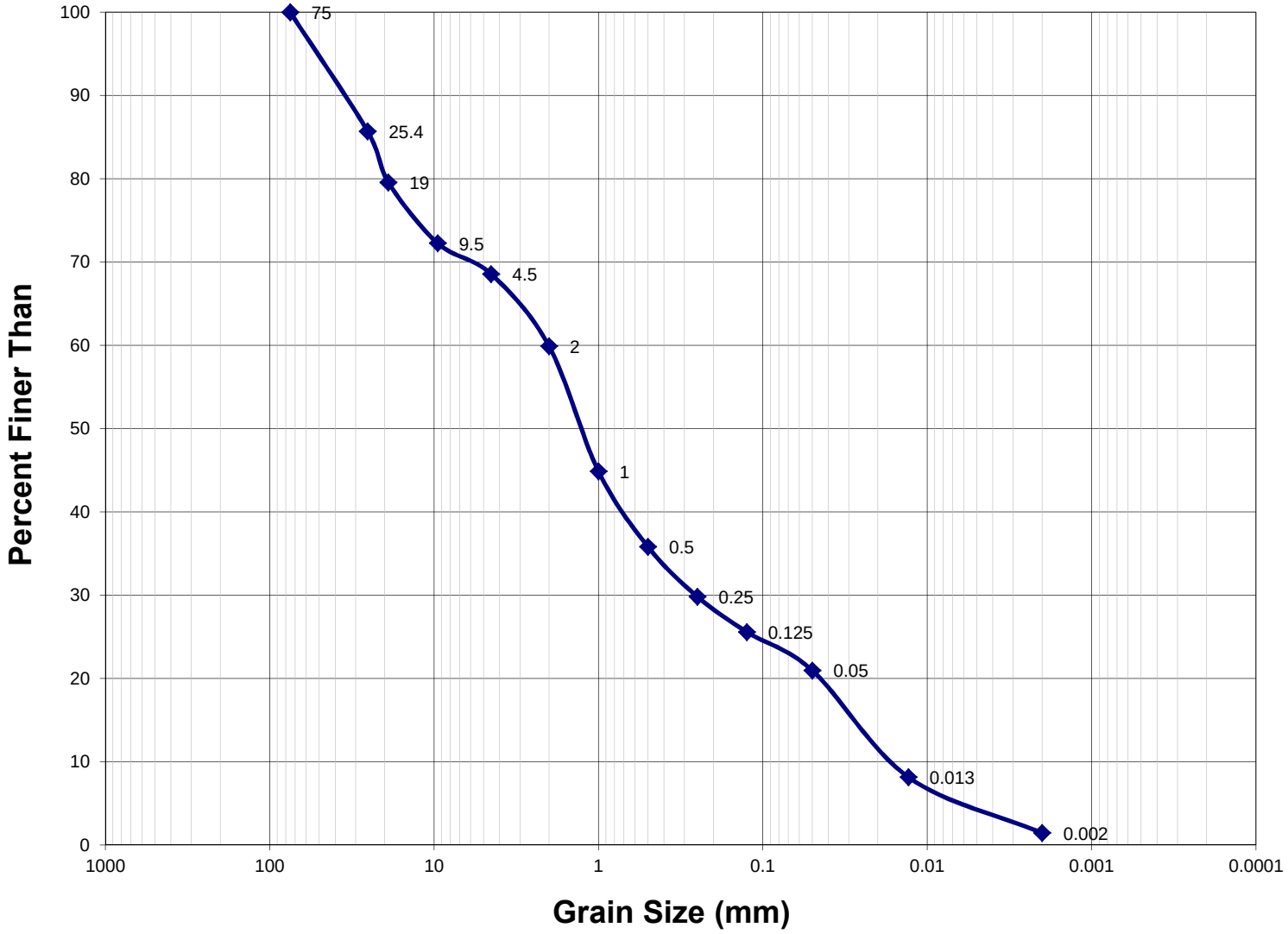
Method Reference: Can. Soc. Soil Sci. (1993) Method 47.2

ALS Laboratory Group
ANALYTICAL CHEMISTRY & TESTING SERVICES
Environmental Division

819-58th Street, Saskatoon, SK S7K 6X5

Client Name: CH2M HILL, INC
Project: CHM400-CHM200-VA
Sample ID: CH12-101-BH001_SOC
Lab ID: L1169182-11

Particle Size Distribution Curve



Summary of Results

Unified Soil Classification System (USCS)

Size Class	Size Range	Wt. (%)
Cobbles	> 3"	0
Gravel	4.75mm - 3"	31
Coarse Sand	2.0mm - 4.75mm	9
Medium Sand	0.425mm - 2.0mm	26
Fine Sand	0.075mm - 0.425mm	12
Fines	< 0.075mm	22

Canadian Soil Survey Committee (CSSC)

Size Class	Size Range	Wt. (%)
Cobbles	> 3"	0
Gravel	2mm - 3"	40
Sand	0.05mm - 2mm	39
Silt	0.002mm - 0.05mm	20
Clay	< 0.002mm	1

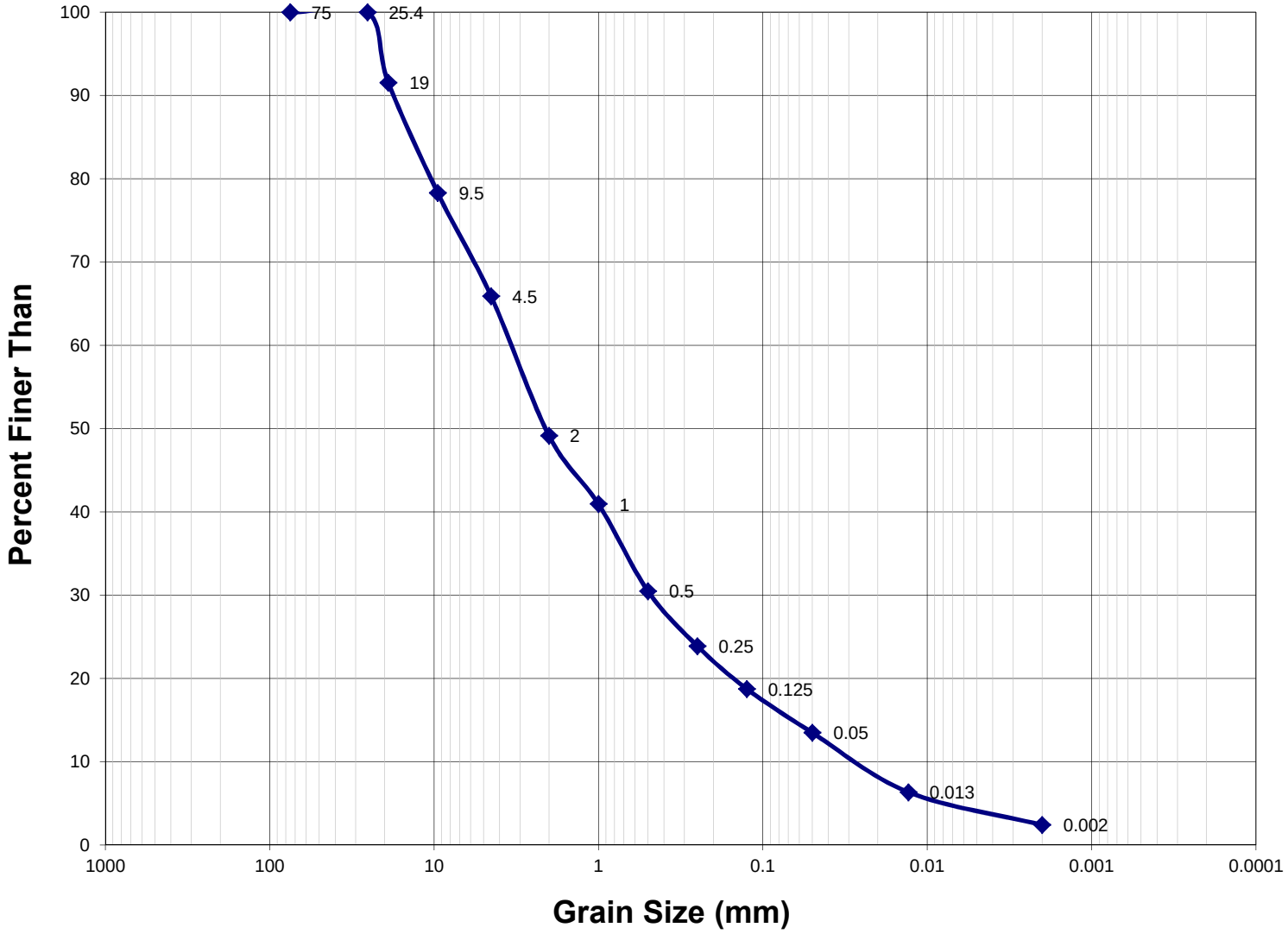
Method Reference: Can. Soc. Soil Sci. (1993) Method 47.2

ALS Laboratory Group
ANALYTICAL CHEMISTRY & TESTING SERVICES
Environmental Division

819-58th Street, Saskatoon, SK S7K 6X5

Client Name: CH2M HILL, INC
Project: CHM400-CHM200-VA
Sample ID: CH12-101-BH002_SOB
Lab ID: L1169182-2

Particle Size Distribution Curve



Summary of Results

Unified Soil Classification System (USCS)

Size Class	Size Range	Wt. (%)
Cobbles	> 3"	0
Gravel	4.75mm - 3"	33
Coarse Sand	2.0mm - 4.75mm	17
Medium Sand	0.425mm - 2.0mm	21
Fine Sand	0.075mm - 0.425mm	13
Fines	< 0.075mm	15

Canadian Soil Survey Committee (CSSC)

Size Class	Size Range	Wt. (%)
Cobbles	> 3"	0
Gravel	2mm - 3"	51
Sand	0.05mm - 2mm	36
Silt	0.002mm - 0.05mm	11
Clay	< 0.002mm	2

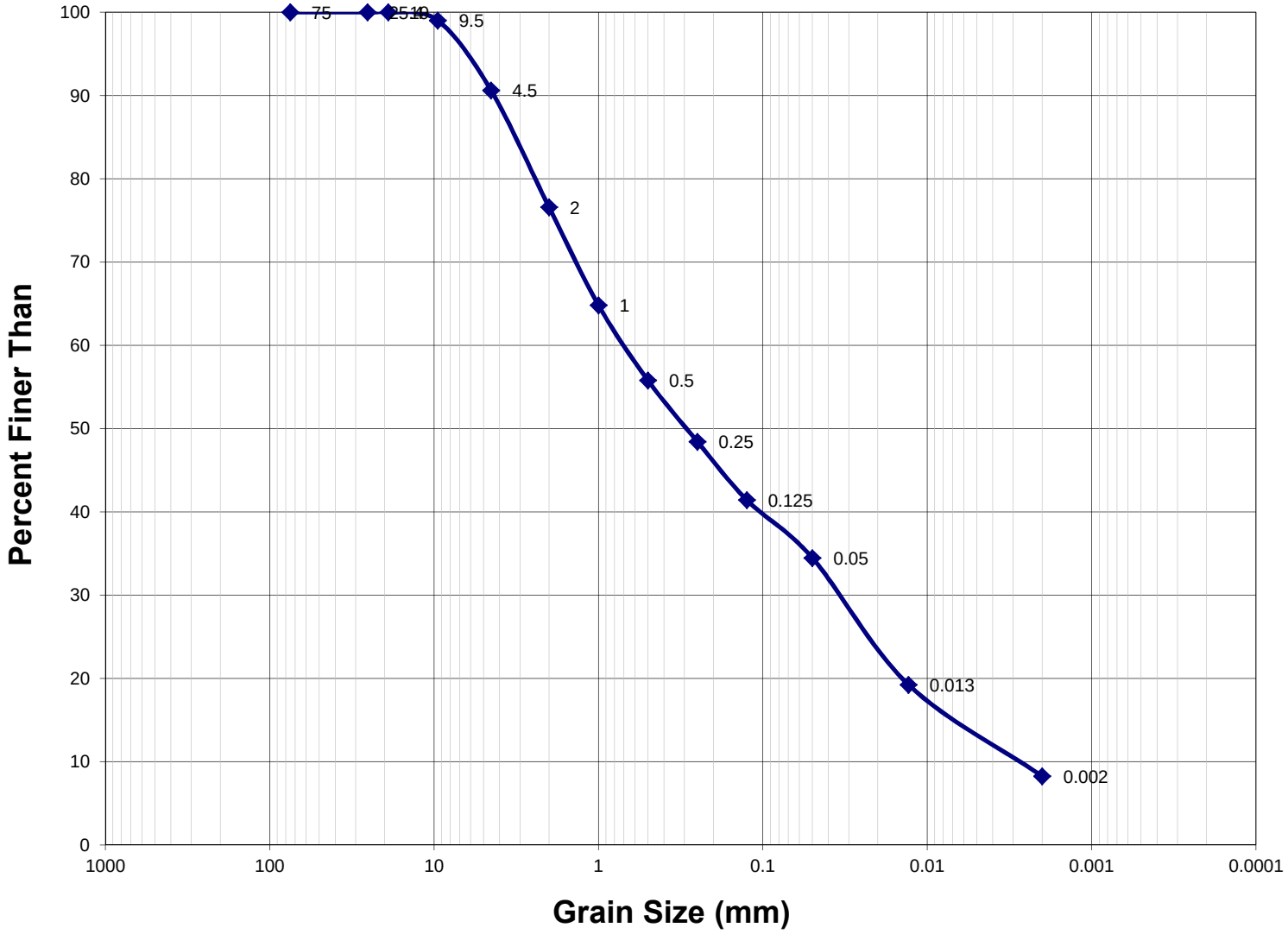
Method Reference: Can. Soc. Soil Sci. (1993) Method 47.2

ALS Laboratory Group
ANALYTICAL CHEMISTRY & TESTING SERVICES
Environmental Division

819-58th Street, Saskatoon, SK S7K 6X5

Client Name: CH2M HILL, INC
Project: CHM400-CHM200-VA
Sample ID: CH12-101-BH002_SOC
Lab ID: L1169182-33

Particle Size Distribution Curve



Summary of Results

Unified Soil Classification System (USCS)

Size Class	Size Range	Wt. (%)
Cobbles	> 3"	0
Gravel	4.75mm - 3"	9
Coarse Sand	2.0mm - 4.75mm	14
Medium Sand	0.425mm - 2.0mm	23
Fine Sand	0.075mm - 0.425mm	17
Fines	< 0.075mm	37

Canadian Soil Survey Committee (CSSC)

Size Class	Size Range	Wt. (%)
Cobbles	> 3"	0
Gravel	2mm - 3"	23
Sand	0.05mm - 2mm	42
Silt	0.002mm - 0.05mm	26
Clay	< 0.002mm	8

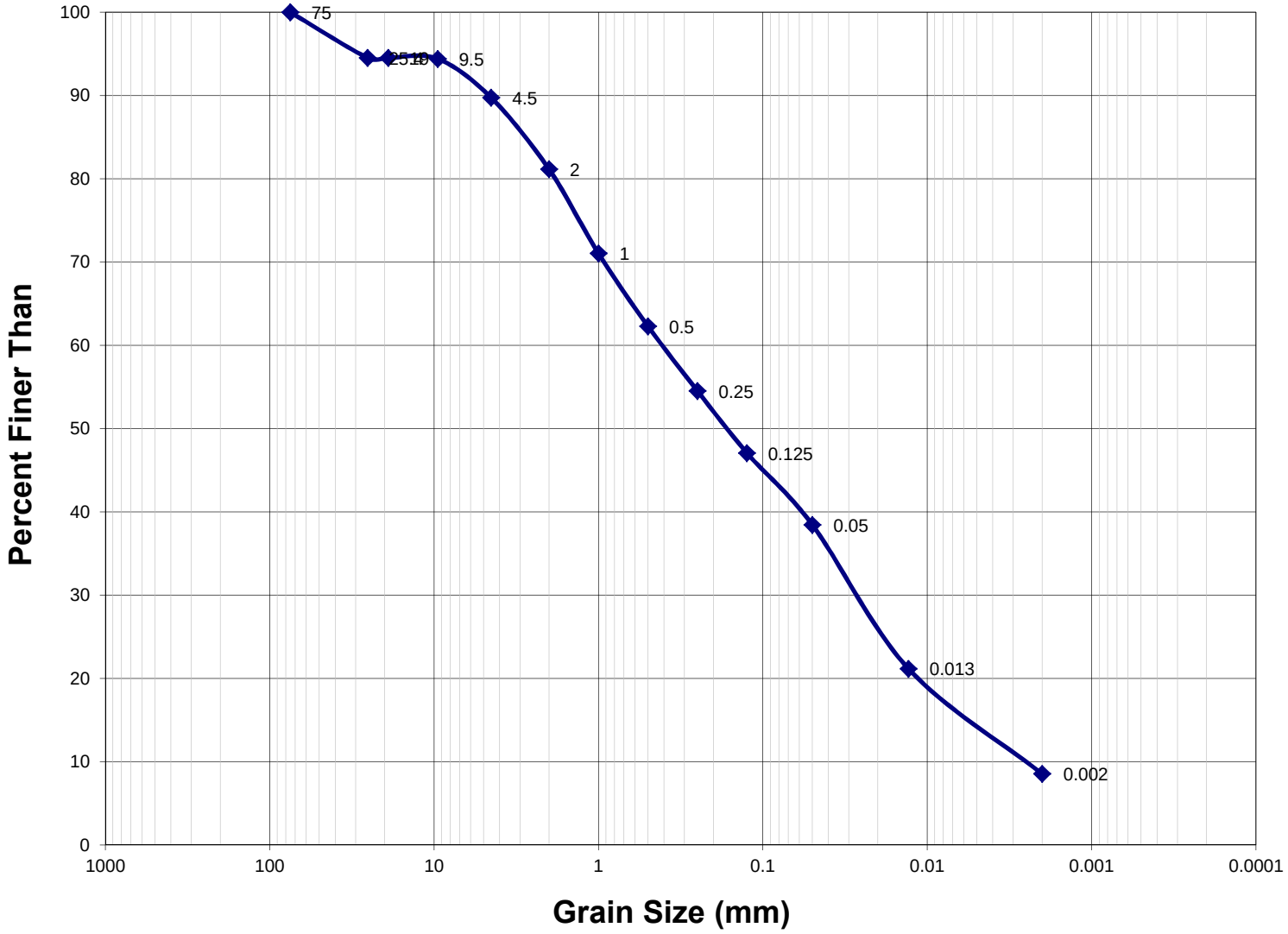
Method Reference: Can. Soc. Soil Sci. (1993) Method 47.2

ALS Laboratory Group
ANALYTICAL CHEMISTRY & TESTING SERVICES
Environmental Division

819-58th Street, Saskatoon, SK S7K 6X5

Client Name: CH2M HILL, INC
Project: CHM400-CHM200-VA
Sample ID: CH12-101-BH003_SOB
Lab ID: L1169182-133

Particle Size Distribution Curve



Summary of Results

Unified Soil Classification System (USCS)

Size Class	Size Range	Wt. (%)
Cobbles	> 3"	0
Gravel	4.75mm - 3"	10
Coarse Sand	2.0mm - 4.75mm	9
Medium Sand	0.425mm - 2.0mm	21
Fine Sand	0.075mm - 0.425mm	19
Fines	< 0.075mm	41

Canadian Soil Survey Committee (CSSC)

Size Class	Size Range	Wt. (%)
Cobbles	> 3"	0
Gravel	2mm - 3"	19
Sand	0.05mm - 2mm	43
Silt	0.002mm - 0.05mm	30
Clay	< 0.002mm	9

Method Reference: Can. Soc. Soil Sci. (1993) Method 47.2

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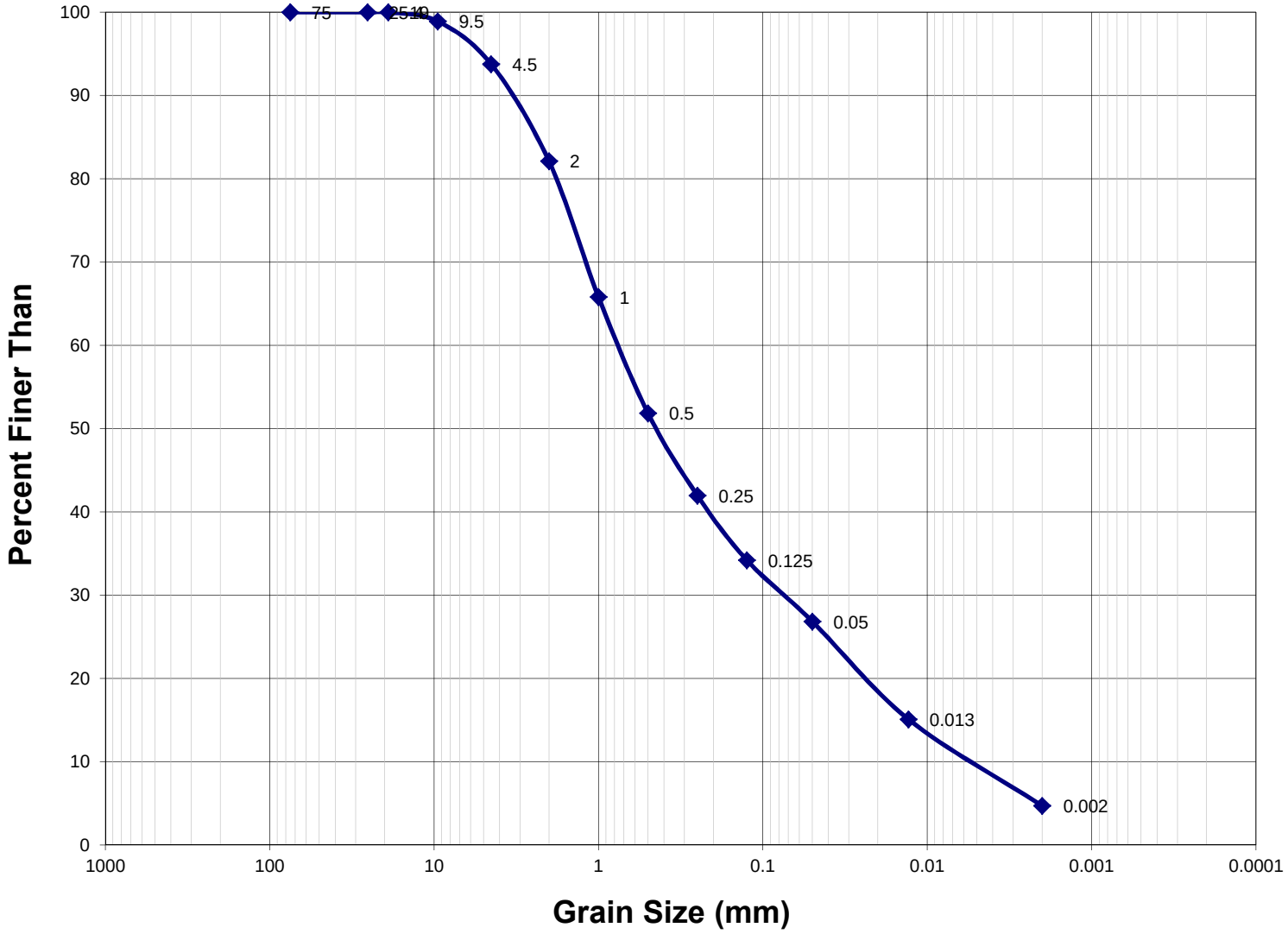
ANALYTICAL CHEMISTRY & TESTING SERVICES
Environmental Division

819-58th Street, Saskatoon, SK S7K 6X5

Client Name: CH2M HILL, INC
Project: CHM400-CHM200-VA
Sample ID: CH12-101-BH003_SOC
Lab ID: L1169182-14

Particle Size Distribution Curve



Summary of Results

Unified Soil Classification System (USCS)

Size Class	Size Range	Wt. (%)
Cobbles	> 3"	0
Gravel	4.75mm - 3"	6
Coarse Sand	2.0mm - 4.75mm	12
Medium Sand	0.425mm - 2.0mm	33
Fine Sand	0.075mm - 0.425mm	20
Fines	< 0.075mm	29

Canadian Soil Survey Committee (CSSC)

Size Class	Size Range	Wt. (%)
Cobbles	> 3"	0
Gravel	2mm - 3"	18
Sand	0.05mm - 2mm	55
Silt	0.002mm - 0.05mm	22
Clay	< 0.002mm	5

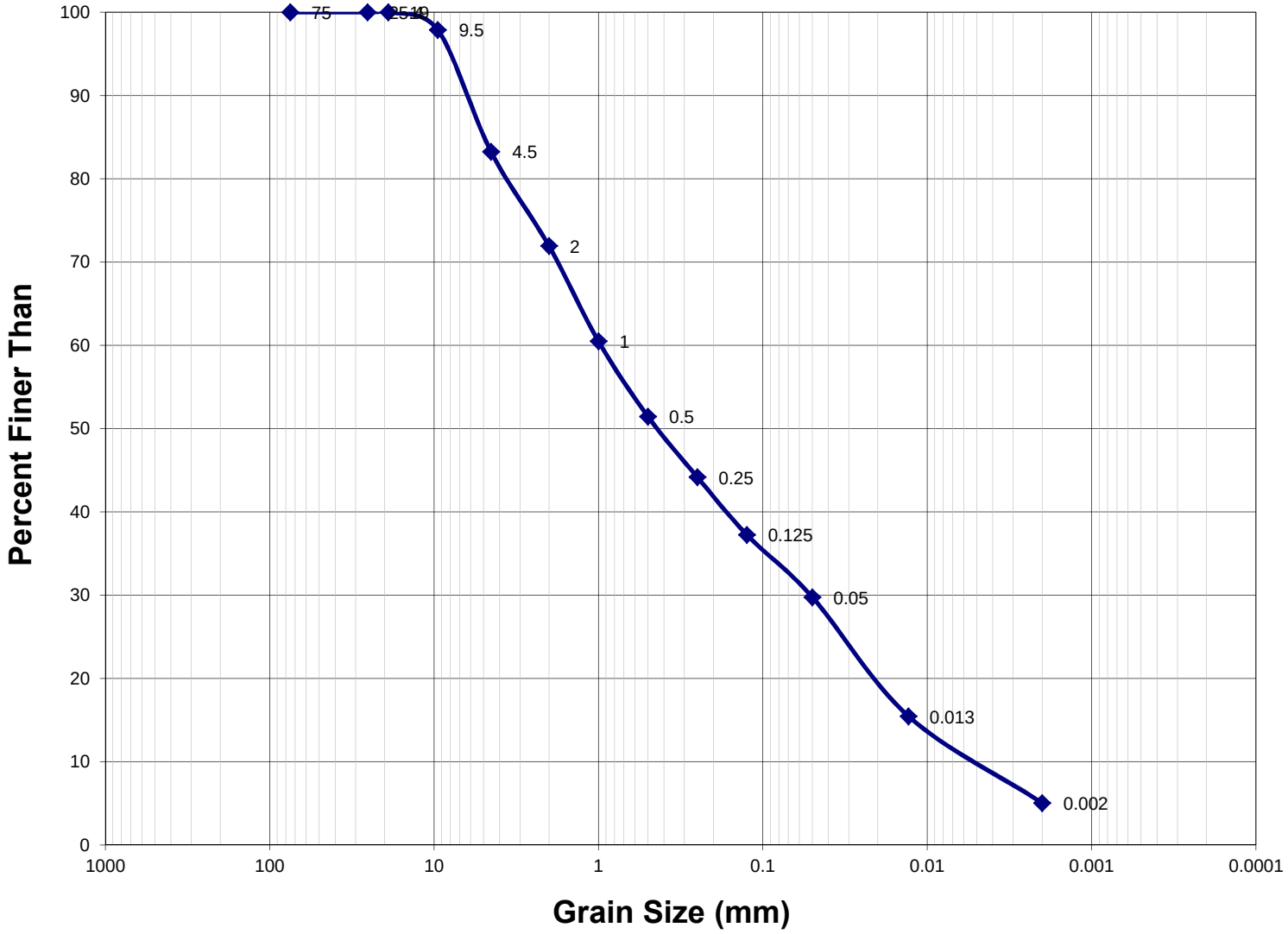
Method Reference: Can. Soc. Soil Sci. (1993) Method 47.2

ALS Laboratory Group
ANALYTICAL CHEMISTRY & TESTING SERVICES
Environmental Division

819-58th Street, Saskatoon, SK S7K 6X5

Client Name: CH2M HILL, INC
Project: CHM400-CHM200-VA
Sample ID: CH12-101-BH004_SOB
Lab ID: L1169182-6

Particle Size Distribution Curve



Summary of Results

Unified Soil Classification System (USCS)

Size Class	Size Range	Wt. (%)
Cobbles	> 3"	0
Gravel	4.75mm - 3"	16
Coarse Sand	2.0mm - 4.75mm	12
Medium Sand	0.425mm - 2.0mm	23
Fine Sand	0.075mm - 0.425mm	17
Fines	< 0.075mm	32

Canadian Soil Survey Committee (CSSC)

Size Class	Size Range	Wt. (%)
Cobbles	> 3"	0
Gravel	2mm - 3"	28
Sand	0.05mm - 2mm	42
Silt	0.002mm - 0.05mm	25
Clay	< 0.002mm	5

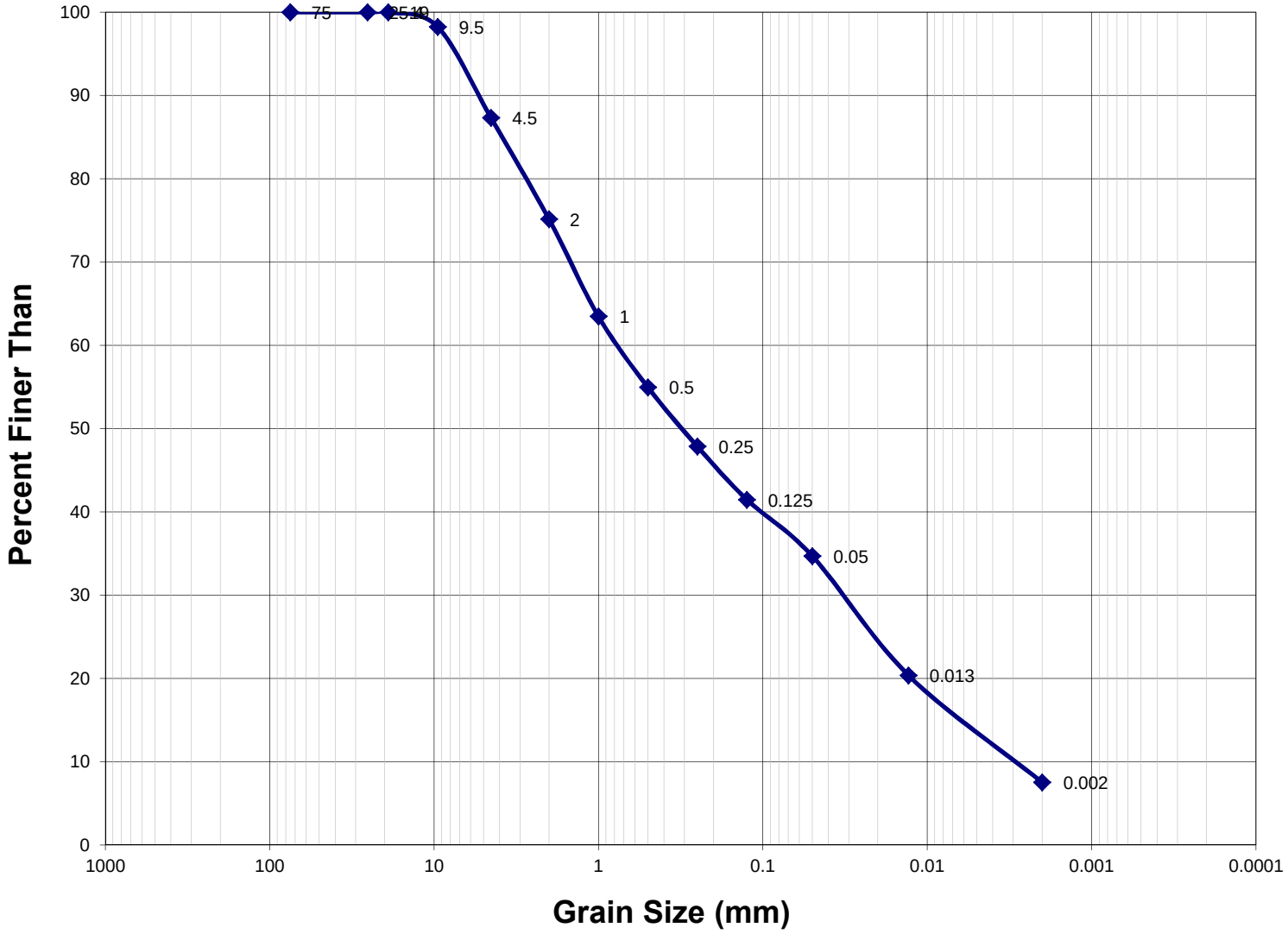
Method Reference: Can. Soc. Soil Sci. (1993) Method 47.2

ALS Laboratory Group
ANALYTICAL CHEMISTRY & TESTING SERVICES
Environmental Division

819-58th Street, Saskatoon, SK S7K 6X5

Client Name: CH2M HILL, INC
Project: CHM400-CHM200-VA
Sample ID: CH12-101-BH004_SOC
Lab ID: L1169182-7

Particle Size Distribution Curve



Summary of Results

Unified Soil Classification System (USCS)

Size Class	Size Range	Wt. (%)
Cobbles	> 3"	0
Gravel	4.75mm - 3"	12
Coarse Sand	2.0mm - 4.75mm	13
Medium Sand	0.425mm - 2.0mm	22
Fine Sand	0.075mm - 0.425mm	16
Fines	< 0.075mm	37

Canadian Soil Survey Committee (CSSC)

Size Class	Size Range	Wt. (%)
Cobbles	> 3"	0
Gravel	2mm - 3"	25
Sand	0.05mm - 2mm	40
Silt	0.002mm - 0.05mm	27
Clay	< 0.002mm	8

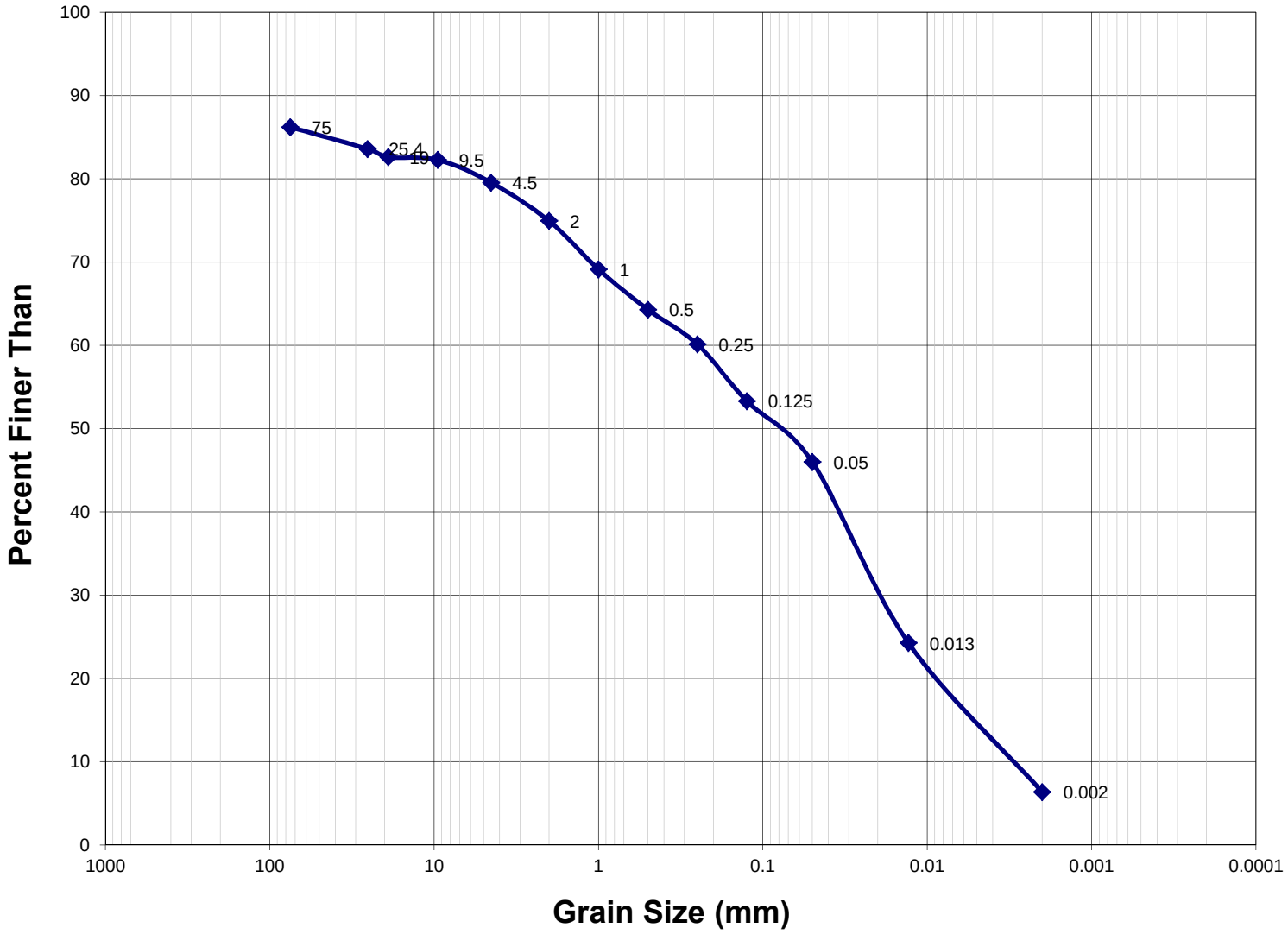
Method Reference: Can. Soc. Soil Sci. (1993) Method 47.2

ALS Laboratory Group
ANALYTICAL CHEMISTRY & TESTING SERVICES
Environmental Division

819-58th Street, Saskatoon, SK S7K 6X5

Client Name: CH2M HILL, INC
Project: CHM400-CHM200-VA
Sample ID: CH12-101-BH005_SOB
Lab ID: L1169205-4

Particle Size Distribution Curve



Summary of Results

Unified Soil Classification System (USCS)

Size Class	Size Range	Wt. (%)
Cobbles	> 3"	14
Gravel	4.75mm - 3"	7
Coarse Sand	2.0mm - 4.75mm	5
Medium Sand	0.425mm - 2.0mm	12
Fine Sand	0.075mm - 0.425mm	15
Fines	< 0.075mm	48

Canadian Soil Survey Committee (CSSC)

Size Class	Size Range	Wt. (%)
Cobbles	> 3"	14
Gravel	2mm - 3"	11
Sand	0.05mm - 2mm	29
Silt	0.002mm - 0.05mm	40
Clay	< 0.002mm	6

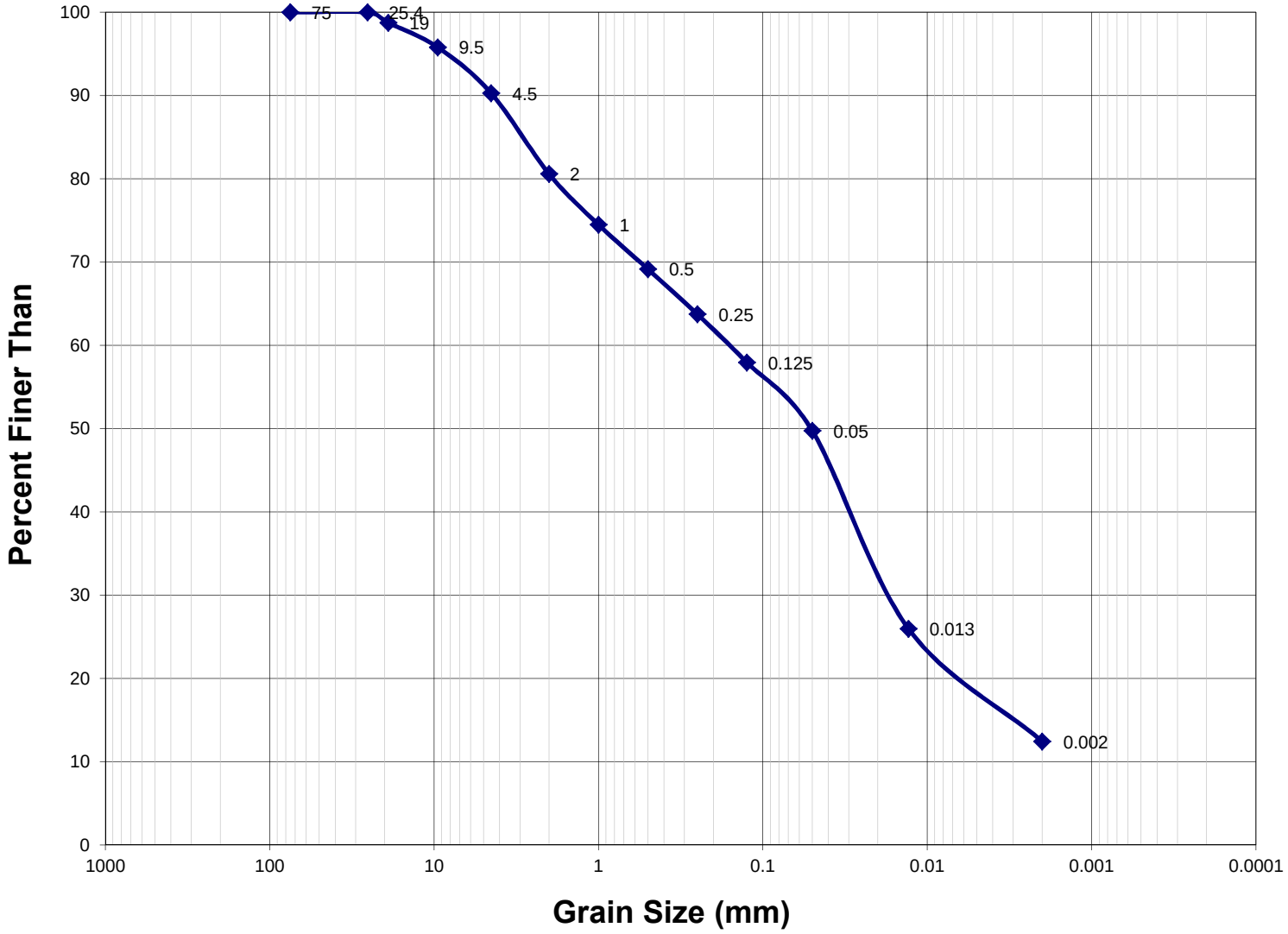
Method Reference: Can. Soc. Soil Sci. (1993) Method 47.2

ALS Laboratory Group
ANALYTICAL CHEMISTRY & TESTING SERVICES
Environmental Division

819-58th Street, Saskatoon, SK S7K 6X5

Client Name: CH2M HILL, INC
Project: CHM400-CHM200-VA
Sample ID: CH12-101-BH005_SOC
Lab ID: L1169205-5

Particle Size Distribution Curve



Summary of Results

Unified Soil Classification System (USCS)

Size Class	Size Range	Wt. (%)
Cobbles	> 3"	0
Gravel	4.75mm - 3"	9
Coarse Sand	2.0mm - 4.75mm	10
Medium Sand	0.425mm - 2.0mm	13
Fine Sand	0.075mm - 0.425mm	15
Fines	< 0.075mm	52

Canadian Soil Survey Committee (CSSC)

Size Class	Size Range	Wt. (%)
Cobbles	> 3"	0
Gravel	2mm - 3"	19
Sand	0.05mm - 2mm	31
Silt	0.002mm - 0.05mm	37
Clay	< 0.002mm	12

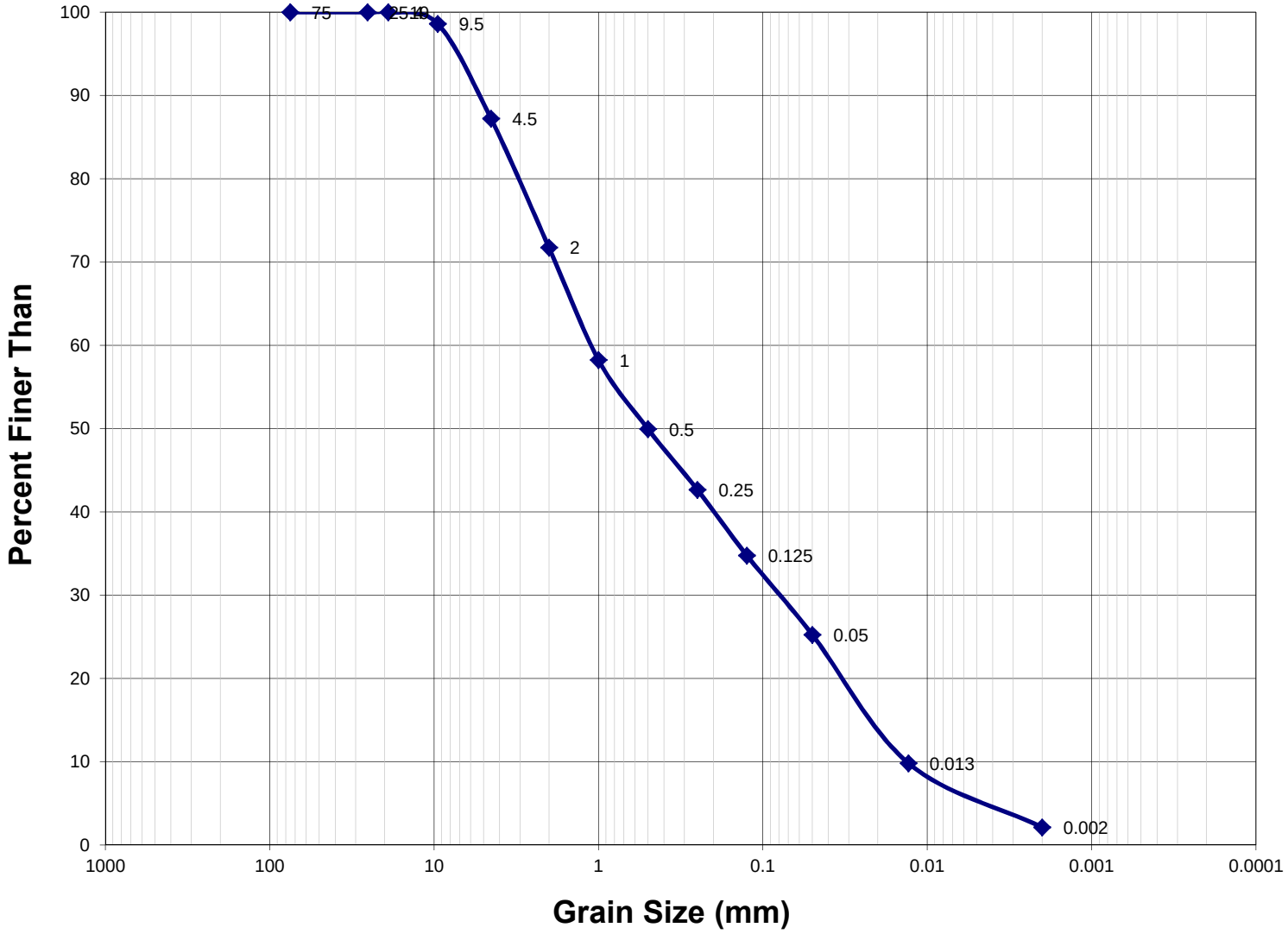
Method Reference: Can. Soc. Soil Sci. (1993) Method 47.2

ALS Laboratory Group
ANALYTICAL CHEMISTRY & TESTING SERVICES
Environmental Division

819-58th Street, Saskatoon, SK S7K 6X5

Client Name: CH2M HILL, INC
Project: CHM400-CHM200-VA
Sample ID: CH12-101-BH006_SOB
Lab ID: L1169182-16

Particle Size Distribution Curve



Summary of Results

Unified Soil Classification System (USCS)

Size Class	Size Range	Wt. (%)
Cobbles	> 3"	0
Gravel	4.75mm - 3"	12
Coarse Sand	2.0mm - 4.75mm	16
Medium Sand	0.425mm - 2.0mm	24
Fine Sand	0.075mm - 0.425mm	19
Fines	< 0.075mm	28

Canadian Soil Survey Committee (CSSC)

Size Class	Size Range	Wt. (%)
Cobbles	> 3"	0
Gravel	2mm - 3"	28
Sand	0.05mm - 2mm	46
Silt	0.002mm - 0.05mm	23
Clay	< 0.002mm	2

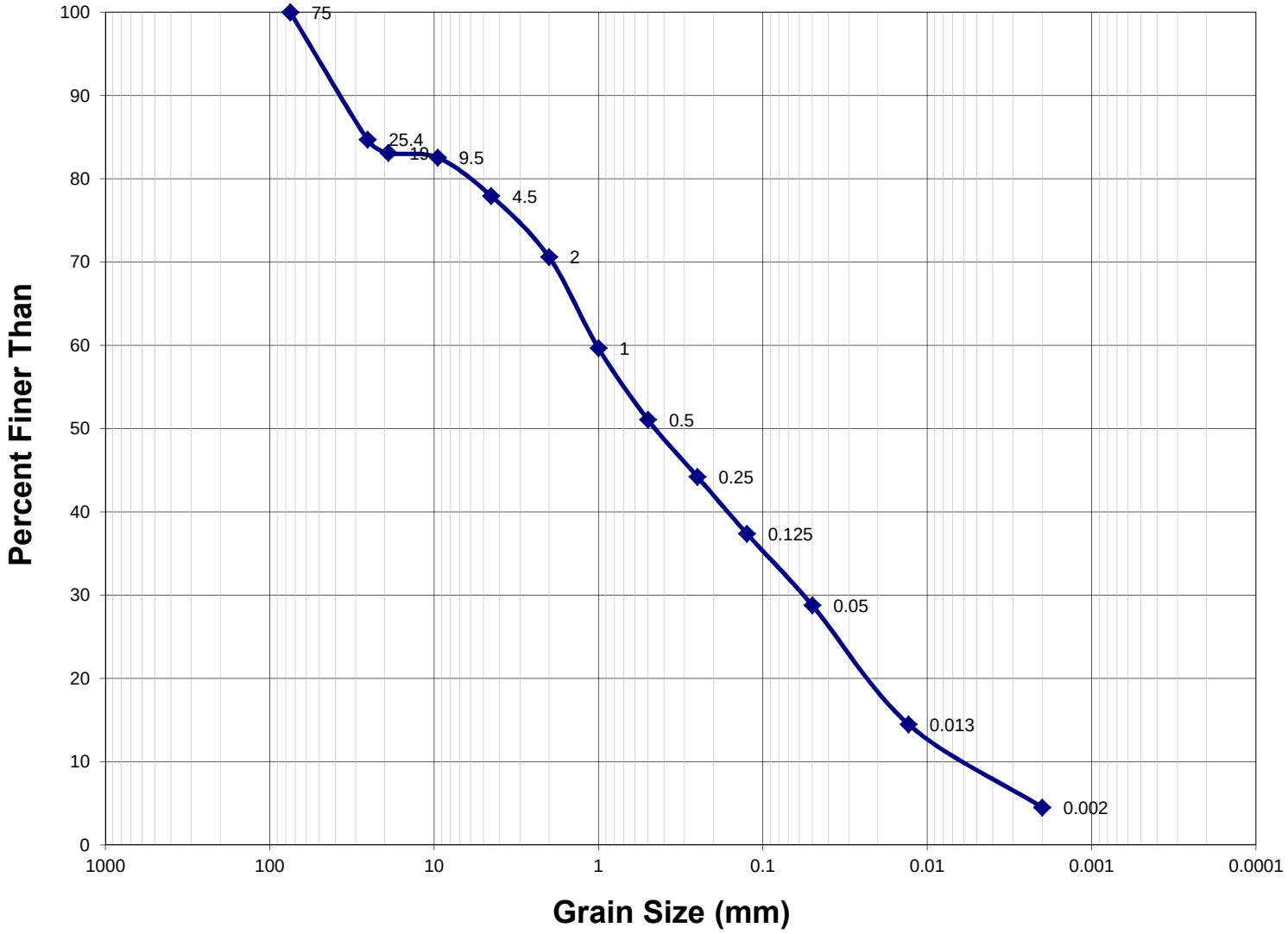
Method Reference: Can. Soc. Soil Sci. (1993) Method 47.2

ALS Laboratory Group
ANALYTICAL CHEMISTRY & TESTING SERVICES
Environmental Division

819-58th Street, Saskatoon, SK S7K 6X5

Client Name: CH2M HILL, INC
Project: CHM400-CHM200-VA
Sample ID: CH12-101-BH007_SOB
Lab ID: L1169205-11

Particle Size Distribution Curve



Summary of Results

Unified Soil Classification System (USCS)

Size Class	Size Range	Wt. (%)
Cobbles	> 3"	0
Gravel	4.75mm - 3"	22
Coarse Sand	2.0mm - 4.75mm	8
Medium Sand	0.425mm - 2.0mm	22
Fine Sand	0.075mm - 0.425mm	17
Fines	< 0.075mm	32

Canadian Soil Survey Committee (CSSC)

Size Class	Size Range	Wt. (%)
Cobbles	> 3"	0
Gravel	2mm - 3"	29
Sand	0.05mm - 2mm	42
Silt	0.002mm - 0.05mm	24
Clay	< 0.002mm	5

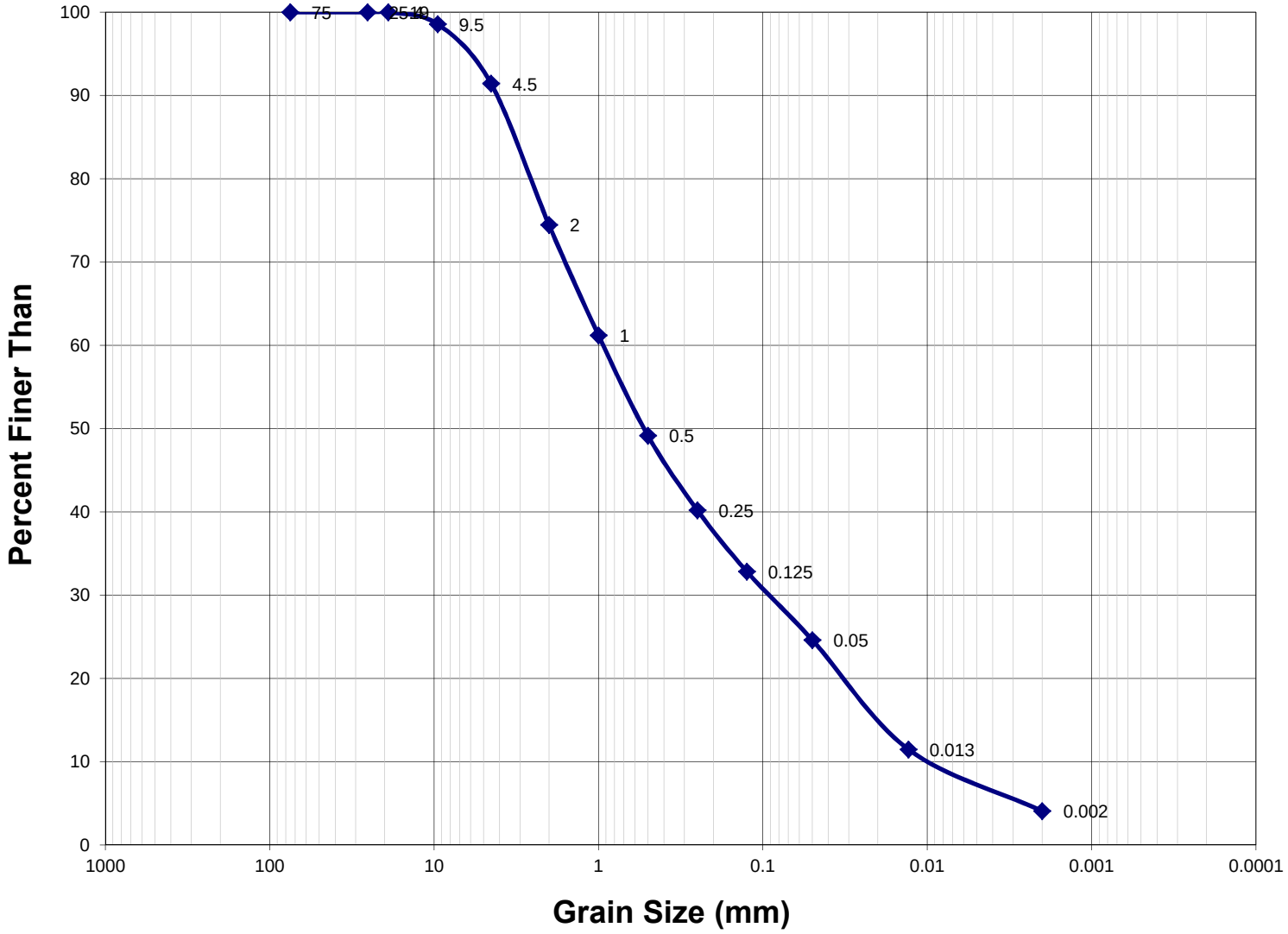
Method Reference: Can. Soc. Soil Sci. (1993) Method 47.2

ALS Laboratory Group
ANALYTICAL CHEMISTRY & TESTING SERVICES
Environmental Division

819-58th Street, Saskatoon, SK S7K 6X5

Client Name: CH2M HILL, INC
Project: CHM400-CHM200-VA
Sample ID: CH12-101-BH008_SOB
Lab ID: L1169205-2

Particle Size Distribution Curve



Summary of Results

Unified Soil Classification System (USCS)

Size Class	Size Range	Wt. (%)
Cobbles	> 3"	0
Gravel	4.75mm - 3"	8
Coarse Sand	2.0mm - 4.75mm	17
Medium Sand	0.425mm - 2.0mm	28
Fine Sand	0.075mm - 0.425mm	19
Fines	< 0.075mm	27

Canadian Soil Survey Committee (CSSC)

Size Class	Size Range	Wt. (%)
Cobbles	> 3"	0
Gravel	2mm - 3"	26
Sand	0.05mm - 2mm	50
Silt	0.002mm - 0.05mm	21
Clay	< 0.002mm	4

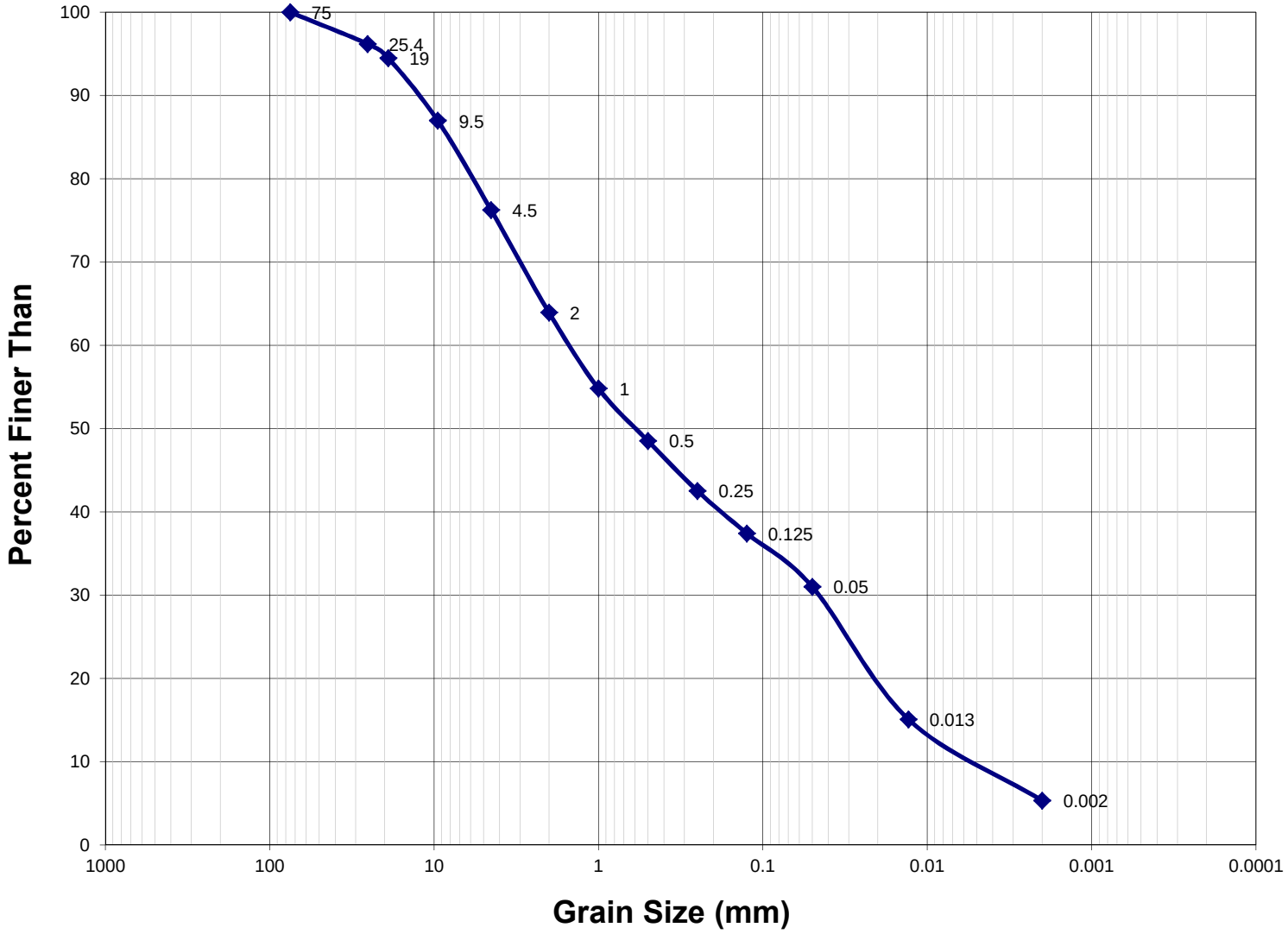
Method Reference: Can. Soc. Soil Sci. (1993) Method 47.2

ALS Laboratory Group
ANALYTICAL CHEMISTRY & TESTING SERVICES
Environmental Division

819-58th Street, Saskatoon, SK S7K 6X5

Client Name: CH2M HILL, INC
Project: CHM400-CHM200-VA
Sample ID: CH12-101-PZ001_SOB
Lab ID: L1169182-19

Particle Size Distribution Curve



Summary of Results

Unified Soil Classification System (USCS)

Size Class	Size Range	Wt. (%)
Cobbles	> 3"	0
Gravel	4.75mm - 3"	23
Coarse Sand	2.0mm - 4.75mm	13
Medium Sand	0.425mm - 2.0mm	17
Fine Sand	0.075mm - 0.425mm	14
Fines	< 0.075mm	33

Canadian Soil Survey Committee (CSSC)

Size Class	Size Range	Wt. (%)
Cobbles	> 3"	0
Gravel	2mm - 3"	36
Sand	0.05mm - 2mm	33
Silt	0.002mm - 0.05mm	26
Clay	< 0.002mm	5

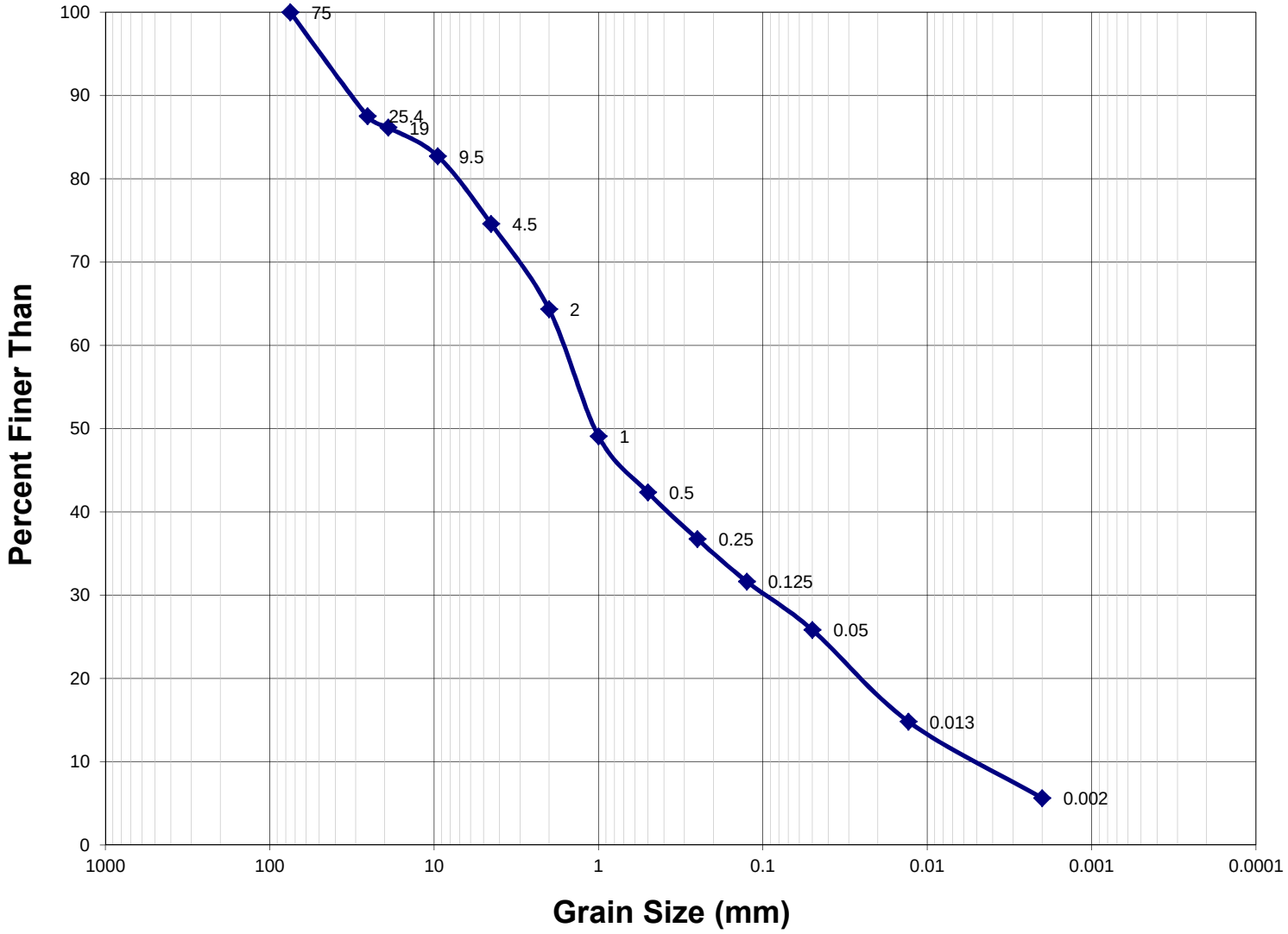
Method Reference: Can. Soc. Soil Sci. (1993) Method 47.2

ALS Laboratory Group
ANALYTICAL CHEMISTRY & TESTING SERVICES
Environmental Division

819-58th Street, Saskatoon, SK S7K 6X5

Client Name: CH2M HILL, INC
Project: CHM400-CHM200-VA
Sample ID: CH12-101-PZ001_SOC
Lab ID: L1169182-20

Particle Size Distribution Curve



Summary of Results

Unified Soil Classification System (USCS)

Size Class	Size Range	Wt. (%)
Cobbles	> 3"	0
Gravel	4.75mm - 3"	25
Coarse Sand	2.0mm - 4.75mm	11
Medium Sand	0.425mm - 2.0mm	24
Fine Sand	0.075mm - 0.425mm	13
Fines	< 0.075mm	28

Canadian Soil Survey Committee (CSSC)

Size Class	Size Range	Wt. (%)
Cobbles	> 3"	0
Gravel	2mm - 3"	36
Sand	0.05mm - 2mm	39
Silt	0.002mm - 0.05mm	20
Clay	< 0.002mm	6

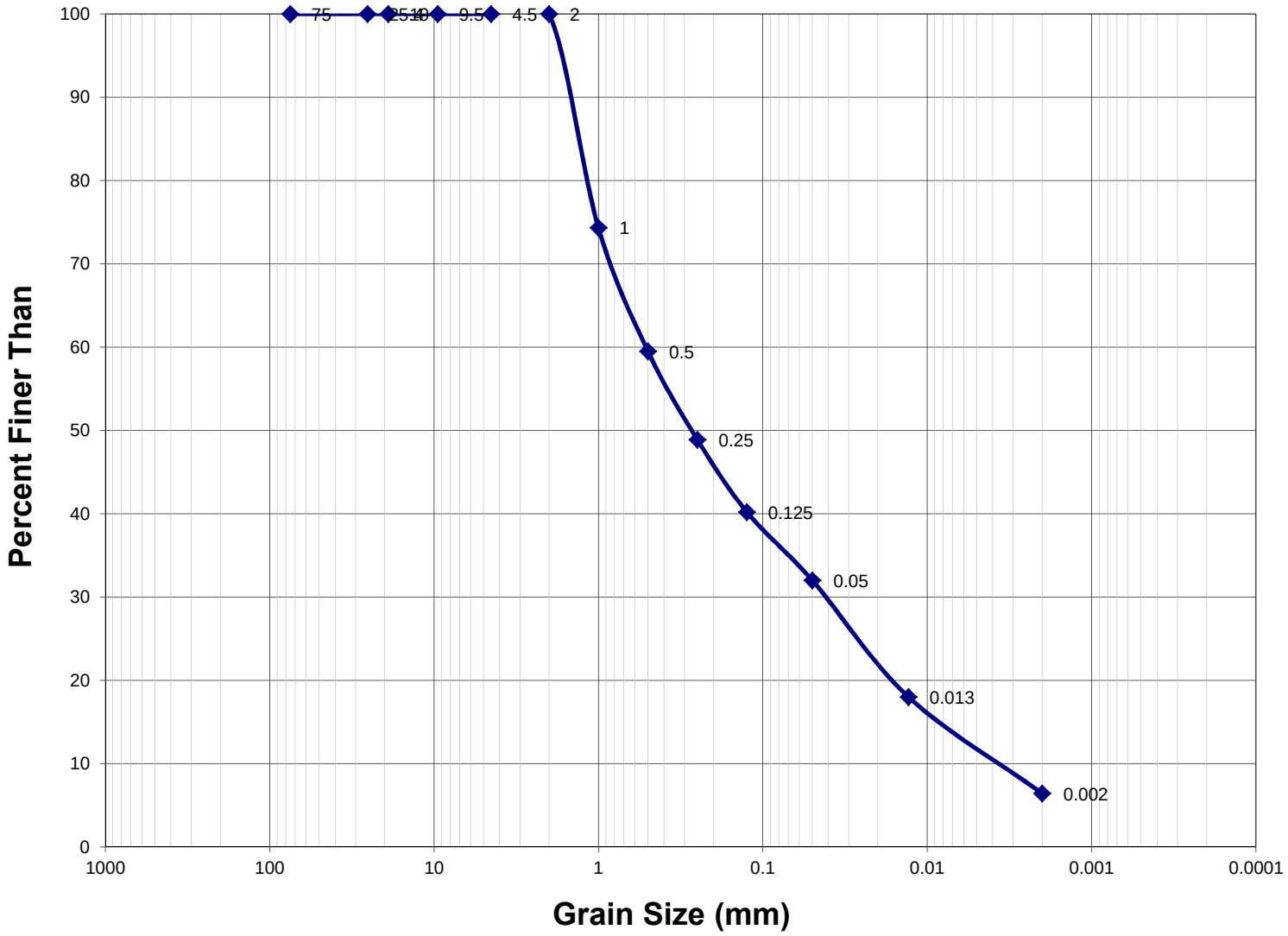
Method Reference: Can. Soc. Soil Sci. (1993) Method 47.2

ALS Laboratory Group
ANALYTICAL CHEMISTRY & TESTING SERVICES
Environmental Division

819-58th Street, Saskatoon, SK S7K 6X5

Client Name: CH2M HILL, INC
Project: CHM400-CHM200-VA
Sample ID: CH12-101-PZ002_SOB
Lab ID: L1169205-7

Particle Size Distribution Curve



Summary of Results

Unified Soil Classification System (USCS)

Size Class	Size Range	Wt. (%)
Cobbles	> 3"	0
Gravel	4.75mm - 3"	0
Coarse Sand	2.0mm - 4.75mm	0
Medium Sand	0.425mm - 2.0mm	44
Fine Sand	0.075mm - 0.425mm	22
Fines	< 0.075mm	35

Canadian Soil Survey Committee (CSSC)

Size Class	Size Range	Wt. (%)
Cobbles	> 3"	0
Gravel	2mm - 3"	0
Sand	0.05mm - 2mm	68
Silt	0.002mm - 0.05mm	26
Clay	< 0.002mm	6

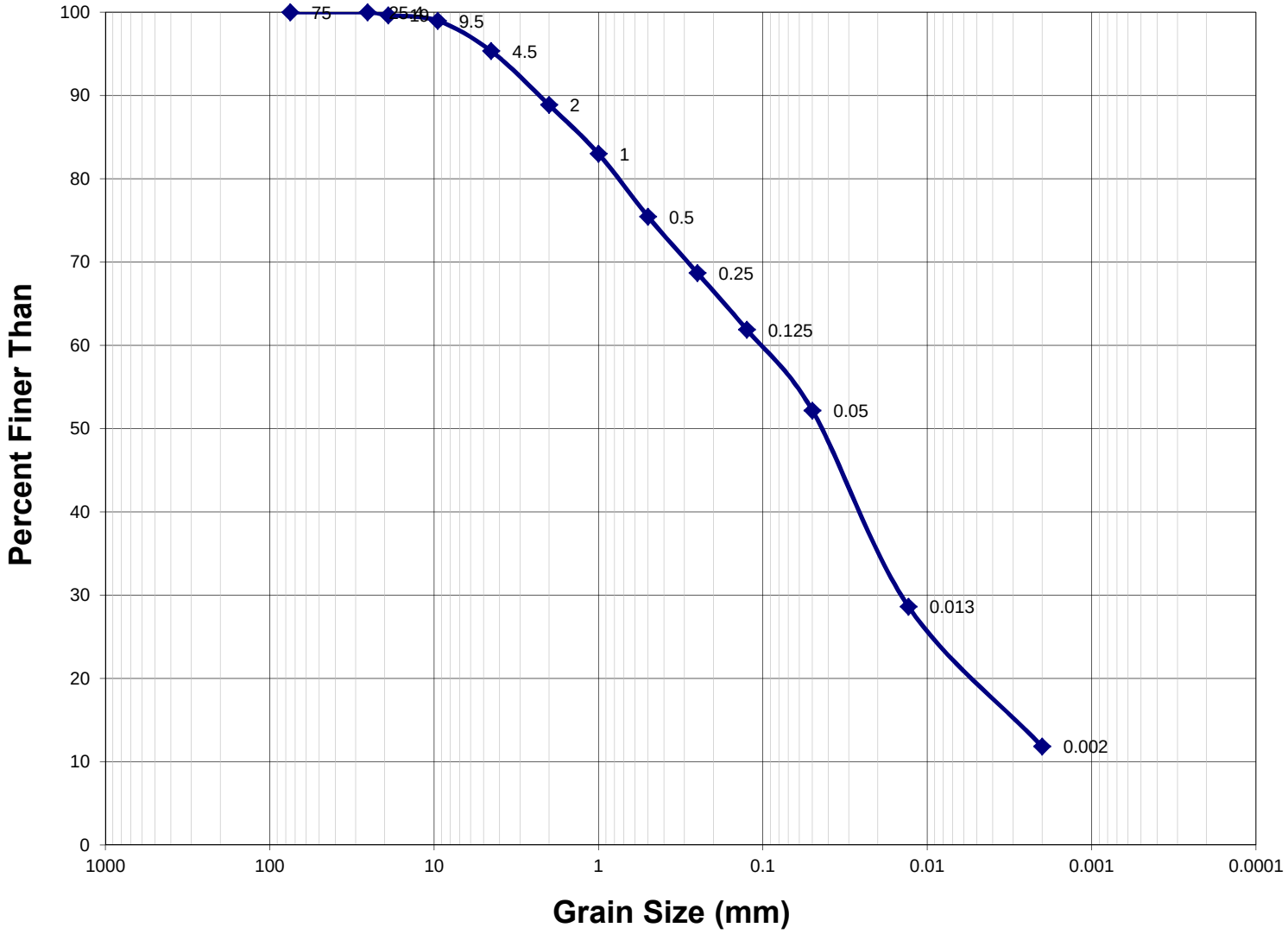
Method Reference: Can. Soc. Soil Sci. (1993) Method 47.2

ALS Laboratory Group
ANALYTICAL CHEMISTRY & TESTING SERVICES
Environmental Division

819-58th Street, Saskatoon, SK S7K 6X5

Client Name: CH2M HILL, INC
Project: CHM400-CHM200-VA
Sample ID: CH12-101-PZ002_SOC
Lab ID: L1169205-8

Particle Size Distribution Curve



Summary of Results

Unified Soil Classification System (USCS)

Size Class	Size Range	Wt. (%)
Cobbles	> 3"	0
Gravel	4.75mm - 3"	4
Coarse Sand	2.0mm - 4.75mm	7
Medium Sand	0.425mm - 2.0mm	15
Fine Sand	0.075mm - 0.425mm	18
Fines	< 0.075mm	55

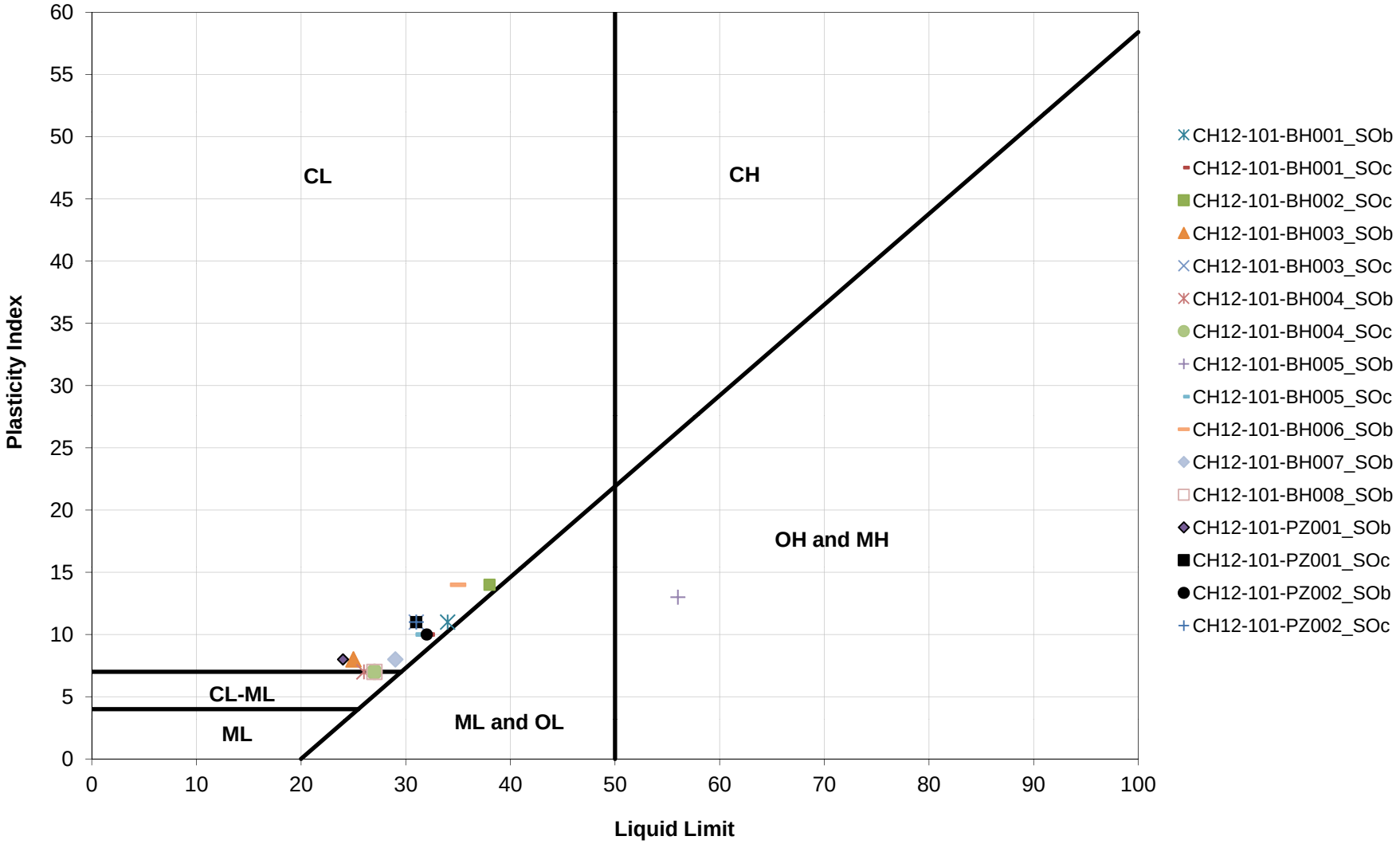
Canadian Soil Survey Committee (CSSC)

Size Class	Size Range	Wt. (%)
Cobbles	> 3"	0
Gravel	2mm - 3"	11
Sand	0.05mm - 2mm	37
Silt	0.002mm - 0.05mm	40
Clay	< 0.002mm	12

Method Reference: Can. Soc. Soil Sci. (1993) Method 47.2

Plasticity Chart

Faro Water Treatment Plant
Faro Mine Remediation Project



ALS ENVIRONMENTAL ANALYTICAL REPORT

Grouping	Analyte	L1169182-1 SOIL 19-JUN-12 16:00 CH12-101-BH002_SOA	L1169182-2 SOIL 19-JUN-12 16:00 CH12-101-BH002_SOB	L1169182-3 SOIL 19-JUN-12 16:15 CH12-101-BH002_SOC	L1169182-4 SOIL 19-JUN-12 16:00 CH12-101-BH902_SOB	L1169182-5 SOIL 20-JUN-12 14:35 CH12-101-BH004_SOA
SOIL						
Physical Tests	Grain Size Curve		SEE ATTACHED	SEE ATTACHED		
	Moisture (%)	7.44	52.1	19.5	6.02	14.9
	Liquid Limit (LL) (%)		24	38		
	pH (1:2 soil:water) (pH)	7.01	6.25	7.91	7.76	7.43
	Plasticity Index (PI) (%)		5	14		
Metals	Aluminum (Al) (mg/kg)	13900	11600	25000	12000	17300
	Antimony (Sb) (mg/kg)	1.29	0.76	0.18	0.88	5.99
	Arsenic (As) (mg/kg)	50.4	8.15	12.4	49.5	53.2
	Barium (Ba) (mg/kg)	224	483	183	115	288
	Beryllium (Be) (mg/kg)	0.69	0.47	0.82	0.63	0.74
	Bismuth (Bi) (mg/kg)	0.84	<0.20	<0.20	1.42	1.29
	Boron (B) (mg/kg)	<10	<10	<10	<10	<10
	Cadmium (Cd) (mg/kg)	1.22	0.870	0.100	1.05	2.79
	Calcium (Ca) (mg/kg)	4640	28300	48500	3310	11700
	Chromium (Cr) (mg/kg)	37.7	23.7	48.3	28.5	39.2
	Cobalt (Co) (mg/kg)	17.2	6.86	21.0	15.3	21.1
	Copper (Cu) (mg/kg)	119	27.8	29.1	113	156
	Iron (Fe) (mg/kg)	31800	17700	42600	29200	45200
	Lead (Pb) (mg/kg)	413	29.2	17.7	240	2800
	Lithium (Li) (mg/kg)	27.1	10.3	35.1	24.4	26.8
	Magnesium (Mg) (mg/kg)	7360	4530	15700	5840	9430
	Manganese (Mn) (mg/kg)	354	436	607	310	500
	Mercury (Hg) (mg/kg)	0.298	0.120	0.0096	0.165	2.20 DLR
	Molybdenum (Mo) (mg/kg)	1.94	1.24	1.07	1.84	2.26
	Nickel (Ni) (mg/kg)	35.4	24.4	45.0	29.3	39.9
	Phosphorus (P) (mg/kg)	579	1220	552	424	629
	Potassium (K) (mg/kg)	2720	580	6460	2710	3000
	Selenium (Se) (mg/kg)	0.34	1.74	<0.20	0.24	0.51
	Silver (Ag) (mg/kg)	0.81	0.38	<0.10	1.08	3.97
	Sodium (Na) (mg/kg)	350	160	200	240	620
	Strontium (Sr) (mg/kg)	36.1	120	116	25.4	63.9
	Thallium (Tl) (mg/kg)	0.482	0.113	0.256	0.425	0.866
	Tin (Sn) (mg/kg)	<2.0	<2.0	<2.0	<2.0	<2.0
	Titanium (Ti) (mg/kg)	462	260	301	386	466
	Uranium (U) (mg/kg)	1.08	2.80	0.683	0.975	1.17
	Vanadium (V) (mg/kg)	34.8	25.4	48.8	30.4	39.3

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1169182-6	L1169182-7	L1169182-8	L1169182-9	L1169182-10
	Description	SOIL	SOIL	SOIL	SOIL	SOIL
	Sampled Date	20-JUN-12	20-JUN-12	20-JUN-12	21-JUN-12	21-JUN-12
	Sampled Time	15:20	15:25	15:25	16:45	17:00
	Client ID	CH12-101-BH004_SOB	CH12-101-BH004_SOC	CH12-101-BH904_SOC	CH12-101-BH001_SOA	CH12-101-BH001_SOB
Grouping	**Analyte**					
SOIL						
Physical Tests	Grain Size Curve	SEE ATTACHED	SEE ATTACHED			SEE ATTACHED
	Moisture (%)	0.90	1.29	1.22	10.3	7.39
	Liquid Limit (LL) (%)	26	27			34
	pH (1:2 soil:water) (pH)	8.74	8.91	8.74	8.05	8.47
	Plasticity Index (PI) (%)	7	7			11
Metals	Aluminum (Al) (mg/kg)	22300	24400	22400	22400	34900
	Antimony (Sb) (mg/kg)	0.39	0.19	0.25	1.76	0.19
	Arsenic (As) (mg/kg)	18.9	11.8	19.0	22.2	10.7
	Barium (Ba) (mg/kg)	45.1	49.8	45.0	310	112
	Beryllium (Be) (mg/kg)	0.75	0.77	0.88	0.86	0.68
	Bismuth (Bi) (mg/kg)	0.21	0.22	0.25	1.32	<0.20
	Boron (B) (mg/kg)	<10	<10	<10	<10	<10
	Cadmium (Cd) (mg/kg)	0.207	0.262	0.210	2.64	0.085
	Calcium (Ca) (mg/kg)	90800	49000	52100	27700	29900
	Chromium (Cr) (mg/kg)	34.7	44.8	38.2	48.6	61.9
	Cobalt (Co) (mg/kg)	19.6	17.9	22.2	17.8	18.9
	Copper (Cu) (mg/kg)	29.9	31.0	34.0	79.0	11.9
	Iron (Fe) (mg/kg)	38100	40800	38400	40500	37500
	Lead (Pb) (mg/kg)	18.1	16.6	16.4	647	10.1
	Lithium (Li) (mg/kg)	50.4	52.9	49.6	36.7	73.1
	Magnesium (Mg) (mg/kg)	17200	19200	16500	15100	34400
	Manganese (Mn) (mg/kg)	706	512	456	598	254
	Mercury (Hg) (mg/kg)	0.0079	<0.0050	<0.0050	0.446	0.0101
	Molybdenum (Mo) (mg/kg)	<0.50	<0.50	<0.50	1.18	0.81
	Nickel (Ni) (mg/kg)	40.0	39.5	44.9	39.7	54.6
	Phosphorus (P) (mg/kg)	308	347	324	525	533
	Potassium (K) (mg/kg)	1980	2190	1910	2670	2530
	Selenium (Se) (mg/kg)	<0.20	<0.20	<0.20	0.34	<0.20
	Silver (Ag) (mg/kg)	0.62	0.90	0.78	1.05	<0.10
	Sodium (Na) (mg/kg)	190	200	210	750	200
	Strontium (Sr) (mg/kg)	311	186	210	91.3	81.5
	Thallium (Tl) (mg/kg)	0.102	0.087	0.101	0.386	0.131
	Tin (Sn) (mg/kg)	<2.0	<2.0	<2.0	<2.0	<2.0
	Titanium (Ti) (mg/kg)	46.9	51.1	65.2	469	240
	Uranium (U) (mg/kg)	0.503	0.458	0.509	1.00	0.738
	Vanadium (V) (mg/kg)	29.9	33.9	28.3	43.1	38.6

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Grouping	Analyte	L1169182-11 SOIL 21-JUN-12 17:35 CH12-101-BH001_SOC	L1169182-12 SOIL 21-JUN-12 09:50 CH12-101-BH003_SOA	L1169182-13 SOIL 21-JUN-12 10:00 CH12-101-BH003_SOB	L1169182-14 SOIL 21-JUN-12 10:45 CH12-101-BH003_SOC	L1169182-15 SOIL 22-JUN-12 17:40 CH12-101-BH006_SOA
Sample ID						
Description						
Sampled Date						
Sampled Time						
Client ID						
SOIL						
Physical Tests	Grain Size Curve	SEE ATTACHED		SEE ATTACHED	SEE ATTACHED	
	Moisture (%)	2.82	6.69	7.29	2.57	11.0
	Liquid Limit (LL) (%)	32		25	31	
	pH (1:2 soil:water) (pH)	8.82	7.94	8.35	8.66	6.66
	Plasticity Index (PI) (%)	10		8	11	
Metals	Aluminum (Al) (mg/kg)	42300	25800	20400	29800	33200
	Antimony (Sb) (mg/kg)	<0.10	0.87	0.42	0.26	0.23
	Arsenic (As) (mg/kg)	2.82	8.75	7.96	4.52	9.19
	Barium (Ba) (mg/kg)	19.4	142	184	141	205
	Beryllium (Be) (mg/kg)	0.36	0.75	0.63	0.67	0.87
	Bismuth (Bi) (mg/kg)	0.25	0.28	0.25	<0.20	0.38
	Boron (B) (mg/kg)	<10	<10	<10	<10	<10
	Cadmium (Cd) (mg/kg)	<0.050	0.317	0.342	<0.050	0.062
	Calcium (Ca) (mg/kg)	5420	20500	21100	42400	6880
	Chromium (Cr) (mg/kg)	47.1	50.0	42.0	46.6	56.5
	Cobalt (Co) (mg/kg)	14.3	18.7	13.6	20.9	20.8
	Copper (Cu) (mg/kg)	0.68	38.9	28.0	24.5	29.6
	Iron (Fe) (mg/kg)	36400	37900	28000	41100	43000
	Lead (Pb) (mg/kg)	5.03	586	20.0	10.2	14.2
	Lithium (Li) (mg/kg)	103	46.6	28.8	47.3	44.0
	Magnesium (Mg) (mg/kg)	51900	16700	10000	17900	19300
	Manganese (Mn) (mg/kg)	78.4	405	377	397	443
	Mercury (Hg) (mg/kg)	<0.0050	0.0827	0.0282	<0.0050	0.0108
	Molybdenum (Mo) (mg/kg)	<0.50	0.69	1.15	0.60	<0.50
	Nickel (Ni) (mg/kg)	28.6	45.2	37.8	48.3	51.7
	Phosphorus (P) (mg/kg)	335	506	654	379	504
	Potassium (K) (mg/kg)	730	2600	3360	7900	2850
	Selenium (Se) (mg/kg)	<0.20	<0.20	<0.20	<0.20	<0.20
	Silver (Ag) (mg/kg)	<0.10	0.61	0.13	<0.10	<0.10
	Sodium (Na) (mg/kg)	<100	730	590	750	830
	Strontium (Sr) (mg/kg)	19.1	77.3	82.7	143	53.6
	Thallium (Tl) (mg/kg)	<0.050	0.223	0.214	0.291	0.239
	Tin (Sn) (mg/kg)	<2.0	<2.0	<2.0	<2.0	<2.0
	Titanium (Ti) (mg/kg)	65.7	423	442	403	605
	Uranium (U) (mg/kg)	0.683	0.744	0.818	0.775	0.850
	Vanadium (V) (mg/kg)	29.2	40.3	36.3	36.6	44.1

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1169182-16	L1169182-17	L1169182-18	L1169182-19	L1169182-20
	Description	SOIL	SOIL	SOIL	SOIL	SOIL
	Sampled Date	22-JUN-12	22-JUN-12	22-JUN-12	22-JUN-12	22-JUN-12
	Sampled Time	17:45	17:40	10:00	10:20	11:00
	Client ID	CH12-101-BH006_SOB	CH12-101-BH906_SOA	CH12-101-PZ001_SOA	CH12-101-PZ001_SOB	CH12-101-PZ001_SOC
Grouping	**Analyte**					
SOIL						
Physical Tests	Grain Size Curve	SEE ATTACHED			SEE ATTACHED	SEE ATTACHED
	Moisture (%)	12.1	11.9	12.0	9.43	5.61
	Liquid Limit (LL) (%)	35			24	31
	pH (1:2 soil:water) (pH)	7.62	6.43	8.36	8.50	8.45
	Plasticity Index (PI) (%)	14			8	11
Metals	Aluminum (Al) (mg/kg)	43500	42700	19400	18300	32700
	Antimony (Sb) (mg/kg)	0.13	0.13	0.97	0.39	0.24
	Arsenic (As) (mg/kg)	8.80	6.43	16.2	7.26	11.3
	Barium (Ba) (mg/kg)	246	244	226	127	172
	Beryllium (Be) (mg/kg)	0.86	0.89	0.63	0.55	0.76
	Bismuth (Bi) (mg/kg)	0.31	0.39	0.44	0.23	0.23
	Boron (B) (mg/kg)	<10	<10	<10	<10	<10
	Cadmium (Cd) (mg/kg)	<0.050	<0.050	0.885	0.282	0.100
	Calcium (Ca) (mg/kg)	16800	13100	13200	20000	37300
	Chromium (Cr) (mg/kg)	55.1	54.0	47.0	40.2	52.7
	Cobalt (Co) (mg/kg)	21.4	18.6	14.0	12.9	20.9
	Copper (Cu) (mg/kg)	42.2	36.5	55.5	28.1	25.8
	Iron (Fe) (mg/kg)	42900	43600	29600	26600	41700
	Lead (Pb) (mg/kg)	15.8	12.2	386	18.8	14.5
	Lithium (Li) (mg/kg)	46.2	47.4	31.5	28.1	43.9
	Magnesium (Mg) (mg/kg)	23300	22600	9530	10400	20100
	Manganese (Mn) (mg/kg)	771	714	335	340	501
	Mercury (Hg) (mg/kg)	<0.0050	0.0061	0.241	0.0229	0.0089
	Molybdenum (Mo) (mg/kg)	<0.50	<0.50	1.18	1.04	0.54
	Nickel (Ni) (mg/kg)	57.6	49.5	32.7	39.3	46.5
	Phosphorus (P) (mg/kg)	573	463	497	629	408
	Potassium (K) (mg/kg)	6570	4850	2650	2590	7240
	Selenium (Se) (mg/kg)	<0.20	<0.20	<0.20	<0.20	<0.20
	Silver (Ag) (mg/kg)	<0.10	<0.10	0.56	<0.10	<0.10
	Sodium (Na) (mg/kg)	2000	1660	570	450	920
	Strontium (Sr) (mg/kg)	116	102	67.5	85.3	129
	Thallium (Tl) (mg/kg)	0.393	0.385	0.361	0.186	0.289
	Tin (Sn) (mg/kg)	<2.0	<2.0	<2.0	<2.0	<2.0
	Titanium (Ti) (mg/kg)	921	823	453	412	540
	Uranium (U) (mg/kg)	0.651	0.779	0.710	0.915	0.906
	Vanadium (V) (mg/kg)	48.0	48.2	37.1	33.4	45.1

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Grouping	Analyte	L1169205-1 SOIL 23-JUN-12 15:15 CH12-101-BH008_SOA	L1169205-2 SOIL 23-JUN-12 16:16 CH12-101-BH008_SOB	L1169205-3 SOIL 24-JUN-12 09:00 CH12-101-BH005_SOA	L1169205-4 SOIL 24-JUN-12 09:05 CH12-101-BH005_SOB	L1169205-5 SOIL 24-JUN-12 09:40 CH12-101-BH005_SOC
Sample ID		L1169205-1	L1169205-2	L1169205-3	L1169205-4	L1169205-5
Description		SOIL	SOIL	SOIL	SOIL	SOIL
Sampled Date		23-JUN-12	23-JUN-12	24-JUN-12	24-JUN-12	24-JUN-12
Sampled Time		15:15	16:16	09:00	09:05	09:40
Client ID		CH12-101-BH008_SOA	CH12-101-BH008_SOB	CH12-101-BH005_SOA	CH12-101-BH005_SOB	CH12-101-BH005_SOC
SOIL						
Physical Tests	Grain Size Curve		SEE ATTACHED		SEE ATTACHED	SEE ATTACHED
	Moisture (%)	12.6	9.85	26.3	28.9	12.8
	Liquid Limit (LL) (%)		27		56	31
	pH (1:2 soil:water) (pH)	8.18	8.28	6.04	7.03	8.04
	Plasticity Index (PI) (%)		7		13	10
Metals	Aluminum (Al) (mg/kg)	9340	34700	19600	16000	16200
	Antimony (Sb) (mg/kg)	1.25	0.14	0.41	0.58	0.76
	Arsenic (As) (mg/kg)	9.75	9.71	8.99	6.88	10.8
	Barium (Ba) (mg/kg)	298	215	245	201	233
	Beryllium (Be) (mg/kg)	0.37	0.62	0.64	0.49	0.61
	Bismuth (Bi) (mg/kg)	<0.20	0.28	0.25	<0.20	0.29
	Boron (B) (mg/kg)	16	<10	<10	<10	<10
	Cadmium (Cd) (mg/kg)	0.825	0.058	0.257	0.568	0.501
	Calcium (Ca) (mg/kg)	11900	42300	5440	7100	16600
	Chromium (Cr) (mg/kg)	21.2	45.5	41.8	29.6	44.8
	Cobalt (Co) (mg/kg)	7.58	19.5	13.8	9.85	14.1
	Copper (Cu) (mg/kg)	26.7	36.1	25.7	25.0	33.8
	Iron (Fe) (mg/kg)	16600	39200	28100	20200	30400
	Lead (Pb) (mg/kg)	266	13.3	19.5	215	17.2
	Lithium (Li) (mg/kg)	11.3	38.1	23.5	17.9	25.8
	Magnesium (Mg) (mg/kg)	7590	17500	8670	6680	9710
	Manganese (Mn) (mg/kg)	264	583	314	303	573
	Mercury (Hg) (mg/kg)	0.242	<0.0050	0.0294	0.104	0.0309
	Molybdenum (Mo) (mg/kg)	1.16	<0.50	1.02	0.66	2.18
	Nickel (Ni) (mg/kg)	23.6	43.0	35.1	25.0	42.5
	Phosphorus (P) (mg/kg)	898	343	916	483	814
	Potassium (K) (mg/kg)	1060	7530	1630	1230	2060
	Selenium (Se) (mg/kg)	0.34	<0.20	0.38	0.21	<0.20
	Silver (Ag) (mg/kg)	0.48	<0.10	0.13	0.34	0.16
	Sodium (Na) (mg/kg)	330	1580	780	930	290
	Strontium (Sr) (mg/kg)	78.3	201	43.0	45.5	67.8
	Thallium (Tl) (mg/kg)	0.169	0.341	0.174	0.172	0.183
	Tin (Sn) (mg/kg)	<2.0	<2.0	<2.0	<2.0	<2.0
	Titanium (Ti) (mg/kg)	385	969	532	450	507
	Uranium (U) (mg/kg)	0.772	0.889	1.69	0.728	1.93
	Vanadium (V) (mg/kg)	31.3	41.6	45.4	32.7	48.8

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Grouping	Analyte	L1169205-6 SOIL 24-JUN-12 13:05 CH12-101-PZ002_SOA	L1169205-7 SOIL 24-JUN-12 13:30 CH12-101-PZ002_SOB	L1169205-8 SOIL 24-JUN-12 13:48 CH12-101-PZ002_SOC	L1169205-9 SOIL 24-JUN-12 13:30 CH12-101-PZ902_SOB	L1169205-10 SOIL 25-JUN-12 10:40 CH12-101-BH007_SOA
SOIL						
Physical Tests	Grain Size Curve		SEE ATTACHED	SEE ATTACHED		
	Moisture (%)	19.8	5.61	12.9	11.9	10.7
	Liquid Limit (LL) (%)		32	31		
	pH (1:2 soil:water) (pH)	8.15	8.16	7.34	7.43	7.36
	Plasticity Index (PI) (%)		10	11		
Metals	Aluminum (Al) (mg/kg)	28400	27100	20000	21500	19200
	Antimony (Sb) (mg/kg)	1.43	0.54	0.61	0.62	0.48
	Arsenic (As) (mg/kg)	10.8	10.4	11.4	12.8	11.0
	Barium (Ba) (mg/kg)	241	138	292	286	159
	Beryllium (Be) (mg/kg)	0.72	0.83	0.73	0.77	0.61
	Bismuth (Bi) (mg/kg)	0.35	0.39	0.30	0.35	1.26
	Boron (B) (mg/kg)	<10	<10	<10	<10	<10
	Cadmium (Cd) (mg/kg)	1.55	0.478	0.307	0.307	0.435
	Calcium (Ca) (mg/kg)	23100	29400	9670	9960	5220
	Chromium (Cr) (mg/kg)	43.4	45.4	47.5	51.0	38.5
	Cobalt (Co) (mg/kg)	17.9	16.9	14.8	16.2	12.9
	Copper (Cu) (mg/kg)	58.1	37.3	34.9	36.2	41.4
	Iron (Fe) (mg/kg)	36700	34300	29900	32100	28000
	Lead (Pb) (mg/kg)	980	205	30.1	33.4	143
	Lithium (Li) (mg/kg)	45.9	47.8	28.4	30.6	25.7
	Magnesium (Mg) (mg/kg)	19700	13200	9480	10500	9700
	Manganese (Mn) (mg/kg)	385	387	597	534	332
	Mercury (Hg) (mg/kg)	0.798 DLA	0.109	0.0448	0.0413	0.0779
	Molybdenum (Mo) (mg/kg)	0.85	1.12	0.95	1.08	1.01
	Nickel (Ni) (mg/kg)	40.8	39.1	44.6	46.9	33.5
	Phosphorus (P) (mg/kg)	663	503	613	627	331
	Potassium (K) (mg/kg)	2910	3660	1970	2240	1990
	Selenium (Se) (mg/kg)	<0.20	0.21	0.47	0.42	<0.20
	Silver (Ag) (mg/kg)	1.08	0.28	0.21	0.19	0.23
	Sodium (Na) (mg/kg)	670	890	560	570	550
	Strontium (Sr) (mg/kg)	91.1	143	56.9	62.4	41.1
	Thallium (Tl) (mg/kg)	0.364	0.244	0.190	0.221	0.241
	Tin (Sn) (mg/kg)	<2.0	<2.0	<2.0	<2.0	<2.0
	Titanium (Ti) (mg/kg)	417	596	572	623	506
	Uranium (U) (mg/kg)	0.711	1.06	1.51	1.48	0.836
	Vanadium (V) (mg/kg)	38.5	41.2	47.8	48.1	40.6

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1169205-11				
	Description	SOIL				
	Sampled Date	25-JUN-12				
	Sampled Time	10:48				
	Client ID	CH12-101-BH007_SOB				
Grouping	**Analyte**					
SOIL						
Physical Tests	Grain Size Curve	SEE ATTACHED				
	Moisture (%)	7.26				
	Liquid Limit (LL) (%)	29				
	pH (1:2 soil:water) (pH)	8.02				
	Plasticity Index (PI) (%)	8				
Metals	Aluminum (Al) (mg/kg)	38300				
	Antimony (Sb) (mg/kg)	0.23				
	Arsenic (As) (mg/kg)	11.9				
	Barium (Ba) (mg/kg)	285				
	Beryllium (Be) (mg/kg)	0.78				
	Bismuth (Bi) (mg/kg)	0.22				
	Boron (B) (mg/kg)	<10				
	Cadmium (Cd) (mg/kg)	0.072				
	Calcium (Ca) (mg/kg)	17600				
	Chromium (Cr) (mg/kg)	58.6				
	Cobalt (Co) (mg/kg)	18.5				
	Copper (Cu) (mg/kg)	25.1				
	Iron (Fe) (mg/kg)	40300				
	Lead (Pb) (mg/kg)	17.2				
	Lithium (Li) (mg/kg)	63.9				
	Magnesium (Mg) (mg/kg)	21300				
	Manganese (Mn) (mg/kg)	618				
	Mercury (Hg) (mg/kg)	0.0091				
	Molybdenum (Mo) (mg/kg)	0.64				
	Nickel (Ni) (mg/kg)	40.5				
	Phosphorus (P) (mg/kg)	360				
	Potassium (K) (mg/kg)	7460				
	Selenium (Se) (mg/kg)	<0.20				
	Silver (Ag) (mg/kg)	<0.10				
	Sodium (Na) (mg/kg)	1270				
	Strontium (Sr) (mg/kg)	89.6				
	Thallium (Tl) (mg/kg)	0.337				
	Tin (Sn) (mg/kg)	<2.0				
	Titanium (Ti) (mg/kg)	842				
	Uranium (U) (mg/kg)	0.743				
	Vanadium (V) (mg/kg)	51.8				

* Please refer to the Reference Information section for an explanation of any qualifiers detected.