January 28, 2014

LABORATORY REPORT FOR

Giant Mine Backfill Testing - South Pond

Submitted to:

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(PWGSC)
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REPORT

Reference Number: 1314260010-094-R-Rev0-5000

Distribution:

1 Electronic Copy - Public Works and Government Services Canada (PWGSC)

2 Hard Copies - Golder Associates Ltd., Sudbury, Ontario

Golder Associate

Study Limitations

This report was prepared for the exclusive use of Public Works and Government Services Canada (PWGSC) on the Giant Mine Project. The report, which specifically includes all tables, figures and appendices, is based on measurements and observations made and data and information collected during the laboratory studies conducted by Golder Associates Ltd. (Golder) for PWGSC. The test results are based solely on the ambient conditions of the laboratory at the time the measurements and tests were conducted.

The services performed, as described in this report, were conducted in a manner consistent with that level of care and skill normally exercised by other members of the engineering and science professions currently practicing under similar conditions, subject to the time limits and financial and physical constraints applicable to the services.

The sample(s) provided for the tests are assumed to be representative of material found at the site. The test data given herein pertains to the sample(s) provided, and may not be applicable to material from other production periods or zones. Assessment of the sample environmental conditions and possible hazards associated with the material composition is based on the results of chemical analysis of samples which are possibly from a limited number of locations. However, it is never possible, even with exhaustive sampling and testing, to dismiss the possibility that part of a site or a production line may remain undetected. The results found from the tests may not be reproducible under the field conditions.

The report is of a summary nature and is not intended to stand alone without reference to the instructions given to Golder by PWGSC, communications between Golder and PWGSC, and to any other reports prepared by Golder for PWGSC relative to the specific site described in the report, tables, drawings, figures and appendices. ***In order to properly understand the suggestions, recommendations and opinions expressed in this report, reference must be made to the whole of the report. Golder cannot be responsible for use of portions of the report without reference to the entire report.***

No other party may use or rely on this report or any portion thereof without Golder's express written consent. Any use, which a third party makes of this report, or any reliance on, or decisions to be made based on it, are the responsibilities of such third parties. Golder accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.

The findings and conclusions of this report are valid only as of the date of this report. If new information is discovered in future work, Golder should be requested to re-evaluate the conclusions of this report, and to provide amendments as required.

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1.0 INTRODUCTION

Public Works and Government Services Canada (PWGSC) has retained Golder Associates Ltd. (Golder) to carry out laboratory testing on Giant Mine tailings to assess the rheological and strength properties of the tailings for the purpose of using them as feed material for underground paste backfill.

2.0 SAMPLE RECEIPT AND PREPARATION

2.1 Sample Receipt

Samples received by Golder's Sudbury laboratory are summarized in Table 1. All samples were received in good condition with all seals intact. The total weight of the shipment was 1308 kg. The samples were shipped via Canadian North Cargo.

Table 1: Sample Receipt Summary

Date	Amount/Container	Label as Received	Golder Sample ID
July 23, 2013	1 – 20L pail	Aggregate Sample - 1/2" sample 1 of 2	13-1426-0010 Aggregate
	1 – 20L pail	Aggregate Sample Giant Mine - 1/2" 2 of 2	
	1 – 20L pail	SPTP-1 TP-1 Giant Mine July 9/13	13-1426-0010 SPTP-1 TP1
	1 – 20L pail	SPTP-2 TP2 Giant Mine July 9/13	13-1426-0010 SPTP-2 TP2
	1 – 20L pail	SPTP3 Giant Mine July 9/13	13-1426-0010 SPTP 3
	1 – 20L pail	SPTP-4 Giant Mine July 9/13	13-1426-0010 SPTP 4
	1 – 20L pail	SPTP 5	13-1426-0010 SPTP 5
	1 – 20L pail	SPTP-6 Giant Mine July 9/13	13-1426-0010 SPTP 6
	1 – 20L pail	Giant Mine Central Pond CPTP01 July 09/13 collected July 11/13	13-1426-0010 CPTP 01
	1 – 20L pail	Giant Mine Central Pond CPTP02 July 9/13 collected July 11/13	13-1426-0010 CPTP 02
	1 – 200L drum	July 10/13 SP- TP 1+2+3 (3x 5g pails each) Giant Mine	13-1426-0010 SP-TP 1+2+3
	1 – 200L drum	July 10/13 SP TP 4+5+6 (3x 5gal pails each) Giant Mine	13-1426-0010 SP-TP 4+5+6
	1 – 200L drum	Giant Mine Water Sample Barrel 1 of 2 July 10, 2013	13-1426-0010 Water
	1 – 200L drum	Giant Mine Water Sample Barrel 2 of 2 July 10, 2013	

All samples received by Golder are subjected to material property characterization tests to establish properties and allow for comparison should future testing be required.

2.2 Hazard Assessment

Prior to handling the Giant Mine samples each pail and drums were assessed separately for hazardous gases. The gas analysis results are presented in Table 2.

Table 2: Sample Hazard Assessment

Date	Label as Received	Golder Sample ID	VOC (ppm)	HCN (ppm)	H_2S (ppm)
July 23, 2013	Aggregate Sample - 1/2" sample 1 of 2	13-1426-0010 Aggregate	0	0	0
	Aggregate Sample Giant Mine - 1/2" 2 of 2		0	0	0
	SPTP-1 TP-1 Giant Mine July 9/13	13-1426-0010 SPTP-1 TP1	0	0	0
	SPTP-2 TP2 Giant Mine July 9/13	13-1426-0010 SPTP-2 TP2	0	0	0
	SPTP3 Giant Mine July 9/13	13-1426-0010 SPTP 3	0	0	0
	SPTP-4 Giant Mine July 9/13	13-1426-0010 SPTP 4	0	0	0
	SPTP 5	13-1426-0010 SPTP 5	0	0	0
	SPTP-6 Giant Mine July 9/13	13-1426-0010 SPTP 6	0	0	0
	Giant Mine Central Pond CPTP01 July 09/13 collected July 11/13	13-1426-0010 CPTP 01	0	0	0
	Giant Mine Central Pond CPTP02 July 9/13 collected July 11/13	13-1426-0010 CPTP 02	0	0	0
	July 10/13 SP- TP 1+2+3 (3x 5g pails each) Giant Mine	13-1426-0010 SP-TP 1+2+3	0	0	0
	July 10/13 SP TP 4+5+6 (3x 5gal pails each) Giant Mine	13-1426-0010 SP-TP 4+5+6	0	0	0
	Giant Mine Water Sample Barrel 1 of 2 July 10, 2013	13-1426-0010 Water	0	0	0
	Giant Mine Water Sample Barrel 2 of 2 July 10, 2013		0	0	0

VOC: Volatile Organic Compounds
HCN: Hydrogen Cyanide gas
H_2S: Hydrogen Sulphide gas

Metals analysis using Inductively Coupled Plasma with a Mass Spectrometer detector (ICP-MS) was performed on a composite sample obtained via individual pipe samples from each pail. In addition cyanide levels were also examined. This testing helps to identify health and safety hazards such as heavy metals or cyanide which may be present. The sample was sent to an external laboratory for ICP-MS analysis. Figure 1, Table 3, and Appendix A present the results.

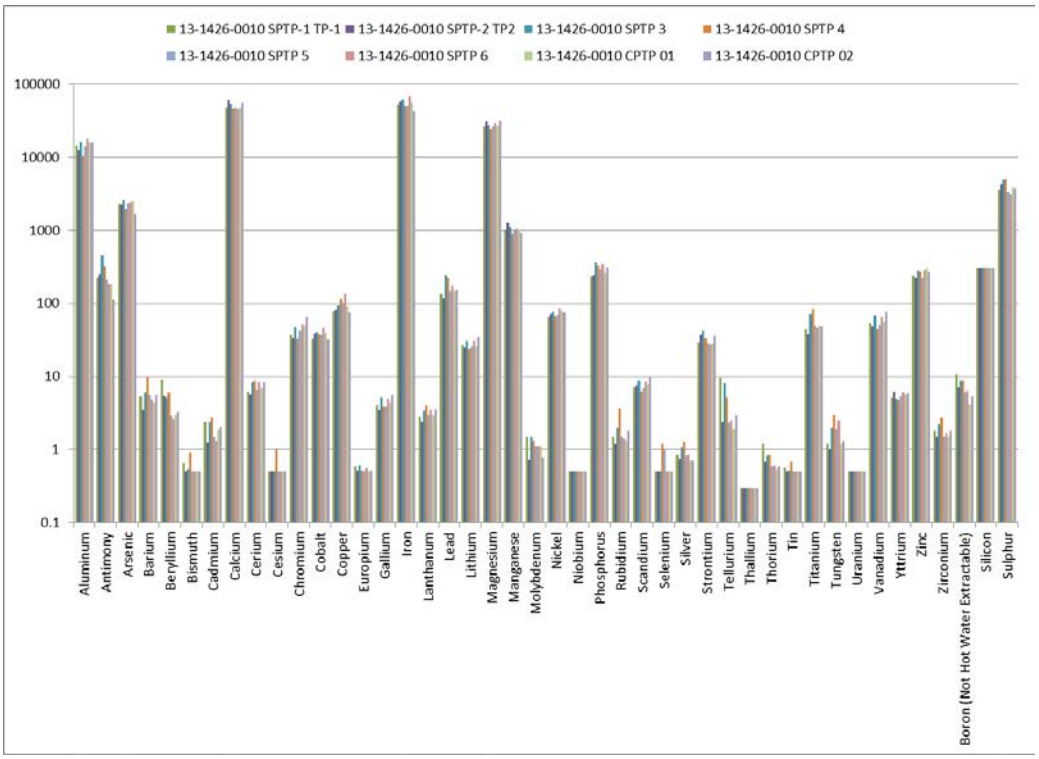

Figure 1: ICP-MS Results

Table 3: Cyanide Analysis Results

Sample	Result (mg/kg)
13-1426-0010 SPTP-1 TP1	0.79
13-1426-0010 SPTP-2 TP2	0.59
13-1426-0010 SPTP 3	0.48
13-1426-0010 SPTP 4	0.40
13-1426-0010 SPTP 5	1.24
13-1426-0010 SPTP 6	0.2
13-1426-0010 CPTP 01	0.67
13-1426-0010 CPTP 02	0.77

No hazardous gases were detected in any of the samples. The concentrations of heavy metals and cyanide present in the samples were considered to be acceptable to handle according to Golder's established protocols.

2.3 Sample Preparation

Proper sample preparation is a critical first step to ensure proper homogenization of solids, representative sub-sampling and reproducibility of results.

The first step was to mix all of the samples individually with the available 13-1426-0010 Water in order to achieve homogenized samples.

The two barrels of 13-1426-0010 Water were combined and treated as one sample.

3.0 MATERIAL CHARACTERIZATION

3.1 pH Analysis

Table 4 presents the pH of each sample and the temperature at which it was measured.

Table 4: pH Analysis

Sample	pH	Temperature (°Celsius)
13-1426-0010 SPTP-1 TP1	8.5	20
13-1426-0010 SPTP-2 TP2	8.6	20
13-1426-0010 SPTP 3	8.5	20
13-1426-0010 SPTP 4	8.7	20
13-1426-0010 SPTP 5	8.5	19
13-1426-0010 SPTP 6	8.5	19
13-1426-0010 CPTP 01	8.4	19
13-1426-0010 CPTP 02	8.5	20
13-1426-0010 SP-TP 1+2+3	8.3	19
13-1426-0010 SP-TP 4+5+6	8.5	20
13-1426-0010 Water	7.5	20

3.2 Particle Size Distribution

Particle size distribution (PSD) was determined using mechanical sieving and a Fritsch laser particle size analyzer according to ASTM D4464.

Specific values are presented in Table 5, as well as on Figures 2 and 3. The gradation parameter DXX, tabulated in microns, refers to the average particle diameter that XX% by weight of material is smaller than.

Table 5: Particle Size Distribution

Sample	D10 (µm)	D30 (µm)	D50 (µm)	D60 (µm)	D80 (µm)
13-1426-0010 SPTP-1 TP1	4	17	42	69	135
13-1426-0010 SPTP-2 TP2	5	22	54	86	133
13-1426-0010 SPTP 3	4	20	51	82	133
13-1426-0010 SPTP 4	3	9	20	27	58
13-1426-0010 SPTP 5	5	22	59	92	133
13-1426-0010 SPTP 6	4	15	39	63	125
13-1426-0010 CPTP 01	4	19	50	83	134
13-1426-0010 CPTP 02	4	17	43	72	135
13-1426-0010 SP-TP 1+2+3	5	23	58	93	137
13-1426-0010 SP-TP 4+5+6	3	9	21	30	74
13-1426-0010 Aggregate	525	2737	5265	6839	10217

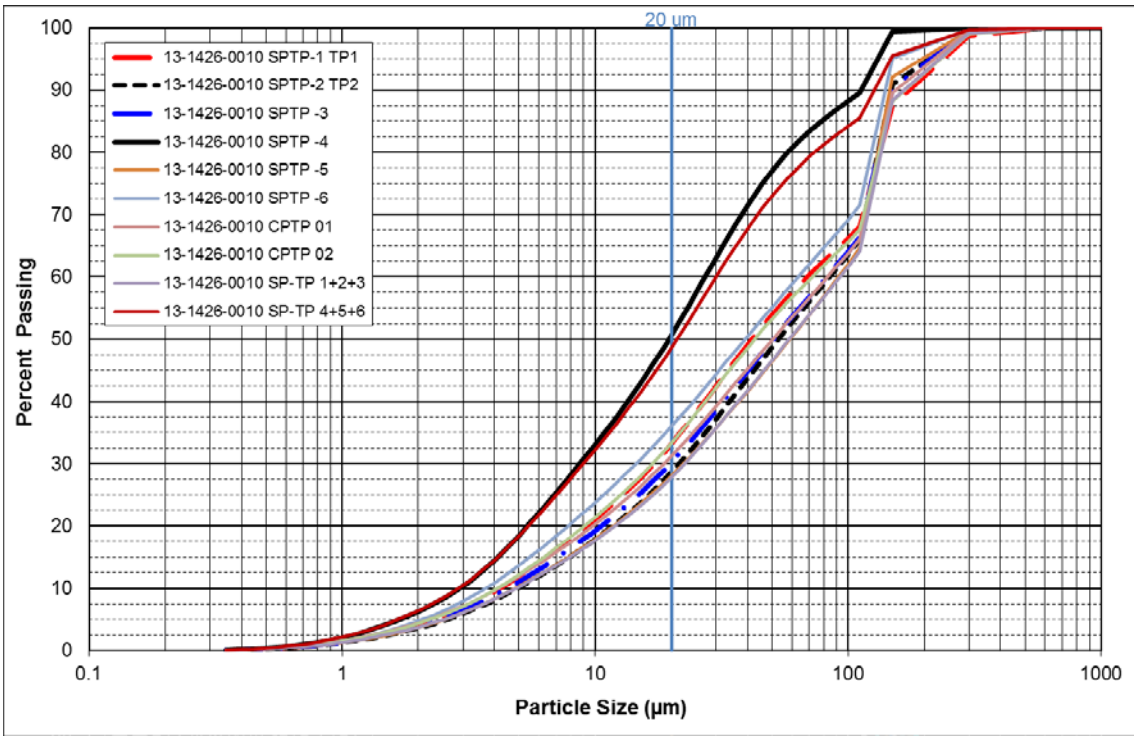

Figure 2: PSD Results – Tailings

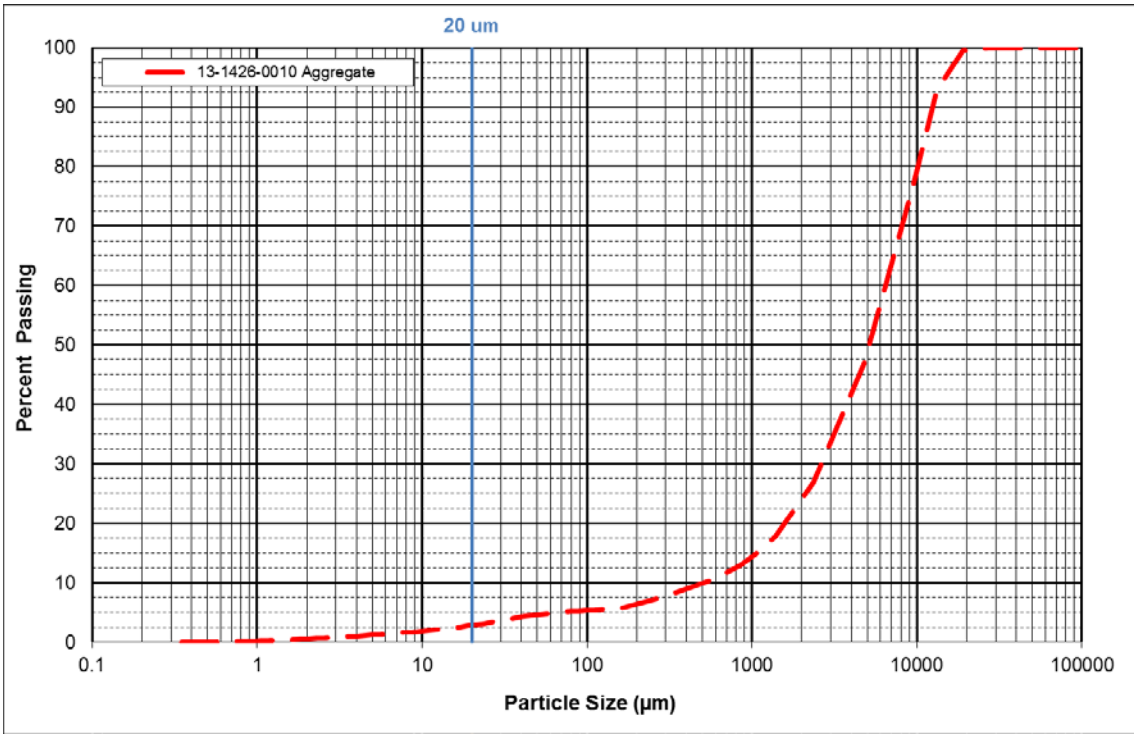

Figure 3: PSD Results - Aggregate

3.3 Specific Gravity

The specific gravity (SG) of the sample was determined using vacuum de-aired water. Each slurry sample was also vacuum de-aired prior to SG measurement. The results are presented in Table 6.

Table 6: Specific Gravity Results

Sample	Trial 1	Trial 2	Average
13-1426-0010 SPTP-1 TP1	2.86	2.82	2.84
13-1426-0010 SPTP-2 TP2	2.85	2.85	2.85
13-1426-0010 SPTP 3	2.86	2.86	2.86
13-1426-0010 SPTP 4	2.82	2.78	2.80
13-1426-0010 SPTP 5	2.85	2.85	2.85
13-1426-0010 SPTP 6	2.90	2.86	2.88
13-1426-0010 CPTP 01	2.84	2.85	2.85
13-1426-0010 CPTP 02	2.87	2.86	2.86
13-1426-0010 SP-TP 1+2+3	2.84	2.88	2.86
13-1426-0010 SP-TP 4+5+6	2.86	2.86	2.86
13-1426-0010 Aggregate	3.01	3.02	3.01

4.0 RHEOLOGICAL CHARACTERIZATION

Rheological testing was carried out to evaluate flow and handling properties. These tests provide an indication regarding the material's behaviour in the course of mixing, slump adjustment, pumping, flowing and also while sitting idle. Rheological characterization provides data for the selection of process equipment such as mixers, pumps and pipelines.

4.1 Slump vs. Solids Content

To gauge sensitivity to water additions, small increments of water were added to the bulk sample. After each addition, slump and solids content was determined. This generates a relationship between slump and solids content which is typically used to determine the degree of process control required to maintain slump control of the final product. Photos are presented in Appendix C and the results are presented on Figure 4.

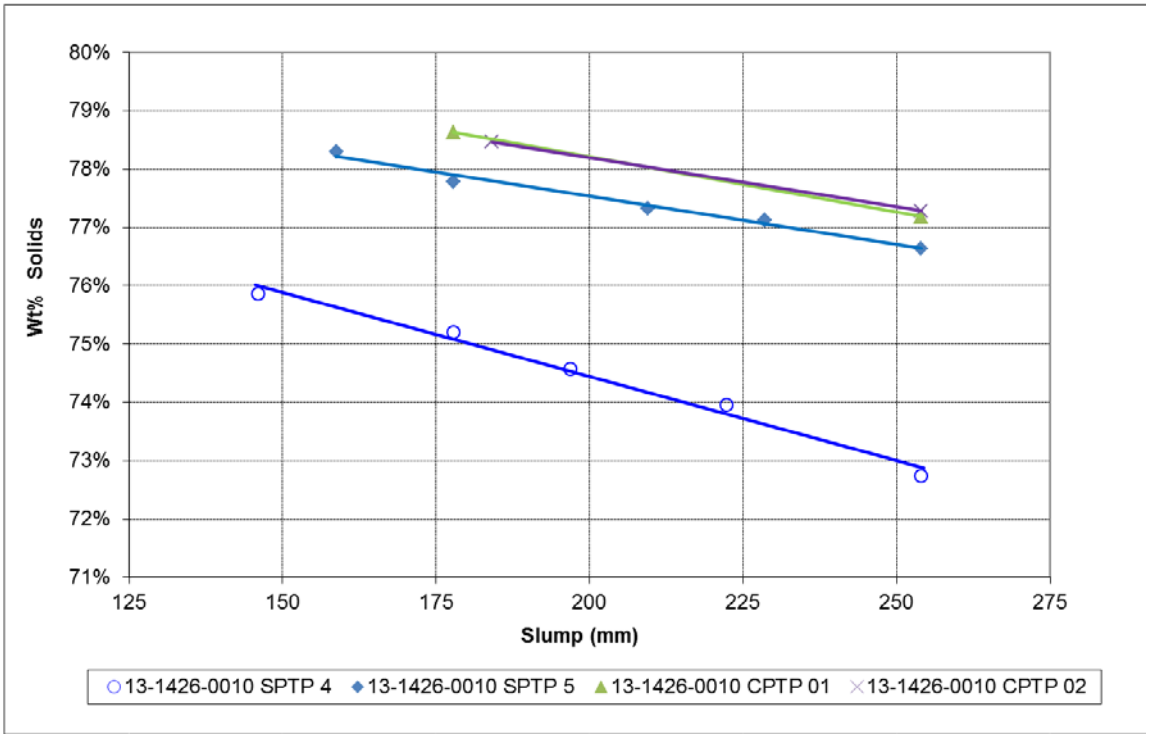

Figure 4: Solids Content vs. Slump

4.2 Static Yield Stress Testing

Yield stress is defined as the minimum force required to initiate flow. Static yield stress was determined by using a very slow moving (0.2 RPM) vane spindle attached to a torque spring. The spindle was immersed in the sample and measurements were taken at various solids contents. There are different test methods to determine yield stress, one termed 'static' and the other 'dynamic'. Figure 5 presents the static yield stress testing results.

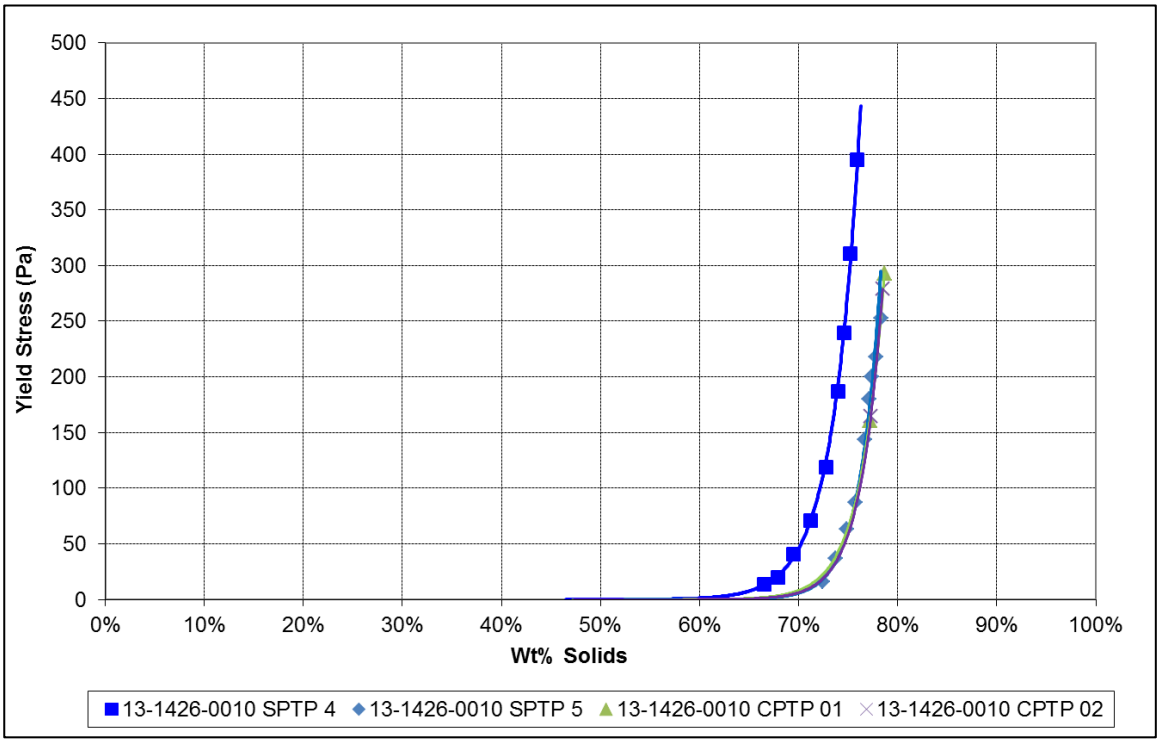

Figure 5: Static Yield Stress vs. wt% Solids

4.3 Water Bleed and Yield Stress vs. Time

Moisture retention testing was carried out to assess the water bleed properties of the paste while sitting idle in test beakers. Two slump consistencies were tested at four time intervals. At each time interval the water bleed and yield stress were measured. Figures 6 to 9 present the results.

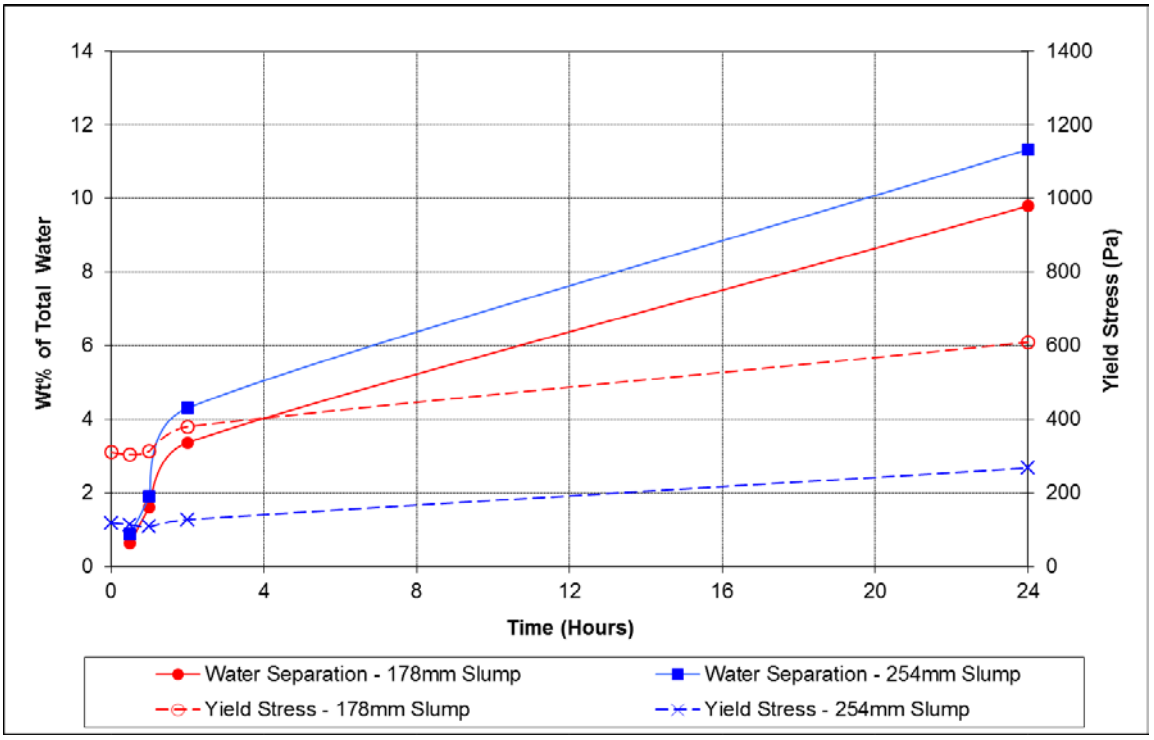

Figure 6: Water Bleed and Yield Stress vs. Time - 13-1426-0010 SPTP 4

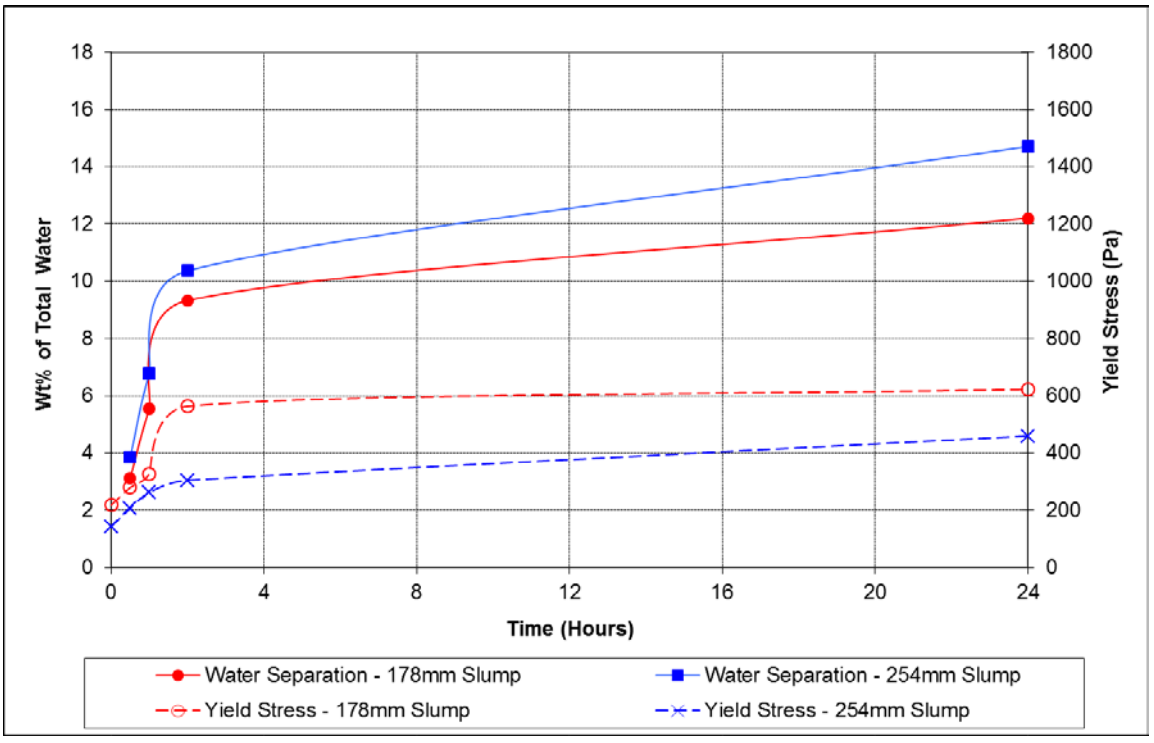

Figure 7: Water Bleed and Yield Stress vs. Time - 13-1426-0010 SPTP 5

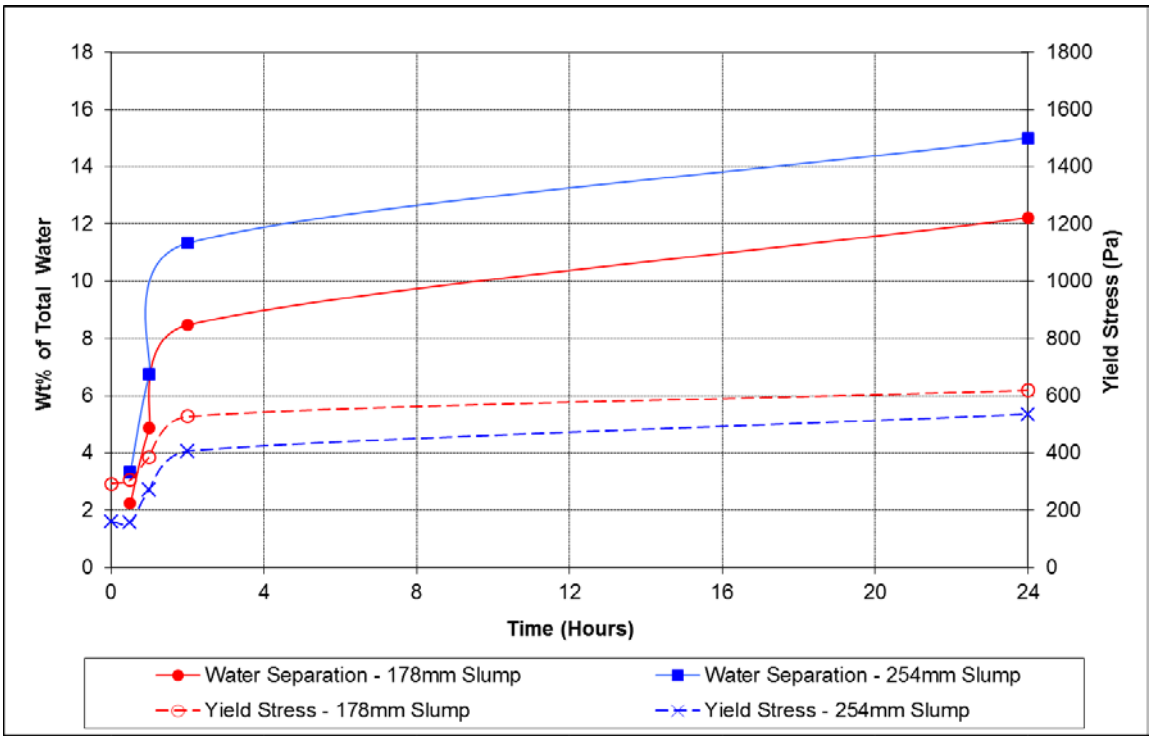

Figure 8: Water Bleed and Yield Stress vs. Time - 13-1426-0010 CPTP 01

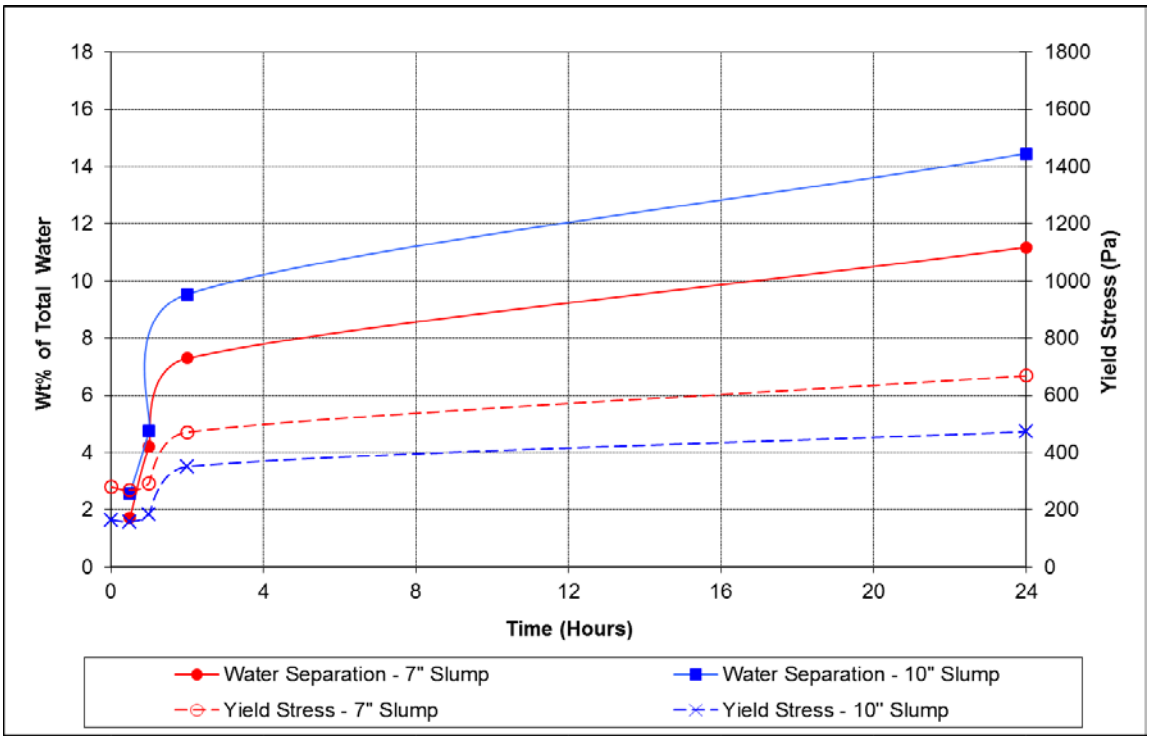

Figure 9: Water Bleed and Yield Stress vs. Time - 13-1426-0010 CPTP 02

4.4 Plug Yield Stress

Plug yield stress analysis was performed to determine if consolidation has occurred throughout a cross-section of idle paste material, as may be present in a pipeline's cross-section. Two slump consistencies of material were allowed to sit idle for two hours, and a specially designed vane spindle was immersed at three depths to measure yield stress. Figures 10 to 13 present the results.

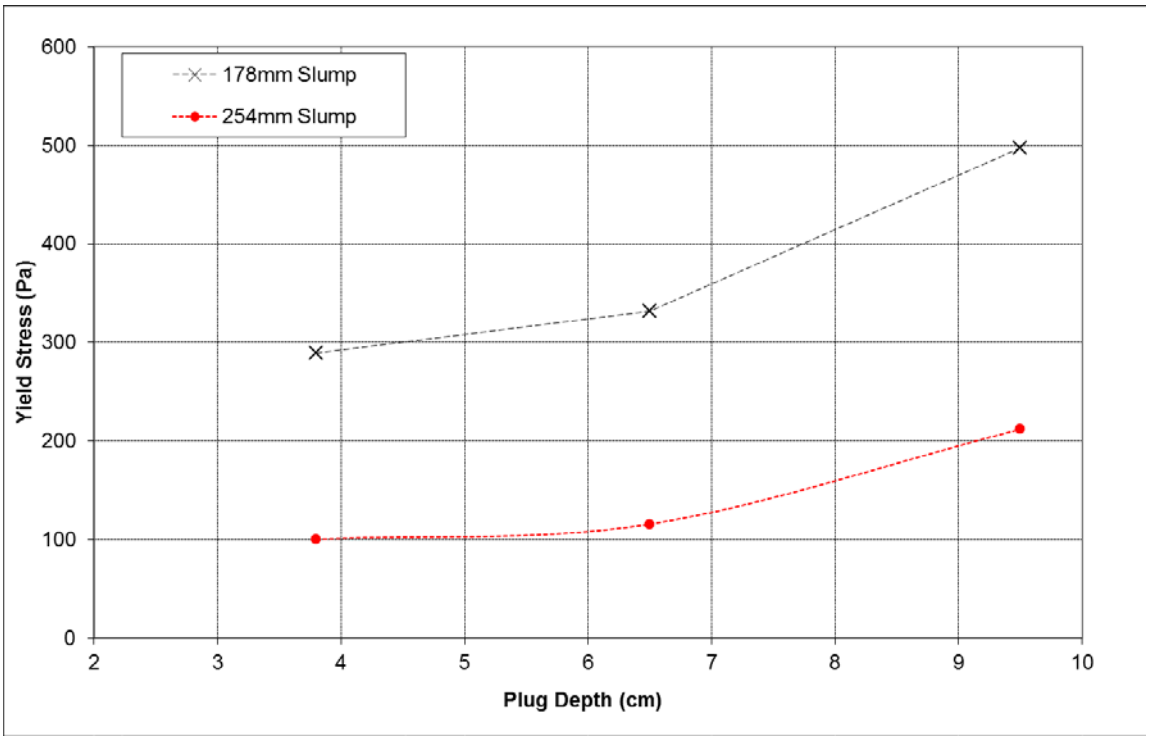

Figure 10: Plug Yield Stress Results - 13-1426-0010 SPTP 4

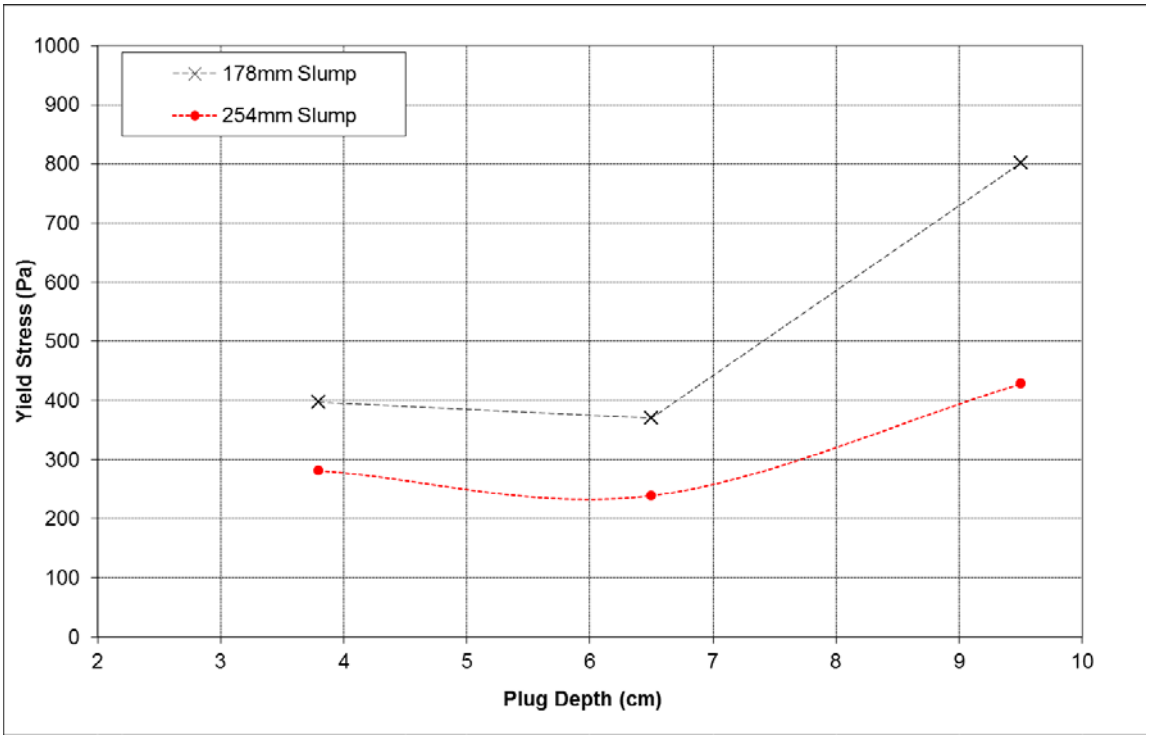

Figure 11: Plug Yield Stress Results - 13-1426-0010 SPTP 5

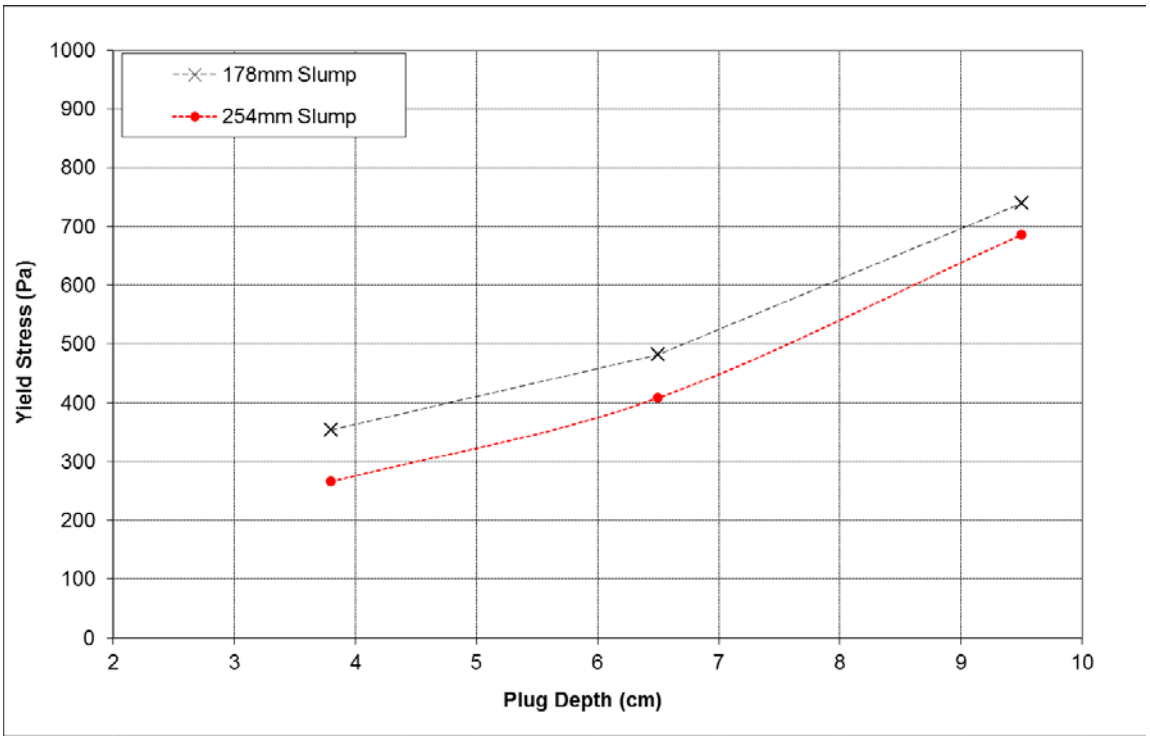

Figure 12: Plug Yield Stress Results - 13-1426-0010 CPTP 01

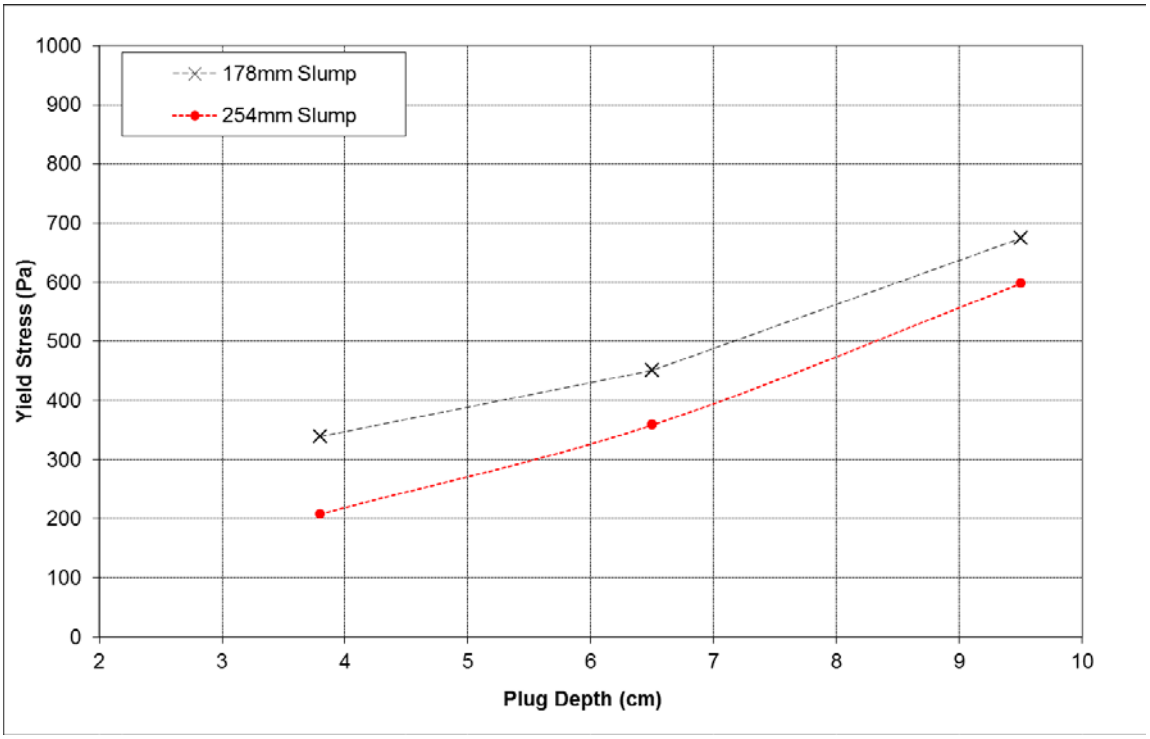

Figure 13: Plug Yield Stress Results - 13-1426-0010 CPTP 02

4.5 Viscosity and Dynamic Yield Stress Determination

Viscosity testing provides bench scale flow properties and fluid characterization. Dynamic viscosity and yield stress data is essential for mixer, pump and pipeline design. In order to compare or duplicate viscosity results of non-Newtonian fluids, it is important to test according to the same conditions. Test conditions and parameters such as cycle time and instrument sensor configuration are critical to producing usable data from bench scale viscometers.

The yield stress determined through this testing is referred to as dynamic yield stress since it is extrapolated from dynamic shear stress data to zero shear. The instrument sensor or bob rotated inside the cup which contained the sample and torque measurements were recorded at several incremental speeds or shear rates.

The rheograms are presented in Appendix B and summarized test results are presented in Tables 7 to 10 as well as on Figures 14 to 21.

Table 7: Bingham Viscosity and Yield Stress Summary - 13-1426-0010 SPTP 4

Wt% Solids	Bingham Yield Stress (Pa)		Bingham Viscosity (PaS)	
	Ramp Up	Ramp Down	Ramp Up	Ramp Down
75.2	422	423	1.433	1.405
74.3	275	271	0.968	0.975
73.4	196	194	0.642	0.638
72.3	136	138	0.363	0.356
70.2	73	74	0.146	0.141
66.6	27	27	0.046	0.047

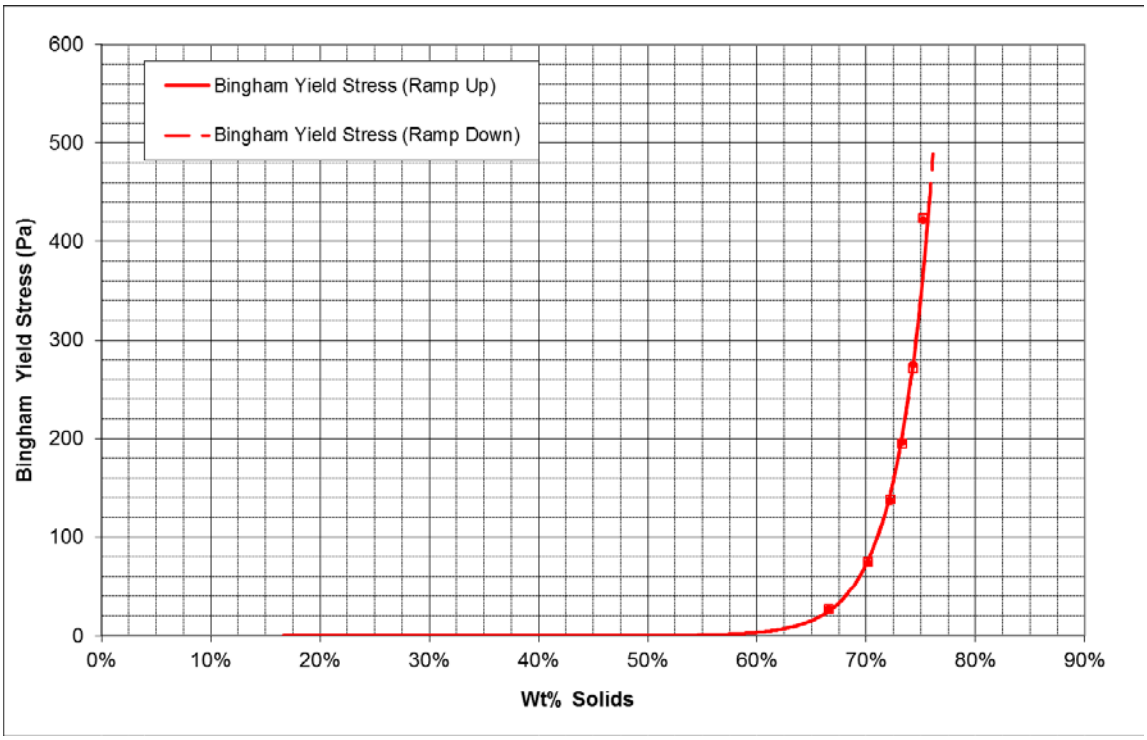

Figure 14: Bingham Yield Stress Results - 13-1426-0010 SPTP 4

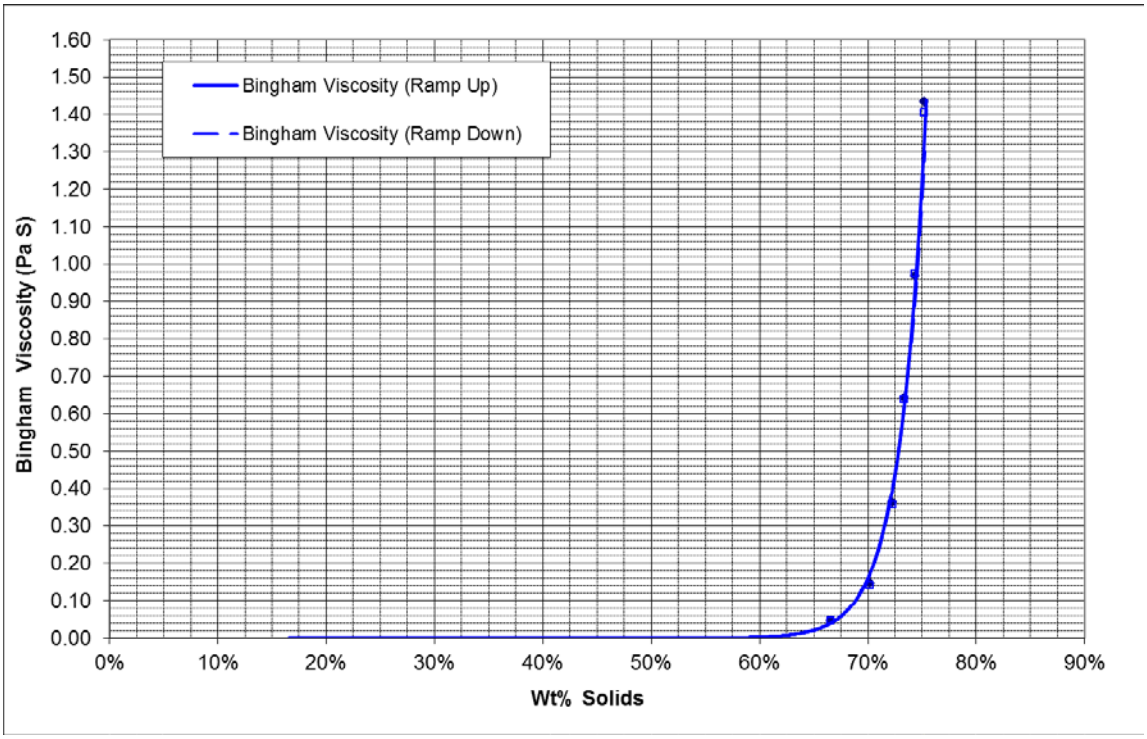

Figure 15: Bingham Viscosity Results - 13-1426-0010 SPTP 4

Table 8: Bingham Viscosity and Yield Stress Summary - 13-1426-0010 SPTP 5

Wt% Solids	Bingham Yield Stress (Pa)		Bingham Viscosity (PaS)	
	Ramp Up	Ramp Down	Ramp Up	Ramp Down
77.4	124	72	0.612	0.696
75.9	100	56	0.489	0.548
74.4	51	32	0.262	0.290
72.3	26	17	0.111	0.122
69.5	11	8	0.045	0.052

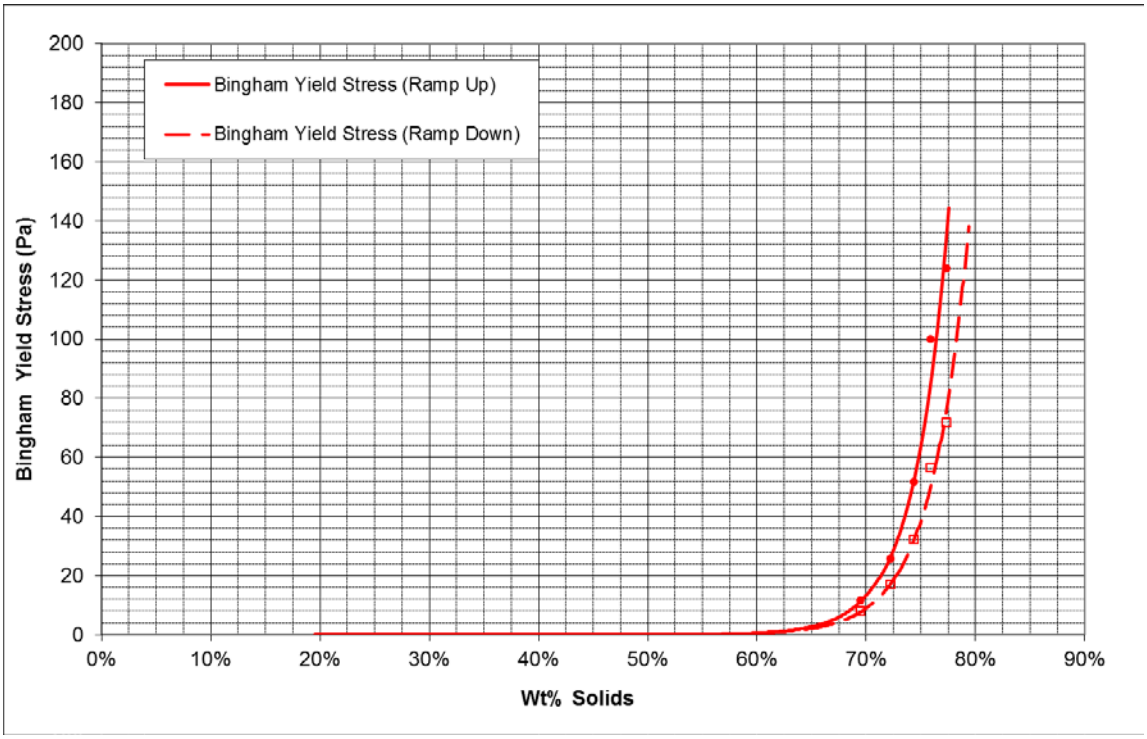

Figure 16: Bingham Yield Stress Results - 13-1426-0010 SPTP 5

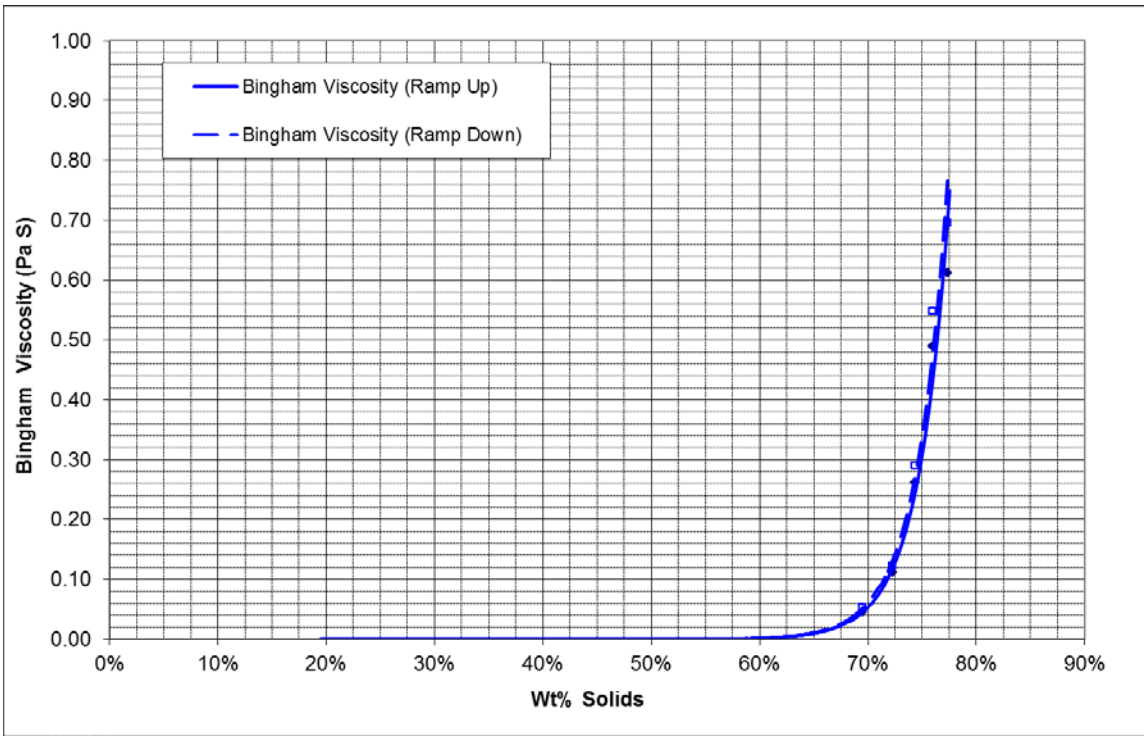

Figure 17: Bingham Viscosity Results - 13-1426-0010 SPTP 5

Table 9: Bingham Viscosity and Yield Stress Summary - 13-1426-0010 CPTP 01

Wt% Solids	Bingham Yield Stress (Pa)		Bingham Viscosity (PaS)	
	Ramp Up	Ramp Down	Ramp Up	Ramp Down
78.5	110	83	0.694	0.743
77.3	79	64	0.549	0.574

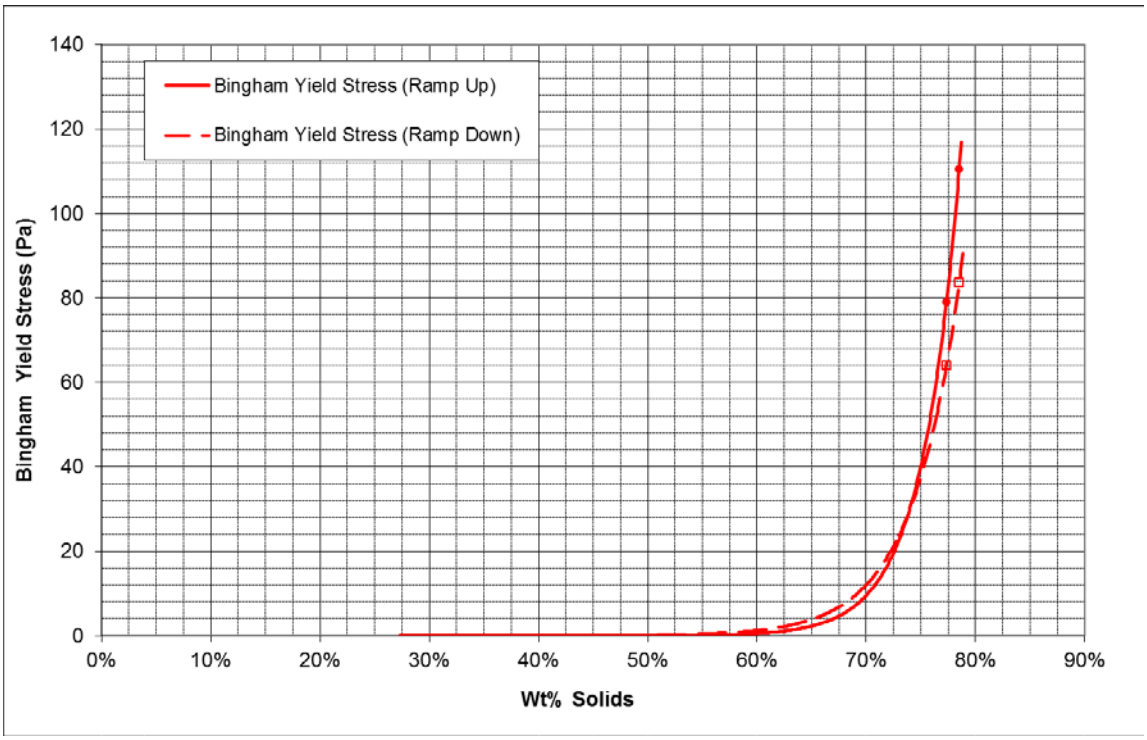

Figure 18: Bingham Yield Stress Results - 13-1426-0010 CPTP 01

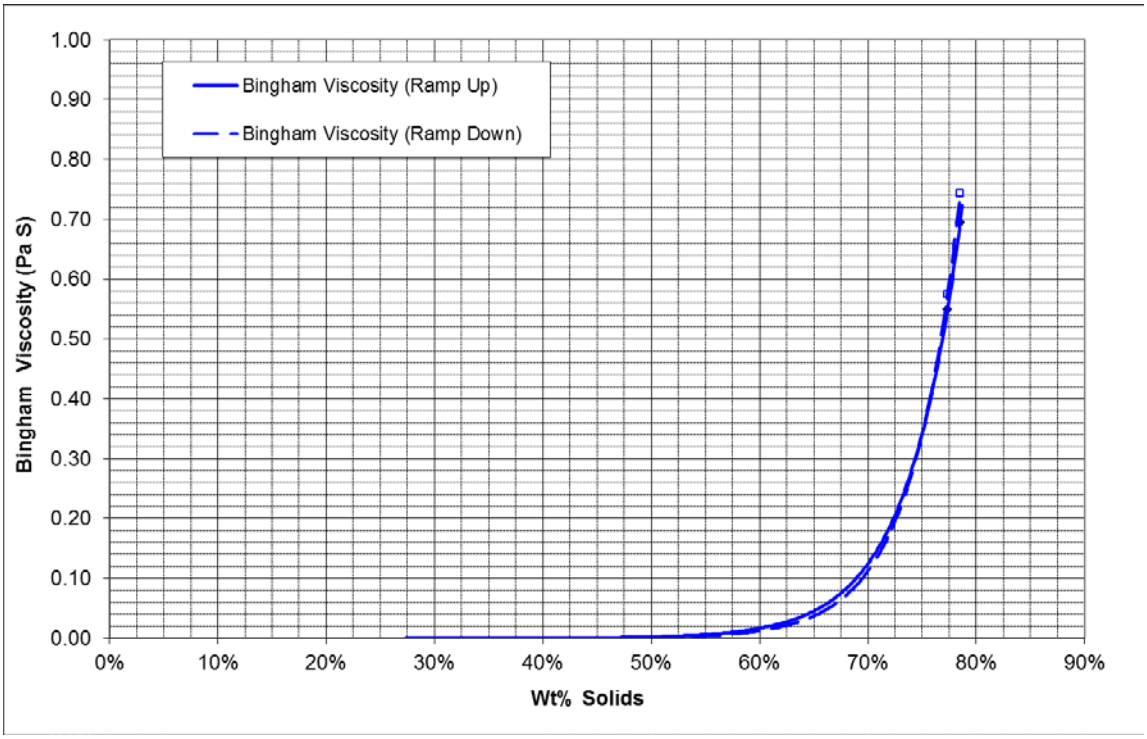

Figure 19: Bingham Viscosity Results - 13-1426-0010 CPTP 01

Table 10: Bingham Viscosity and Yield Stress Summary - 13-1426-0010 CPTP 02

Wt% Solids	Bingham Yield Stress (Pa)		Bingham Viscosity (PaS)	
	Ramp Up	Ramp Down	Ramp Up	Ramp Down
78.4	198	139	0.878	1.028
77.4	165	103	0.766	0.892

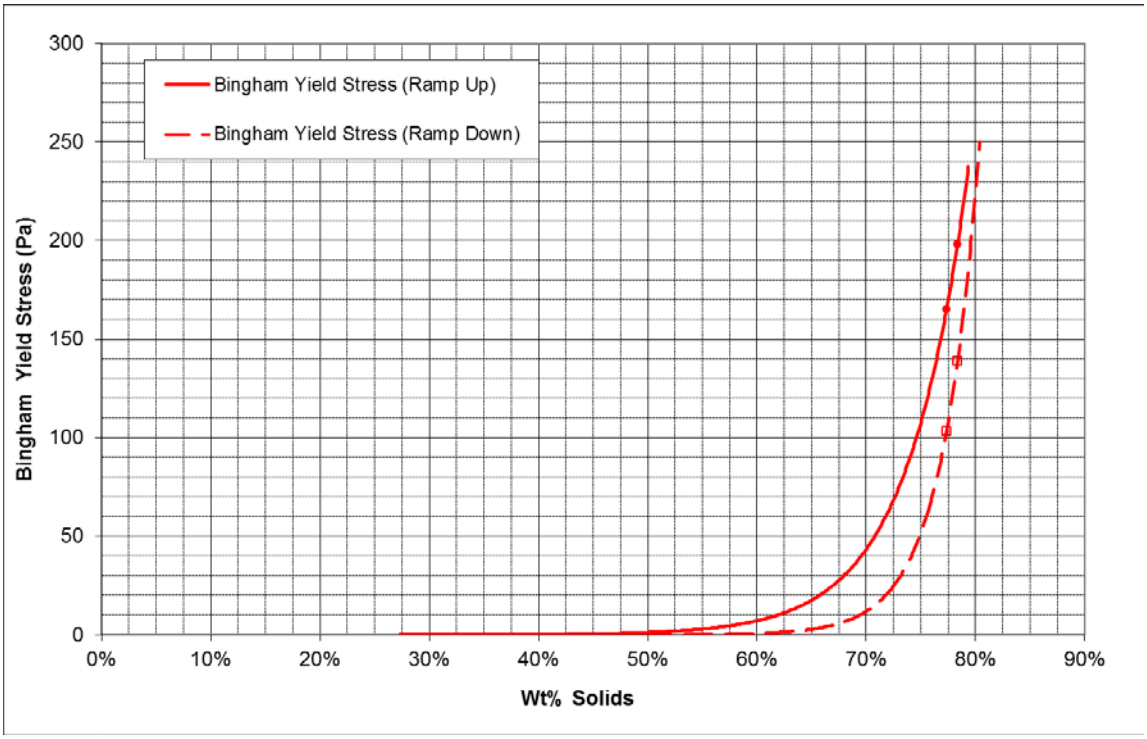

Figure 20: Bingham Yield Stress Results - 13-1426-0010 CPTP 02

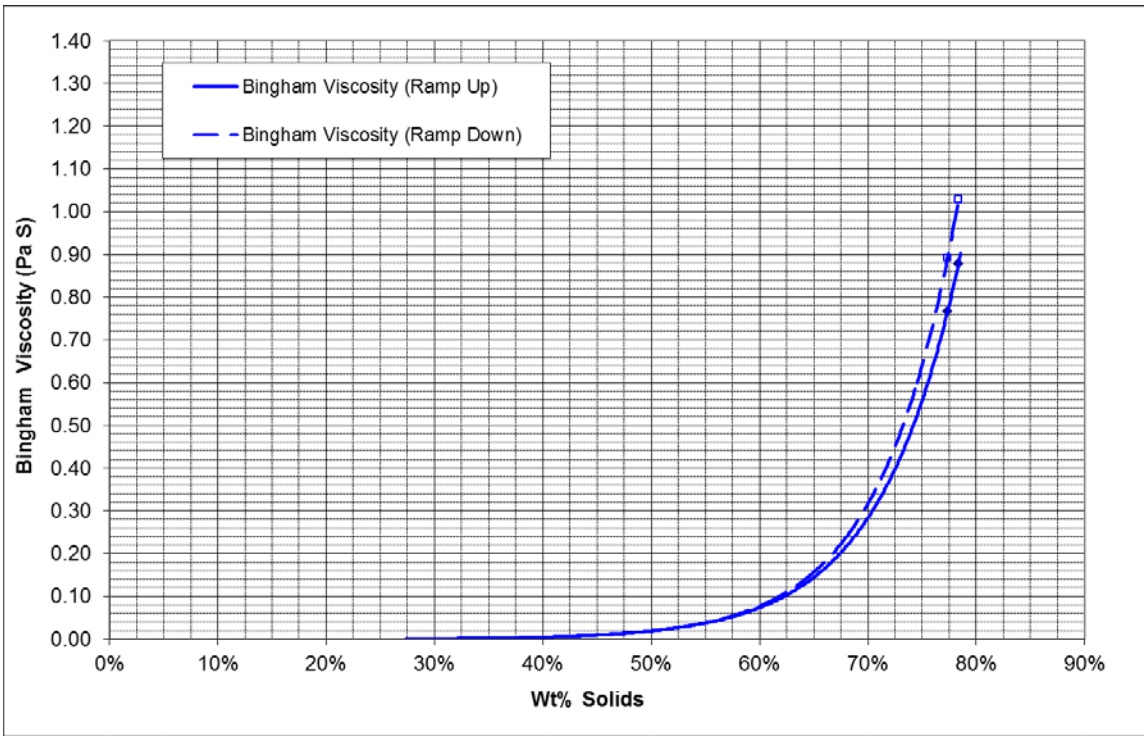

Figure 21: Bingham Viscosity Results - 13-1426-0010 CPTP 02

5.0 UNCONFINED COMPRESSIVE STRENGTH TESTING

Unconfined compressive strength (UCS) testing was carried out using a Humboldt HM2800 digital load frame. The load was measured using s-type load cells. Depending on strength, either a 10 kN or 45 kN (2,000 lb or 10,000 lb) load cell was utilized.

The cured cylinder was placed between two platens and during testing the bottom platen advanced at a rate of 2 mm (0.08 inch) per minute. The load was continuously monitored and the peak load was automatically recorded by the instrument.

5.1 UCS Program and Results

The UCS program was carried out to assess the backfill strength using 76 x 152 mm (3'' x 6'') cylinders. The cylinders were cured in a high humidity environment maintained at 20 to 25°C. Three cylinders per curing period were cast and the results were averaged. The test program is presented in Tables 11 and 12; the results are presented in Tables 13 and 14, as well as on Figures 22 to 27.

Table 11: UCS Testing Program

Mix	Wt% Binder	Binder	Material	Slump (mm)	Curing Days			Total
					7	28	56	
1	1	NPC	13-1426-0010 SP-TP 1+2+3	178	3	3	3	9
2	3			254	3	3	3	9
3	1		13-1426-0010 SP-TP 4+5+6	178	3	3	3	9
4	3			254	3	3	3	9
5	2	90% BFS / 10% NPC	13-1426-0010 SP-TP 4+5+6	178	3	3	3	9
6	2	NPC	13-1426-0010 SP-TP 1+2+3	178	3	3	3	9
7	7	90% BFS / 10% NPC		178	3	3	3	9
8	15	NPC		178	3	3	3	9
9	8		90% 13-1426-0010 SP-TP 4+5+6 – 10% Aggregate	127	3	3	3	9
10	5			127	3	3	3	9
11	8		13-1426-0010 SP-TP 4+5+6	127	3	3	3	9
12	3		90% 13-1426-0010 SP-TP 4+5+6 – 10% Aggregate	254	3	3	3	9
13	1			178	3	3	3	9
14	3	90% BFS / 10% NPC	13-1426-0010 SP-TP 4+5+6	254	3	3	3	9
15	1			178	3	3	3	9

Notes: NPC = Normal Portland Cement
BFS = Blast Furnace Slag

Table 12: UCS Testing Program

Mix	Wt% Binder	Binder	Material	Slump (mm)	Curing Days			Total
					1	3	7	
16	1	NPC		254	3	3	3	9
17	3		13-1426-0010 SP-TP 4+5+6	254	3	3	3	9
18	3			178	3	3	3	9
19	15		90% 13-1426-0010 SP-TP 4+5+6 – 10% Aggregate	127	3	3	3	9
20	12			127	3	3	3	9
21	15		13-1426-0010 SP-TP 4+5+6	127	3	3	3	9
22	3			254	3	3	3	9
23	3			254	3	3	3	9

Notes: NPC = Normal Portland Cement
BFS = Blast Furnace Slag

Table 13: UCS Results

Mix	Wt% Binder	Binder	Material	Slump (mm)	Average UCS (kPa)			Average Bulk Density (kg/m^3)
					Curing 7 days	Curing 28 days	Curing 56 days	
1	1	NPC	13-1426-0010 SP-TP 1+2+3	178	145	149	150	2122
2	3			254	225	313	369	2120
3	1		13-1426-0010 SP-TP 4+5+6	178	58	72	81	2045
4	3			254	135	183	192	1999
5	2	90/10	13-1426-0010 SP-TP 4+5+6	178	165	530	644	2109
6	2	NPC	13-1426-0010 SP-TP 1+2+3	178	179	212	236	2143
7	7	90/10		178	1459	3678	4895	2129
8	15	NPC		178	5785	6875	6812	2157
9	8		90% 13-1426-0010 SP-TP 4+5+6 – 10% Aggregate	127	1161	1435	1543	2097
10	5			127	483	621	684	2086
11	8		13-1426-0010 SP-TP 4+5+6	127	1056	1333	1371	2082
12	3		90% 13-1426-0010 SP-TP 4+5+6 – 10% Aggregate	254	145	194	217	2059
13	1			178	69	82	96	2103
14	3	90% BFS / 10% NPC	13-1426-0010 SP-TP 4+5+6	254	202	850	1104	2053
15	1			178	4	66	69	2086

Table 14: UCS Results

Mix	Wt% Binder	Binder	Material	Slump (mm)	Average UCS (kPa)			Average Bulk Density (kg/m^3)
					Curing 1 day	Curing 3 days	Curing 7days	
16	1	NPC	13-1426-0010 SP-TP 4+5+6	254	Too Soft	38	---	2026
17	3			254	59	118	---	2041
18	3			178	75	137	---	2090
19	15		90% 13-1426-0010 SP-TP 4+5+6 – 10% Aggregate	127	1403	3773	4678	2127
20	12			127	714	2214	2755	2115
21	15		13-1426-0010 SP-TP 4+5+6	127	1319	3411	4822	2123
22 Counter	3			254	41	97	164	1985
23 (4 Degree °C)	3			254	Too Soft	48	72	1981

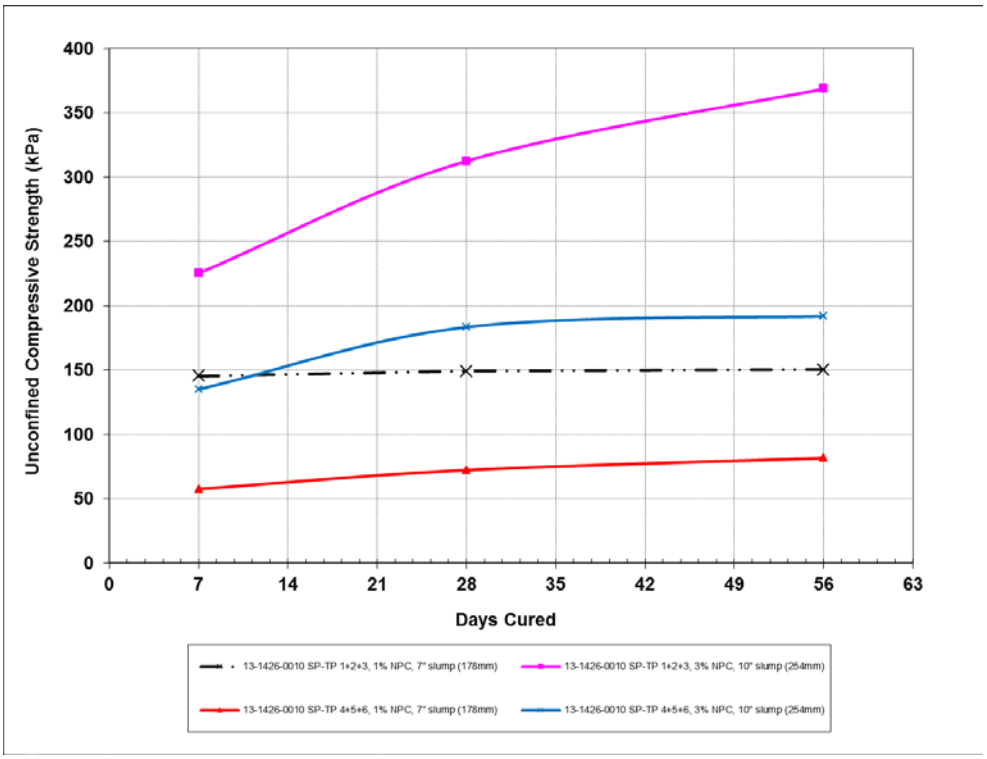

Figure 22: UCS Results- Mix 1 to Mix 4

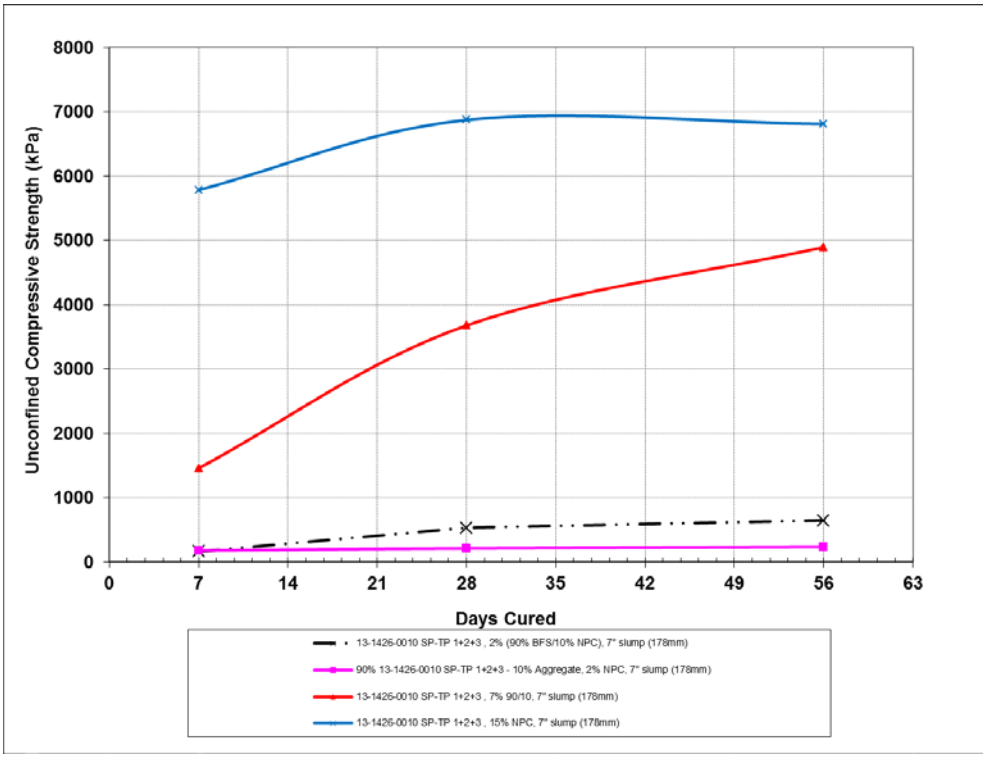

Figure 23: UCS Results – Mix 5 to Mix 8

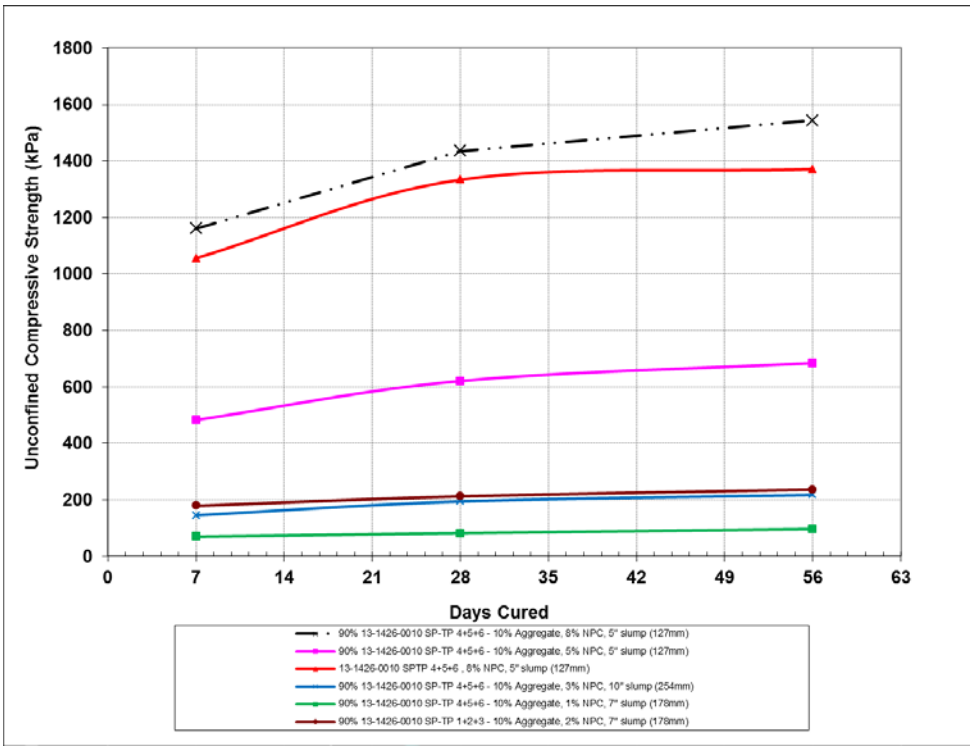

Figure 24: UCS Results - Mix 8 to Mix 13

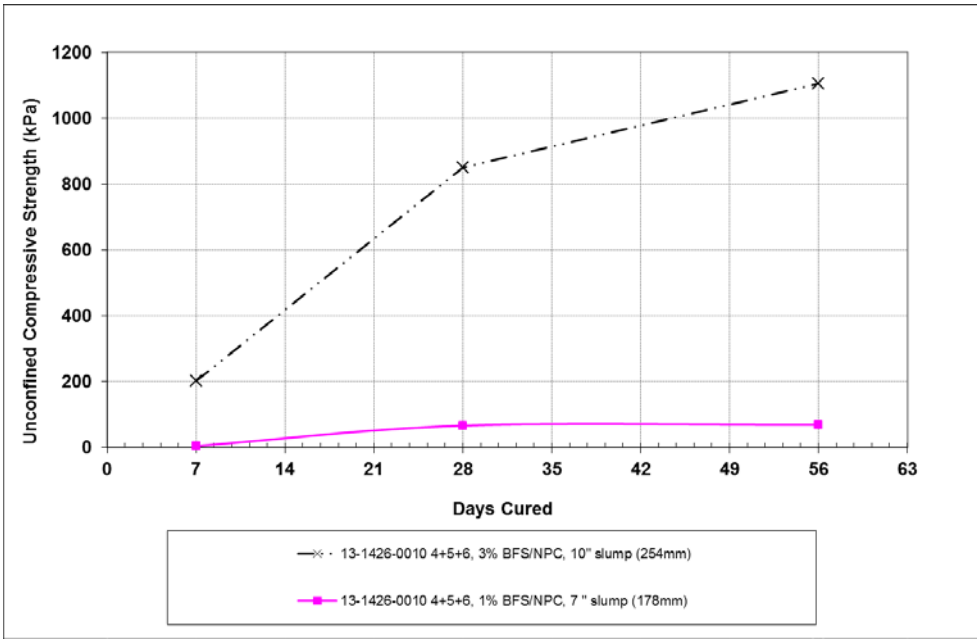

Figure 25: UCS Results - Mix 14 to Mix 15

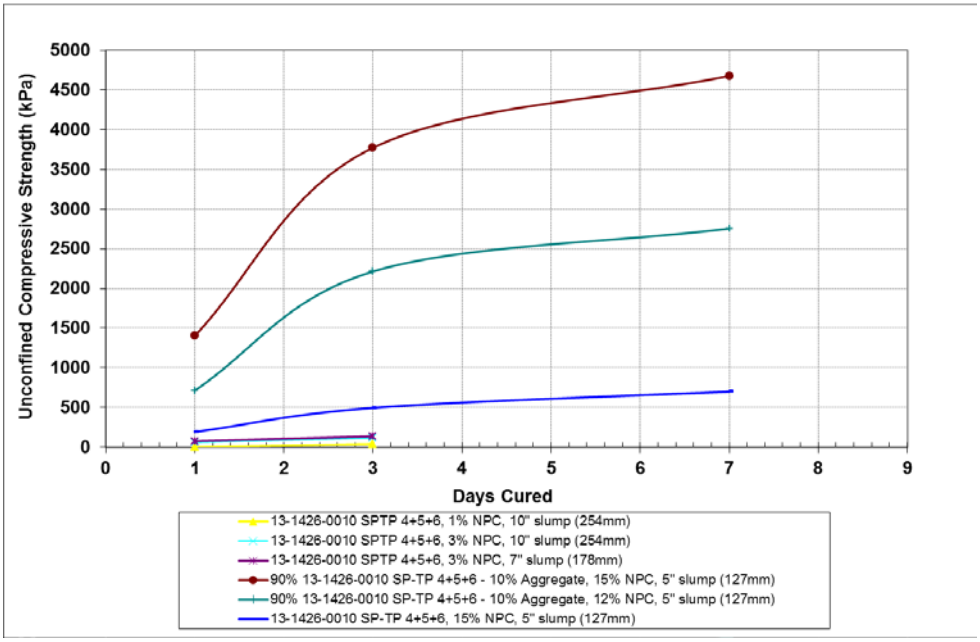

Figure 26: UCS Results - Mix 16 to Mix 21

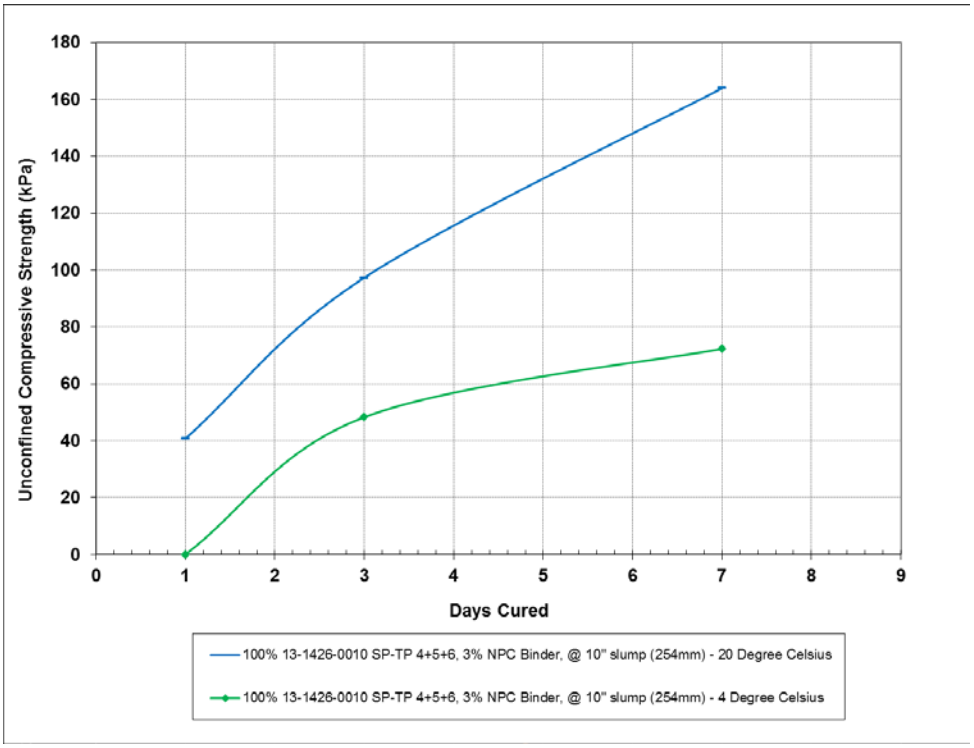

Figure 27: UCS Results - Mix 22 to Mix 23

6.0 CLOSURE

If there are any questions regarding this report, please do not hesitate to contact the undersigned.

GOLDER ASSOCIATES LTD.

ORIGINAL SIGNED

Mark Labelle
Process Laboratory Manager

ORIGINAL SIGNED

Sue Longo, P.Eng.
Associate, Mechanical Engineer

ML/SL/ds/kp

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APPENDIX A

ICP-MS results

TESTMARK Laboratories Ltd.

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Analytical Report

Client: Mark Labelle
Company: Golder Associates Ltd - Paste Engineering Lab
Address: 1010 Lorne St.
Sudbury, ON, P3A 4S4
Phone: (705) 524-6861
Fax: (705) 524-9636
Email: mlabelle@golder.com

Work Order Number: **188101**
Date Order Received: 07/23/13
Regulation: Information not provided
PO #:
Project #:

Analyses were performed on the following samples submitted with your order.

The results relate only to the items tested.

Sample Name	Lab #	Matrix	Type	Comments	Date Collected	Time Collected
GPTLS12 1539	499066	Soil	Grab		07/23/13	
GPTLS12 1540	499067	Soil	Grab		07/23/13	
GPTLS12 1541	499068	Soil	Grab		07/23/13	
GPTLS12 1542	499069	Soil	Grab		07/23/13	
GPTLS12 1543	499070	Soil	Grab		07/23/13	
GPTLS12 1544	499071	Soil	Grab		07/23/13	
GPTLS12 1545	499072	Soil	Grab		07/23/13	
GPTLS12 1546	499073	Soil	Grab		07/23/13	
GPTLS12 1549/1550	499074	Water	Comp		07/23/13	

The following instrumentation and reference methods were used for your sample(s)

Method Name	Description	Reference
CN WAD Soil	Determination of Weak Acid Dissociable Cyanide in Soil **Instrument group:** UV/Vis Spectrophotometer	Based on APHA-4500
ICPMS Soil	Determination of Metals in Soil by ICP/MS and BCSALM Method **Instrument group:** Perkin Elmer ICPMS	Based on SW846-6020A
ICPMS Water	Determination of Metals in Water by ICP/MS **Instrument group:** Perkin Elmer ICPMS	Based on SW846-6020A
KL-WAD CN/W	Determination of Weak Acid Dissociable (WAD) Cyanide in Water **Instrument group:** Subcontracted	OIA-1677

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Golder Associates Ltd - Paste Engineering Lab | Work Order: 188101

This report has been approved by:

Adam Tam, M.Sc.
Inorganic Section Head

TESTMARK Laboratories Ltd.

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Golder Associates Ltd - Paste Engineering Lab | Work Order: 188101

Sample Data:

Sample Name: GPTLS12 1539 **Date: 07/23/13** **Matrix: Soil** **Lab #: 499066**

CN WAD Soil				
Parameter	**MDL**	**Result**	**Units**	**QAQCID**
Weak Acid Dissociable Cyanide	0.1	0.79	mg/kg	20130724.R43.7A
Weak Acid Dissociable Cyanide (Dup)	0.1	0.72	mg/kg	20130724.R43.7A

ICPMS Soil				
Parameter	**MDL**	**Result**	**Units**	**QAQCID**
Aluminum	5	14200	µg/g	20130724.R13na3
Antimony	0.5	224	µg/g	20130724.R13na3
Arsenic	5	2300	µg/g	20130724.R13na3
Barium	0.5	5.23	µg/g	20130724.R13na3
Beryllium	0.5	8.92	µg/g	20130724.R13na3
Bismuth	0.5	0.64	µg/g	20130724.R13na3
Boron (Not Hot Water Extractable)	1	10.8	µg/g	20130724.R13na3
Cadmium	0.05	2.35	µg/g	20130724.R13na3
Calcium	30	47900	µg/g	20130724.R13na3
Cerium	0.5	6.24	µg/g	20130724.R13na3
Cesium	0.5	<0.5	µg/g	20130724.R13na3
Chromium	0.5	36.9	µg/g	20130724.R13na3
Cobalt	0.05	32.9	µg/g	20130724.R13na3
Copper	0.5	79.1	µg/g	20130724.R13na3
Europium	0.5	0.59	µg/g	20130724.R13na3
Gallium	0.5	4	µg/g	20130724.R13na3
Iron	100	52500	µg/g	20130724.R13na3
Lanthanum	0.5	2.8	µg/g	20130724.R13na3
Lead	0.5	136	µg/g	20130724.R13na3
Lithium	3	27	µg/g	20130724.R13na3
Magnesium	2	26500	µg/g	20130724.R13na3
Manganese	5	1020	µg/g	20130724.R13na3
Mercury	0.05	<0.05	µg/g	20130724.R13na3
Molybdenum	0.5	1.5	µg/g	20130724.R13na3
Nickel	0.5	64.9	µg/g	20130724.R13na3
Niobium	0.5	<0.5	µg/g	20130724.R13na3
Phosphorus	30	232	µg/g	20130724.R13na3
Potassium	10	282	µg/g	20130724.R13na3
Rubidium	0.5	1.5	µg/g	20130724.R13na3
Scandium	0.5	7.04	µg/g	20130724.R13na3
Selenium	0.5	<0.5	µg/g	20130724.R13na3
Silicon	300	<300	µg/g	20130724.R13na3
Silver	0.05	0.857	µg/g	20130724.R13na3
Sodium	10	68	µg/g	20130724.R13na3
Strontium	0.5	29.6	µg/g	20130724.R13na3
Sulphur	400	3510	µg/g	20130724.R13na3
Tellurium	0.5	9.53	µg/g	20130724.R13na3
Thallium	0.3	<0.3	µg/g	20130724.R13na3
Thorium	0.5	1.2	µg/g	20130724.R13na3
Tin	0.5	0.56	µg/g	20130724.R13na3

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Golder Associates Ltd - Paste Engineering Lab | Work Order: 188101

Sample Name: GPTLS12 1539 **Date: 07/23/13** **Matrix: Soil** **Lab #: 499066**

ICPMS Soil				
Parameter	**MDL**	**Result**	**Units**	**QAQCID**
Titanium	0.5	44	µg/g	20130724.R13na3
Tungsten	0.5	1.2	µg/g	20130724.R13na3
Uranium	0.5	<0.5	µg/g	20130724.R13na3
Vanadium	0.5	53.3	µg/g	20130724.R13na3
Yttrium	0.5	5.2	µg/g	20130724.R13na3
Zinc	5	237	µg/g	20130724.R13na3
Zirconium	0.5	1.8	µg/g	20130724.R13na3

Sample Name: GPTLS12 1540 **Date: 07/23/13** **Matrix: Soil** **Lab #: 499067**

CN WAD Soil				
Parameter	**MDL**	**Result**	**Units**	**QAQCID**
Weak Acid Dissociable Cyanide	0.1	0.59	mg/kg	20130724.R43.7A

ICPMS Soil				
Parameter	**MDL**	**Result**	**Units**	**QAQCID**
Aluminum	5	12500	µg/g	20130724.R13na3
Antimony	5	253	µg/g	20130724.R13na3
Arsenic	5	2230	µg/g	20130724.R13na3
Barium	0.5	3.5	µg/g	20130724.R13na3
Beryllium	0.5	5.4	µg/g	20130724.R13na3
Bismuth	0.5	<0.5	µg/g	20130724.R13na3
Boron (Not Hot Water Extractable)	1	7.1	µg/g	20130724.R13na3
Cadmium	0.05	1.24	µg/g	20130724.R13na3
Calcium	30	60400	µg/g	20130724.R13na3
Cerium	0.5	5.63	µg/g	20130724.R13na3
Cesium	0.5	<0.5	µg/g	20130724.R13na3
Chromium	0.5	33.8	µg/g	20130724.R13na3
Cobalt	0.05	38.5	µg/g	20130724.R13na3
Copper	0.5	82.1	µg/g	20130724.R13na3
Europium	0.5	0.51	µg/g	20130724.R13na3
Gallium	0.5	3.5	µg/g	20130724.R13na3
Iron	100	58200	µg/g	20130724.R13na3
Lanthanum	0.5	2.4	µg/g	20130724.R13na3
Lead	0.5	119	µg/g	20130724.R13na3
Lithium	3	25.1	µg/g	20130724.R13na3
Magnesium	2	30800	µg/g	20130724.R13na3
Manganese	5	1280	µg/g	20130724.R13na3
Mercury	0.05	<0.05	µg/g	20130724.R13na3
Molybdenum	0.5	0.72	µg/g	20130724.R13na3
Nickel	0.5	71.1	µg/g	20130724.R13na3
Niobium	0.5	<0.5	µg/g	20130724.R13na3
Phosphorus	30	246	µg/g	20130724.R13na3
Potassium	10	220	µg/g	20130724.R13na3
Rubidium	0.5	1.2	µg/g	20130724.R13na3
Scandium	0.5	7.46	µg/g	20130724.R13na3
Selenium	0.5	<0.5	µg/g	20130724.R13na3

Sample Name: GPTLS12 1540 **Date: 07/23/13** **Matrix: Soil** **Lab #: 499067**

ICPMS Soil				
Parameter	**MDL**	**Result**	**Units**	**QAQCID**
Silicon	300	<300	µg/g	20130724.R13na3
Silver	0.05	0.738	µg/g	20130724.R13na3
Sodium	10	46	µg/g	20130724.R13na3
Strontium	0.5	37.2	µg/g	20130724.R13na3
Sulphur	400	4220	µg/g	20130724.R13na3
Tellurium	0.5	2.4	µg/g	20130724.R13na3
Thallium	0.3	<0.3	µg/g	20130724.R13na3
Thorium	0.5	0.67	µg/g	20130724.R13na3
Tin	0.5	<0.5	µg/g	20130724.R13na3
Titanium	0.5	37.7	µg/g	20130724.R13na3
Tungsten	0.5	1	µg/g	20130724.R13na3
Uranium	0.5	<0.5	µg/g	20130724.R13na3
Vanadium	0.5	48.8	µg/g	20130724.R13na3
Yttrium	0.5	6.15	µg/g	20130724.R13na3
Zinc	5	223	µg/g	20130724.R13na3
Zirconium	0.5	1.5	µg/g	20130724.R13na3

Sample Name: GPTLS12 1541 **Date: 07/23/13** **Matrix: Soil** **Lab #: 499068**

CN WAD Soil				
Parameter	**MDL**	**Result**	**Units**	**QAQCID**
Weak Acid Dissociable Cyanide	0.1	0.48	mg/kg	20130724.R43.7A

ICPMS Soil				
Parameter	**MDL**	**Result**	**Units**	**QAQCID**
Aluminum	5	16500	µg/g	20130724.R13na3
Antimony	5	452	µg/g	20130724.R13na3
Arsenic	5	2570	µg/g	20130724.R13na3
Barium	0.5	6.1	µg/g	20130724.R13na3
Beryllium	0.5	5.11	µg/g	20130724.R13na3
Bismuth	0.5	0.54	µg/g	20130724.R13na3
Boron (Not Hot Water Extractable)	1	8.8	µg/g	20130724.R13na3
Cadmium	0.05	2.37	µg/g	20130724.R13na3
Calcium	30	54200	µg/g	20130724.R13na3
Cerium	0.5	8.29	µg/g	20130724.R13na3
Cesium	0.5	<0.5	µg/g	20130724.R13na3
Chromium	0.5	47.7	µg/g	20130724.R13na3
Cobalt	0.05	40	µg/g	20130724.R13na3
Copper	0.5	93.7	µg/g	20130724.R13na3
Europium	0.5	0.6	µg/g	20130724.R13na3
Gallium	0.5	5.19	µg/g	20130724.R13na3
Iron	100	61200	µg/g	20130724.R13na3
Lanthanum	0.5	3.4	µg/g	20130724.R13na3
Lead	0.5	247	µg/g	20130724.R13na3
Lithium	3	30.8	µg/g	20130724.R13na3
Magnesium	2	28000	µg/g	20130724.R13na3
Manganese	5	1120	µg/g	20130724.R13na3

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Sample Name: GPTLS12 1541 **Date: 07/23/13** **Matrix: Soil** **Lab #: 499068**

ICPMS Soil				
Parameter	**MDL**	**Result**	**Units**	**QAQCID**
Mercury	0.05	<0.05	µg/g	20130724.R13na3
Molybdenum	0.5	1.5	µg/g	20130724.R13na3
Nickel	0.5	75.7	µg/g	20130724.R13na3
Niobium	0.5	<0.5	µg/g	20130724.R13na3
Phosphorus	30	362	µg/g	20130724.R13na3
Potassium	10	369	µg/g	20130724.R13na3
Rubidium	0.5	2	µg/g	20130724.R13na3
Scandium	0.5	8.69	µg/g	20130724.R13na3
Selenium	0.5	<0.5	µg/g	20130724.R13na3
Silicon	300	<300	µg/g	20130724.R13na3
Silver	0.05	1.08	µg/g	20130724.R13na3
Sodium	10	111	µg/g	20130724.R13na3
Strontium	0.5	42.3	µg/g	20130724.R13na3
Sulphur	400	4930	µg/g	20130724.R13na3
Tellurium	0.5	8.22	µg/g	20130724.R13na3
Thallium	0.3	<0.3	µg/g	20130724.R13na3
Thorium	0.5	0.84	µg/g	20130724.R13na3
Tin	0.5	0.51	µg/g	20130724.R13na3
Titanium	0.5	71.9	µg/g	20130724.R13na3
Tungsten	0.5	2	µg/g	20130724.R13na3
Uranium	0.5	<0.5	µg/g	20130724.R13na3
Vanadium	0.5	68.2	µg/g	20130724.R13na3
Yttrium	0.5	4.9	µg/g	20130724.R13na3
Zinc	5	281	µg/g	20130724.R13na3
Zirconium	0.5	2.2	µg/g	20130724.R13na3

Sample Name: GPTLS12 1542 **Date: 07/23/13** **Matrix: Soil** **Lab #: 499069**

CN WAD Soil				
Parameter	**MDL**	**Result**	**Units**	**QAQCID**
Weak Acid Dissociable Cyanide	0.1	0.4	mg/kg	20130724.R43.7A

ICPMS Soil				
Parameter	**MDL**	**Result**	**Units**	**QAQCID**
Aluminum	5	10500	µg/g	20130724.R13na3
Antimony	5	323	µg/g	20130724.R13na3
Arsenic	5	1980	µg/g	20130724.R13na3
Barium	0.5	9.92	µg/g	20130724.R13na3
Beryllium	0.5	6.06	µg/g	20130724.R13na3
Bismuth	0.5	0.9	µg/g	20130724.R13na3
Boron (Not Hot Water Extractable)	1	8.7	µg/g	20130724.R13na3
Cadmium	0.05	2.71	µg/g	20130724.R13na3
Calcium	30	47200	µg/g	20130724.R13na3
Cerium	0.5	8.69	µg/g	20130724.R13na3
Cesium	0.5	1	µg/g	20130724.R13na3
Chromium	0.5	32.8	µg/g	20130724.R13na3
Cobalt	0.05	37.9	µg/g	20130724.R13na3

Sample Name: GPTLS12 1542 **Date: 07/23/13** **Matrix: Soil** **Lab #: 499069**

ICPMS Soil				
Parameter	**MDL**	**Result**	**Units**	**QAQCID**
Copper	5	116	µg/g	20130724.R13na3
Europium	0.5	0.52	µg/g	20130724.R13na3
Gallium	0.5	3.8	µg/g	20130724.R13na3
Iron	100	50000	µg/g	20130724.R13na3
Lanthanum	0.5	4	µg/g	20130724.R13na3
Lead	0.5	224	µg/g	20130724.R13na3
Lithium	3	23.8	µg/g	20130724.R13na3
Magnesium	2	24300	µg/g	20130724.R13na3
Manganese	5	911	µg/g	20130724.R13na3
Mercury	0.05	<0.05	µg/g	20130724.R13na3
Molybdenum	0.5	1.3	µg/g	20130724.R13na3
Nickel	0.5	66.2	µg/g	20130724.R13na3
Niobium	0.5	<0.5	µg/g	20130724.R13na3
Phosphorus	30	329	µg/g	20130724.R13na3
Potassium	10	637	µg/g	20130724.R13na3
Rubidium	0.5	3.7	µg/g	20130724.R13na3
Scandium	0.5	6.22	µg/g	20130724.R13na3
Selenium	0.5	1.2	µg/g	20130724.R13na3
Silicon	300	<300	µg/g	20130724.R13na3
Silver	0.05	1.29	µg/g	20130724.R13na3
Sodium	10	95	µg/g	20130724.R13na3
Strontium	0.5	33.7	µg/g	20130724.R13na3
Sulphur	400	4980	µg/g	20130724.R13na3
Tellurium	0.5	5.2	µg/g	20130724.R13na3
Thallium	0.3	<0.3	µg/g	20130724.R13na3
Thorium	0.5	0.85	µg/g	20130724.R13na3
Tin	0.5	0.67	µg/g	20130724.R13na3
Titanium	0.5	83.2	µg/g	20130724.R13na3
Tungsten	0.5	3	µg/g	20130724.R13na3
Uranium	0.5	<0.5	µg/g	20130724.R13na3
Vanadium	0.5	44.1	µg/g	20130724.R13na3
Yttrium	0.5	4.7	µg/g	20130724.R13na3
Zinc	5	275	µg/g	20130724.R13na3
Zirconium	0.5	2.7	µg/g	20130724.R13na3

Sample Name: GPTLS12 1543 **Date: 07/23/13** **Matrix: Soil** **Lab #: 499070**

CN WAD Soil				
Parameter	**MDL**	**Result**	**Units**	**QAQCID**
Weak Acid Dissociable Cyanide	0.1	1.24	mg/kg	20130724.R43.7A

ICPMS Soil				
Parameter	**MDL**	**Result**	**Units**	**QAQCID**
Aluminum	5	14000	µg/g	20130724.R13na3
Antimony	0.5	211	µg/g	20130724.R13na3
Arsenic	5	2350	µg/g	20130724.R13na3
Barium	0.5	5.47	µg/g	20130724.R13na3

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Sample Name: GPTLS12 1543 **Date: 07/23/13** **Matrix: Soil** **Lab #: 499070**

ICPMS Soil				
Parameter	**MDL**	**Result**	**Units**	**QAQCID**
Beryllium	0.5	2.9	µg/g	20130724.R13na3
Bismuth	0.5	<0.5	µg/g	20130724.R13na3
Boron (Not Hot Water Extractable)	1	6.1	µg/g	20130724.R13na3
Cadmium	0.05	1.5	µg/g	20130724.R13na3
Calcium	30	47500	µg/g	20130724.R13na3
Cerium	0.5	6.54	µg/g	20130724.R13na3
Cesium	0.5	<0.5	µg/g	20130724.R13na3
Chromium	0.5	42.5	µg/g	20130724.R13na3
Cobalt	0.05	36.9	µg/g	20130724.R13na3
Copper	5	103	µg/g	20130724.R13na3
Europium	0.5	<0.5	µg/g	20130724.R13na3
Gallium	0.5	3.8	µg/g	20130724.R13na3
Iron	100	50000	µg/g	20130724.R13na3
Lanthanum	0.5	3	µg/g	20130724.R13na3
Lead	0.5	149	µg/g	20130724.R13na3
Lithium	3	25.8	µg/g	20130724.R13na3
Magnesium	2	26600	µg/g	20130724.R13na3
Manganese	5	997	µg/g	20130724.R13na3
Mercury	0.05	<0.05	µg/g	20130724.R13na3
Molybdenum	0.5	1.1	µg/g	20130724.R13na3
Nickel	0.5	69.9	µg/g	20130724.R13na3
Niobium	0.5	<0.5	µg/g	20130724.R13na3
Phosphorus	30	293	µg/g	20130724.R13na3
Potassium	10	307	µg/g	20130724.R13na3
Rubidium	0.5	1.5	µg/g	20130724.R13na3
Scandium	0.5	7.02	µg/g	20130724.R13na3
Selenium	0.5	1	µg/g	20130724.R13na3
Silicon	300	<300	µg/g	20130724.R13na3
Silver	0.05	0.827	µg/g	20130724.R13na3
Sodium	10	76	µg/g	20130724.R13na3
Strontium	0.5	28.5	µg/g	20130724.R13na3
Sulphur	400	3410	µg/g	20130724.R13na3
Tellurium	0.5	2.3	µg/g	20130724.R13na3
Thallium	0.3	<0.3	µg/g	20130724.R13na3
Thorium	0.5	0.59	µg/g	20130724.R13na3
Tin	0.5	<0.5	µg/g	20130724.R13na3
Titanium	0.5	50.1	µg/g	20130724.R13na3
Tungsten	0.5	1.9	µg/g	20130724.R13na3
Uranium	0.5	<0.5	µg/g	20130724.R13na3
Vanadium	0.5	50.6	µg/g	20130724.R13na3
Yttrium	0.5	5.23	µg/g	20130724.R13na3
Zinc	5	222	µg/g	20130724.R13na3
Zirconium	0.5	1.5	µg/g	20130724.R13na3

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Sample Name: GPTLS12 1544 **Date: 07/23/13** **Matrix: Soil** **Lab #: 499071**

CN WAD Soil				
Parameter	**MDL**	**Result**	**Units**	**QAQCID**
Weak Acid Dissociable Cyanide	0.1	0.2	mg/kg	20130724.R43.7A

ICPMS Soil				
Parameter	**MDL**	**Result**	**Units**	**QAQCID**
Aluminum	5	18000	µg/g	20130724.R13na3
Antimony	0.5	183	µg/g	20130724.R13na3
Arsenic	5	2430	µg/g	20130724.R13na3
Barium	0.5	4.8	µg/g	20130724.R13na3
Beryllium	0.5	2.6	µg/g	20130724.R13na3
Bismuth	0.5	<0.5	µg/g	20130724.R13na3
Boron (Not Hot Water Extractable)	1	6.3	µg/g	20130724.R13na3
Cadmium	0.05	1.32	µg/g	20130724.R13na3
Calcium	30	46000	µg/g	20130724.R13na3
Cerium	0.5	8.27	µg/g	20130724.R13na3
Cesium	0.5	<0.5	µg/g	20130724.R13na3
Chromium	0.5	52.4	µg/g	20130724.R13na3
Cobalt	0.05	45.8	µg/g	20130724.R13na3
Copper	5	134	µg/g	20130724.R13na3
Europium	0.5	0.55	µg/g	20130724.R13na3
Gallium	0.5	4.9	µg/g	20130724.R13na3
Iron	100	67400	µg/g	20130724.R13na3
Lanthanum	0.5	3.5	µg/g	20130724.R13na3
Lead	0.5	173	µg/g	20130724.R13na3
Lithium	3	30.8	µg/g	20130724.R13na3
Magnesium	2	28900	µg/g	20130724.R13na3
Manganese	5	1060	µg/g	20130724.R13na3
Mercury	0.05	<0.05	µg/g	20130724.R13na3
Molybdenum	0.5	1.1	µg/g	20130724.R13na3
Nickel	0.5	85.9	µg/g	20130724.R13na3
Niobium	0.5	<0.5	µg/g	20130724.R13na3
Phosphorus	30	345	µg/g	20130724.R13na3
Potassium	10	294	µg/g	20130724.R13na3
Rubidium	0.5	1.4	µg/g	20130724.R13na3
Scandium	0.5	8.48	µg/g	20130724.R13na3
Selenium	0.5	<0.5	µg/g	20130724.R13na3
Silicon	300	<300	µg/g	20130724.R13na3
Silver	0.05	0.85	µg/g	20130724.R13na3
Sodium	10	104	µg/g	20130724.R13na3
Strontium	0.5	27.4	µg/g	20130724.R13na3
Sulphur	400	3060	µg/g	20130724.R13na3
Tellurium	0.5	2.5	µg/g	20130724.R13na3
Thallium	0.3	<0.3	µg/g	20130724.R13na3
Thorium	0.5	0.6	µg/g	20130724.R13na3
Tin	0.5	<0.5	µg/g	20130724.R13na3
Titanium	0.5	46.1	µg/g	20130724.R13na3
Tungsten	0.5	2.5	µg/g	20130724.R13na3

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Sample Name: GPTLS12 1544 **Date: 07/23/13** **Matrix: Soil** **Lab #: 499071**

ICPMS Soil				
Parameter	**MDL**	**Result**	**Units**	**QAQCID**
Uranium	0.5	<0.5	µg/g	20130724.R13na3
Vanadium	0.5	65.7	µg/g	20130724.R13na3
Yttrium	0.5	6.08	µg/g	20130724.R13na3
Zinc	5	289	µg/g	20130724.R13na3
Zirconium	0.5	1.7	µg/g	20130724.R13na3

Sample Name: GPTLS12 1545 **Date: 07/23/13** **Matrix: Soil** **Lab #: 499072**

CN WAD Soil				
Parameter	**MDL**	**Result**	**Units**	**QAQCID**
Weak Acid Dissociable Cyanide	0.1	0.67	mg/kg	20130724.R43.7A

ICPMS Soil				
Parameter	**MDL**	**Result**	**Units**	**QAQCID**
Aluminum	5	16200	µg/g	20130724.R13na3
Antimony	0.5	184	µg/g	20130724.R13na3
Arsenic	5	2500	µg/g	20130724.R13na3
Barium	0.5	4.4	µg/g	20130724.R13na3
Beryllium	0.5	3	µg/g	20130724.R13na3
Bismuth	0.5	<0.5	µg/g	20130724.R13na3
Boron (Not Hot Water Extractable)	1	4.1	µg/g	20130724.R13na3
Cadmium	0.05	1.86	µg/g	20130724.R13na3
Calcium	30	47800	µg/g	20130724.R13na3
Cerium	0.5	7.01	µg/g	20130724.R13na3
Cesium	0.5	<0.5	µg/g	20130724.R13na3
Chromium	0.5	49.3	µg/g	20130724.R13na3
Cobalt	0.05	39.7	µg/g	20130724.R13na3
Copper	0.5	90.3	µg/g	20130724.R13na3
Europium	0.5	<0.5	µg/g	20130724.R13na3
Gallium	0.5	4.4	µg/g	20130724.R13na3
Iron	100	55900	µg/g	20130724.R13na3
Lanthanum	0.5	3	µg/g	20130724.R13na3
Lead	0.5	149	µg/g	20130724.R13na3
Lithium	3	25.7	µg/g	20130724.R13na3
Magnesium	2	26900	µg/g	20130724.R13na3
Manganese	5	1020	µg/g	20130724.R13na3
Mercury	0.05	<0.05	µg/g	20130724.R13na3
Molybdenum	0.5	1.1	µg/g	20130724.R13na3
Nickel	0.5	78.2	µg/g	20130724.R13na3
Niobium	0.5	<0.5	µg/g	20130724.R13na3
Phosphorus	30	262	µg/g	20130724.R13na3
Potassium	10	258	µg/g	20130724.R13na3
Rubidium	0.5	1.3	µg/g	20130724.R13na3
Scandium	0.5	7.62	µg/g	20130724.R13na3
Selenium	0.5	<0.5	µg/g	20130724.R13na3
Silicon	300	<300	µg/g	20130724.R13na3
Silver	0.05	0.716	µg/g	20130724.R13na3

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Sample Name: GPTLS12 1545 **Date: 07/23/13** **Matrix: Soil** **Lab #: 499072**

ICPMS Soil				
Parameter	**MDL**	**Result**	**Units**	**QAQCID**
Sodium	10	108	µg/g	20130724.R13na3
Strontium	0.5	28.2	µg/g	20130724.R13na3
Sulphur	400	3850	µg/g	20130724.R13na3
Tellurium	0.5	1.9	µg/g	20130724.R13na3
Thallium	0.3	<0.3	µg/g	20130724.R13na3
Thorium	0.5	0.54	µg/g	20130724.R13na3
Tin	0.5	<0.5	µg/g	20130724.R13na3
Titanium	0.5	49	µg/g	20130724.R13na3
Tungsten	0.5	1.2	µg/g	20130724.R13na3
Uranium	0.5	<0.5	µg/g	20130724.R13na3
Vanadium	0.5	55.8	µg/g	20130724.R13na3
Yttrium	0.5	5.72	µg/g	20130724.R13na3
Zinc	5	304	µg/g	20130724.R13na3
Zirconium	0.5	1.5	µg/g	20130724.R13na3

Sample Name: GPTLS12 1546 **Date: 07/23/13** **Matrix: Soil** **Lab #: 499073**

CN WAD Soil				
Parameter	**MDL**	**Result**	**Units**	**QAQCID**
Weak Acid Dissociable Cyanide	0.1	0.77	mg/kg	20130724.R43.7A

ICPMS Soil				
Parameter	**MDL**	**Result**	**Units**	**QAQCID**
Aluminum	5	16200	µg/g	20130724.R13na3
Antimony	0.5	114	µg/g	20130724.R13na3
Arsenic	5	1660	µg/g	20130724.R13na3
Barium	0.5	5.54	µg/g	20130724.R13na3
Beryllium	0.5	3.3	µg/g	20130724.R13na3
Bismuth	0.5	<0.5	µg/g	20130724.R13na3
Boron (Not Hot Water Extractable)	1	5.3	µg/g	20130724.R13na3
Cadmium	0.05	2.04	µg/g	20130724.R13na3
Calcium	30	56800	µg/g	20130724.R13na3
Cerium	0.5	8.28	µg/g	20130724.R13na3
Cesium	0.5	<0.5	µg/g	20130724.R13na3
Chromium	0.5	65.9	µg/g	20130724.R13na3
Cobalt	0.05	32.2	µg/g	20130724.R13na3
Copper	0.5	74.8	µg/g	20130724.R13na3
Europium	0.5	0.52	µg/g	20130724.R13na3
Gallium	0.5	5.57	µg/g	20130724.R13na3
Iron	100	42900	µg/g	20130724.R13na3
Lanthanum	0.5	3.6	µg/g	20130724.R13na3
Lead	0.5	151	µg/g	20130724.R13na3
Lithium	3	35.5	µg/g	20130724.R13na3
Magnesium	2	32000	µg/g	20130724.R13na3
Manganese	5	927	µg/g	20130724.R13na3
Mercury	0.05	<0.05	µg/g	20130724.R13na3
Molybdenum	0.5	0.78	µg/g	20130724.R13na3

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Sample Name: GPTLS12 1546 **Date: 07/23/13** **Matrix: Soil** **Lab #: 499073**

ICPMS Soil				
Parameter	**MDL**	**Result**	**Units**	**QAQCID**
Nickel	0.5	74.5	µg/g	20130724.R13na3
Niobium	0.5	<0.5	µg/g	20130724.R13na3
Phosphorus	30	311	µg/g	20130724.R13na3
Potassium	10	380	µg/g	20130724.R13na3
Rubidium	0.5	1.8	µg/g	20130724.R13na3
Scandium	0.5	10.1	µg/g	20130724.R13na3
Selenium	0.5	<0.5	µg/g	20130724.R13na3
Silicon	300	<300	µg/g	20130724.R13na3
Silver	0.05	0.703	µg/g	20130724.R13na3
Sodium	10	99	µg/g	20130724.R13na3
Strontium	0.5	36.2	µg/g	20130724.R13na3
Sulphur	400	3720	µg/g	20130724.R13na3
Tellurium	0.5	3	µg/g	20130724.R13na3
Thallium	0.3	<0.3	µg/g	20130724.R13na3
Thorium	0.5	0.59	µg/g	20130724.R13na3
Tin	0.5	<0.5	µg/g	20130724.R13na3
Titanium	0.5	48.1	µg/g	20130724.R13na3
Tungsten	0.5	1.3	µg/g	20130724.R13na3
Uranium	0.5	<0.5	µg/g	20130724.R13na3
Vanadium	0.5	76	µg/g	20130724.R13na3
Yttrium	0.5	5.86	µg/g	20130724.R13na3
Zinc	5	268	µg/g	20130724.R13na3
Zirconium	0.5	1.8	µg/g	20130724.R13na3

Sample Name: GPTLS12 1549/1550 **Date: 07/23/13** **Matrix: Water** **Lab #: 499074**

ICPMS Water				
Parameter	**MDL**	**Result**	**Units**	**QAQCID**
Aluminum	1	222	ug/L	20130724.R13nr2
Antimony	0.5	169	ug/L	20130724.R13nr2
Arsenic	1	34.3	ug/L	20130724.R13nr2
Barium	1	17.1	ug/L	20130724.R13nr2
Beryllium	0.5	<0.5	ug/L	20130724.R13nr2
Bismuth	1	<1	ug/L	20130724.R13nr2
Boron	2	364	ug/L	20130724.R13nr2
Cadmium	0.1	0.92	ug/L	20130724.R13nr2
Calcium	50	307000	ug/L	20130724.R13nr2
Cerium	1	<1	ug/L	20130724.R13nr2
Cesium	1	<1	ug/L	20130724.R13nr2
Chromium	1	1.2	ug/L	20130724.R13nr2
Cobalt	0.1	2.24	ug/L	20130724.R13nr2
Copper	1	<1	ug/L	20130724.R13nr2
Europium	1	<1	ug/L	20130724.R13nr2
Gallium	1	<1	ug/L	20130724.R13nr2
Iron	20	2790	ug/L	20130724.R13nr2
Lanthanum	1	<1	ug/L	20130724.R13nr2

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Sample Name: GPTLS12 1549/1550 **Date: 07/23/13** **Matrix: Water** **Lab #: 499074**

ICPMS Water				
Parameter	**MDL**	**Result**	**Units**	**QAQCID**
Lead	0.1	2.23	ug/L	20130724.R13nr2
Lithium	5	25.9	ug/L	20130724.R13nr2
Magnesium	4	71500	ug/L	20130724.R13nr2
Manganese	1	66.5	ug/L	20130724.R13nr2
Mercury	0.1	<0.1	ug/L	20130724.R13nr2
Molybdenum	0.5	14.7	ug/L	20130724.R13nr2
Nickel	1	12.2	ug/L	20130724.R13nr2
Niobium	1	<1	ug/L	20130724.R13nr2
Potassium	100	9360	ug/L	20130724.R13nr2
Rubidium	1	8.4	ug/L	20130724.R13nr2
Scandium	1	<1	ug/L	20130724.R13nr2
Selenium	1	6.9	ug/L	20130724.R13nr2
Silicon	600	1050	ug/L	20130724.R13nr2
Silver	0.1	<0.1	ug/L	20130724.R13nr2
Sodium	100	123000	ug/L	20130724.R13nr2
Strontium	1	2820	ug/L	20130724.R13nr2
Sulphur	800	304000	ug/L	20130724.R13nr2
Tellurium	1	<1	ug/L	20130724.R13nr2
Thallium	0.1	0.65	ug/L	20130724.R13nr2
Thorium	1	<1	ug/L	20130724.R13nr2
Tin	1	87.2	ug/L	20130724.R13nr2
Titanium	1	3.7	ug/L	20130724.R13nr2
Tungsten	1	<1	ug/L	20130724.R13nr2
Uranium	1	1.8	ug/L	20130724.R13nr2
Vanadium	0.5	<0.5	ug/L	20130724.R13nr2
Yttrium	1	<1	ug/L	20130724.R13nr2
Zinc	1	10.9	ug/L	20130724.R13nr2
Zirconium	1	<1	ug/L	20130724.R13nr2

KL-WAD CN/W				
Parameter	**MDL**	**Result**	**Units**	**QAQCID**
Weak Acid Dissociable Cyanide	0.001	0.014	mg/L	20130724.K43W

MDL *Method detection limit or minimum reporting limit.*
% Rec *Surrogate compounds are added to the sample in some cases and the recovery is reported as a percent recovered.*
QAQCID *This is a unique reference to the quality control data set used to generate the reported value.*
Data reported for organic analysis in soil samples are corrected for moisture content
Matrix *If the matrix is a leachate, the sample was extracted according to regulation 558.*
INT *Interferences*
TNTC *Too numerous to count*
ND *Not detected*

Quality Control Data:

ICPMS Soil

Method Blank						
Parameter	**MDL**	**Units**	**LCL**	**Result**	**UCL**	**QAQCID**
Aluminum	0.5	µg/g	<0.5	<0.5	2	20130724.R13na3
Antimony	0.5	µg/g	<0.5	<0.5	0.5	20130724.R13na3
Arsenic	0.5	µg/g	<0.5	<0.5	0.5	20130724.R13na3
Barium	0.5	µg/g	<0.5	<0.5	0.5	20130724.R13na3
Beryllium	0.5	µg/g	<0.5	<0.5	2.5	20130724.R13na3
Bismuth	0.5	µg/g	<0.5	<0.5	0.5	20130724.R13na3
Cadmium	0.05	µg/g	<0.05	<0.05	0.5	20130724.R13na3
Calcium	30	µg/g	<30	<30	50	20130724.R13na3
Cerium	0.5	µg/g	<0.5	<0.5	0.5	20130724.R13na3
Cesium	0.5	µg/g	<0.5	<0.5	0.5	20130724.R13na3
Chromium	0.5	µg/g	<0.5	<0.5	0.5	20130724.R13na3
Cobalt	0.05	µg/g	<0.05	<0.05	0.5	20130724.R13na3
Copper	0.5	µg/g	<0.5	<0.5	0.5	20130724.R13na3
Europium	0.5	µg/g	<0.5	<0.5	0.5	20130724.R13na3
Gallium	0.5	µg/g	<0.5	<0.5	0.5	20130724.R13na3
Iron	10	µg/g	<10	<10	10	20130724.R13na3
Lanthanum	0.5	µg/g	<0.5	<0.5	0.5	20130724.R13na3
Lead	0.05	µg/g	<0.05	<0.05	0.5	20130724.R13na3
Magnesium	2	µg/g	<2	<2	3	20130724.R13na3
Manganese	0.5	µg/g	<0.5	<0.5	0.5	20130724.R13na3
Mercury	0.05	µg/g	<0.05	<0.05	0.5	20130724.R13na3
Molybdenum	0.5	µg/g	<0.5	<0.5	0.5	20130724.R13na3
Nickel	0.5	µg/g	<0.5	<0.5	0.5	20130724.R13na3
Niobium	0.5	µg/g	<0.5	<0.5	0.5	20130724.R13na3
Phosphorus	30	µg/g	<30	<30	30	20130724.R13na3
Potassium	10	µg/g	<10	<10	50	20130724.R13na3
Rubidium	0.5	µg/g	<0.5	<0.5	0.5	20130724.R13na3
Scandium	0.5	µg/g	<0.5	<0.5	0.5	20130724.R13na3
Selenium	0.5	µg/g	<0.5	<0.5	0.5	20130724.R13na3
Silver	0.5	µg/g	<0.5	<0.5	0.5	20130724.R13na3
Sodium	10	µg/g	<10	<10	50	20130724.R13na3
Strontium	0.5	µg/g	<0.5	<0.5	0.5	20130724.R13na3
Thallium	0.3	µg/g	<0.3	<0.3	0.5	20130724.R13na3
Thorium	0.5	µg/g	<0.5	<0.5	0.5	20130724.R13na3
Tin	0.5	µg/g	<0.5	<0.5	2.5	20130724.R13na3
Titanium	0.5	µg/g	<0.5	<0.5	0.5	20130724.R13na3
Tungsten	0.5	µg/g	<0.5	<0.5	0.5	20130724.R13na3
Uranium	0.5	µg/g	<0.5	<0.5	0.5	20130724.R13na3
Vanadium	0.5	µg/g	<0.5	<0.5	0.5	20130724.R13na3
Yttrium	0.5	µg/g	<0.5	<0.5	0.5	20130724.R13na3
Zinc	0.5	µg/g	<0.5	<0.5	1	20130724.R13na3
Zirconium	0.5	µg/g	<0.5	<0.5	0.5	20130724.R13na3

ICPMS Soil

SS2 CRM						
Parameter	**MDL**	**Units**	**LCL**	**Result**	**UCL**	**QAQCID**
Aluminum	5	µg/g	6743	13700	19787	20130724.R13na3
Antimony	0.5	µg/g	3	4.2	5.3	20130724.R13na3
Arsenic	0.5	µg/g	25	83.2	125	20130724.R13na3
Barium	0.5	µg/g	149	220	281	20130724.R13na3
Cadmium	0.05	µg/g	1.2	2.73	3.2	20130724.R13na3
Calcium	30	µg/g	87443	104000	138279	20130724.R13na3
Chromium	0.5	µg/g	14	36.3	54	20130724.R13na3
Cobalt	0.05	µg/g	9	11.7	15	20130724.R13na3
Copper	5	µg/g	139	187	243	20130724.R13na3
Iron	100	µg/g	12831	21400	29261	20130724.R13na3
Lead	0.5	µg/g	68	118	184	20130724.R13na3
Lithium	3	µg/g	5	15.8	23	20130724.R13na3
Magnesium	2	µg/g	7628	11000	14502	20130724.R13na3
Manganese	5	µg/g	324	504	590	20130724.R13na3
Molybdenum	0.5	µg/g	1.94	2.9	3.94	20130724.R13na3
Nickel	0.5	µg/g	33	55	75	20130724.R13na3
Silver	0.5	µg/g	0.5	0.55	2	20130724.R13na3
Strontium	0.5	µg/g	156	216	272	20130724.R13na3
Titanium	5	µg/g	298	919	1402	20130724.R13na3
Uranium	0.5	µg/g	1	1.3	1.9	20130724.R13na3
Vanadium	0.5	µg/g	17	40.6	51	20130724.R13na3
Zinc	5	µg/g	337	464	597	20130724.R13na3

ICPMS Water

EU-L-3						
Parameter	**MDL**	**Units**	**LCL**	**Result**	**UCL**	**QAQCID**
Antimony	0.5	ug/L	12.8	20.1	24	20130724.R13nr2
Arsenic	1	ug/L	73.2	80.9	93.8	20130724.R13nr2
Barium	1	ug/L	103	119	145	20130724.R13nr2
Cadmium	0.1	ug/L	18.6	21	27	20130724.R13nr2
Calcium	50	ug/L	1720	2320	2450	20130724.R13nr2
Chromium	1	ug/L	48.7	57.2	76.6	20130724.R13nr2
Cobalt	0.1	ug/L	76.2	81.5	88.8	20130724.R13nr2
Copper	1	ug/L	87.1	90.8	125	20130724.R13nr2
Lead	1	ug/L	36.1	39.6	47.5	20130724.R13nr2
Magnesium	4	ug/L	753	852	1124	20130724.R13nr2
Manganese	1	ug/L	107	117	138	20130724.R13nr2
Molybdenum	1	ug/L	32.7	37.3	46.7	20130724.R13nr2
Nickel	1	ug/L	73.1	78.5	93.8	20130724.R13nr2
Phosphorus	50	ug/L	874	876	1105	20130724.R13nr2
Potassium	0.1	ug/L	1680	1950	2470	20130724.R13nr2
Selenium	1	ug/L	13.7	27.7	42.2	20130724.R13nr2
Sodium	100	ug/L	4480	4500	5950	20130724.R13nr2
Thallium	0.1	ug/L	72.3	76.4	95.1	20130724.R13nr2
Uranium	1	ug/L	89.7	96.4	115	20130724.R13nr2

ICPMS Water

EU-L-3						
Parameter	**MDL**	**Units**	**LCL**	**Result**	**UCL**	**QAQCID**
Vanadium	1	ug/L	43.4	47.7	55.7	20130724.R13nr2
Zinc	1	ug/L	12.5	28.9	48.4	20130724.R13nr2

Lab Control Sample						
Parameter	**MDL**	**Units**	**LCL**	**Result**	**UCL**	**QAQCID**
Arsenic	N/A	%	80	90	120	20130724.R13nr2
Barium	N/A	%	80	95	120	20130724.R13nr2
Cadmium	N/A	%	80	86	120	20130724.R13nr2
Calcium	N/A	%	80	84	120	20130724.R13nr2
Cobalt	N/A	%	80	92	120	20130724.R13nr2
Copper	N/A	%	80	88	120	20130724.R13nr2
Iron	N/A	%	80	90	120	20130724.R13nr2
Lead	N/A	%	80	93	120	20130724.R13nr2
Magnesium	N/A	%	80	84	120	20130724.R13nr2
Manganese	N/A	%	80	89	120	20130724.R13nr2
Molybdenum	N/A	%	80	91	120	20130724.R13nr2
Nickel	N/A	%	80	89	120	20130724.R13nr2
Sodium	N/A	%	80	82	120	20130724.R13nr2
Thallium	N/A	%	80	93	120	20130724.R13nr2
Vanadium	N/A	%	80	87	120	20130724.R13nr2
Zinc	N/A	%	80	99	120	20130724.R13nr2

Method Blank						
Parameter	**MDL**	**Units**	**LCL**	**Result**	**UCL**	**QAQCID**
Aluminum	1	ug/L	<1	<1	1	20130724.R13nr2
Antimony	0.5	ug/L	<0.5	<0.5	0.5	20130724.R13nr2
Arsenic	1	ug/L	<1	<1	1	20130724.R13nr2
Barium	0.5	ug/L	<0.5	<0.5	0.5	20130724.R13nr2
Beryllium	1	ug/L	<1	<1	1	20130724.R13nr2
Bismuth	1	ug/L	<1	<1	3	20130724.R13nr2
Boron	1	ug/L	<1	<1	1	20130724.R13nr2
Cadmium	1	ug/L	<1	<1	1	20130724.R13nr2
Calcium	50	ug/L	<50	<50	150	20130724.R13nr2
Cerium	0.1	ug/L	<0.1	<0.1	0.1	20130724.R13nr2
Cesium	1	ug/L	<1	<1	1	20130724.R13nr2
Chromium	1	ug/L	<1	<1	1	20130724.R13nr2
Cobalt	1	ug/L	<1	<1	1	20130724.R13nr2
Europium	1	ug/L	<1	<1	1	20130724.R13nr2
Gallium	1	ug/L	<1	<1	1	20130724.R13nr2
Iron	20	ug/L	<20	<20	20	20130724.R13nr2
Lanthanum	1	ug/L	<1	<1	1	20130724.R13nr2
Lead	1	ug/L	<1	<1	1	20130724.R13nr2
Lithium	5	ug/L	<5	<5	5	20130724.R13nr2
Magnesium	4	ug/L	<4	<4	4	20130724.R13nr2
Manganese	1	ug/L	<1	<1	1	20130724.R13nr2
Mercury	0.1	ug/L	<0.1	<0.1	0.1	20130724.R13nr2
Molybdenum	1	ug/L	<1	<1	1	20130724.R13nr2

ICPMS Water

Method Blank						
Parameter	**MDL**	**Units**	**LCL**	**Result**	**UCL**	**QAQCID**
Nickel	1	ug/L	<1	<1	1	20130724.R13nr2
Niobium	1	ug/L	<1	<1	1	20130724.R13nr2
Phosphorus	50	ug/L	<50	<50	50	20130724.R13nr2
Rubidium	1	ug/L	<1	<1	1	20130724.R13nr2
Scandium	1	ug/L	<1	<1	1	20130724.R13nr2
Selenium	1	ug/L	<1	<1	1	20130724.R13nr2
Silver	0.1	ug/L	<0.1	<0.1	0.1	20130724.R13nr2
Strontium	1	ug/L	<1	<1	1	20130724.R13nr2
Tellurium	1	ug/L	<1	<1	1	20130724.R13nr2
Thallium	1	ug/L	<1	<1	1	20130724.R13nr2
Thorium	1	ug/L	<1	<1	1	20130724.R13nr2
Tin	1	ug/L	<1	<1	1	20130724.R13nr2
Titanium	0.1	ug/L	<0.1	<0.1	0.1	20130724.R13nr2
Tungsten	1	ug/L	<1	<1	1	20130724.R13nr2
Uranium	1	ug/L	<1	<1	1	20130724.R13nr2
Vanadium	1	ug/L	<1	<1	1	20130724.R13nr2
Yttrium	1	ug/L	<1	<1	1	20130724.R13nr2
Zinc	1	ug/L	<1	<1	1	20130724.R13nr2
Zirconium	1	ug/L	<1	<1	1	20130724.R13nr2

KL-WAD CN/W

%RPD						
Parameter	**MDL**	**Units**	**LCL**	**Result**	**UCL**	**QAQCID**
Weak Acid Dissociable Cyanide	N/A	%	0	0	20	20130724.K43W

Lab Control Sample						
Parameter	**MDL**	**Units**	**LCL**	**Result**	**UCL**	**QAQCID**
Weak Acid Dissociable Cyanide	0.001	mg/L	0.09	0.105	0.11	20130724.K43W

Matrix Spike						
Parameter	**MDL**	**Units**	**LCL**	**Result**	**UCL**	**QAQCID**
Weak Acid Dissociable Cyanide	N/A	% Rec	80	104	120	20130724.K43W

Method Blank						
Parameter	**MDL**	**Units**	**LCL**	**Result**	**UCL**	**QAQCID**
Weak Acid Dissociable Cyanide	0.001	mg/L	<0.001	<0.001	0.003	20130724.K43W

UCL Upper Control Limit
LCL Lower Control Limit

APPENDIX B

Rheograms

Golder Associates Ltd.

Viscosity / Flow Curve Testing R/S Plus Rheometer

Client:	Giant Mine
Project Number:	13-1426-0010
Date:	8/1/2013
Technologist	KC

		Status	Reviewer	Date Complete
Data Entry		**Complete**	**KC**	**8/2/2013**
Data Review	**1st Review**	**Complete**	**KC**	**8/2/2013**
	2nd Review	**Complete**	**am**	**8/7/2013**

Sample ID:	13-1426-0010 SPTP 4
Sample Description:	fine grey material
Water:	13-1426-0010 Water
pH Adjustment:	none
Bob:	CC25 Profiled Bob
Additional Info:	material sticks to itself
Specific Gravity	2.8

VISCOSITY DATA

Ramp Up

REF	Trial 1	Trial 2	Trial 3	AVG
1	1.4402	1.4751	1.3851	1.433
2	0.9567	0.9343	1.0144	0.968
3	0.6247	0.6616	0.6394	0.642
4	0.3671	0.3648	0.3574	0.363
5	0.1475	0.1445	0.1474	0.146
6	0.0471	0.0457	0.0449	0.046
7				

Ramp Down

Trial 1	Trial 2	Trial 3	AVG
1.5021	1.3486	1.3645	1.405
0.9736	0.9514	0.9987	0.975
0.6281	0.6446	0.6417	0.638
0.3570	0.3534	0.3584	0.356
0.1407	0.1407	0.1413	0.141
0.0479	0.0467	0.0474	0.047

YIELD STRESS DATA

Ramp Up

REF	Trial 1	Trial 2	Trial 3	AVG
1	437.0973	402.7189	424.9784	422
2	271.0842	274.9252	280.1724	275
3	199.4283	192.2763	197.5775	196
4	135.1464	133.6241	139.9822	136
5	73.2401	73.5876	72.5182	73
6	26.8036	26.6005	27.9790	27
7				

Ramp Down

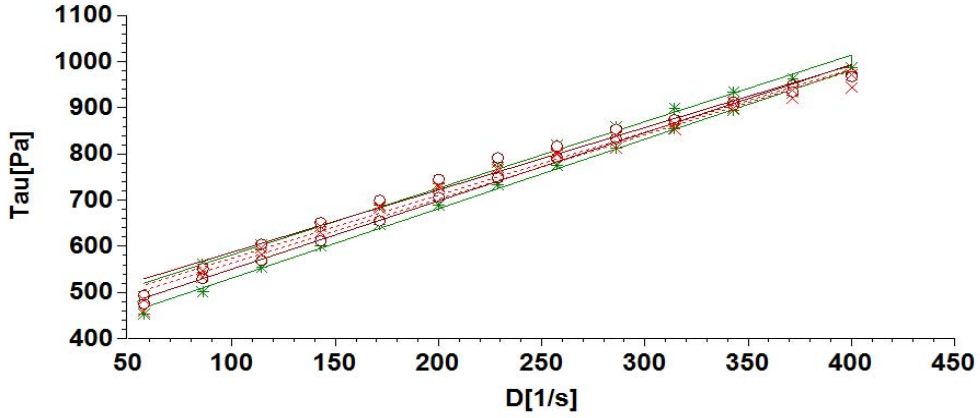
Trial 1	Trial 2	Trial 3	AVG
380.5812	451.8005	437.2177	423
262.5644	267.5689	282.6542	271
193.2052	195.3254	194.1806	194
137.7607	137.1868	139.0976	138
74.9144	74.0590	73.8479	74
26.4894	26.1948	26.9976	27

WEIGHT PERCENT SOLIDS

REF	Pan #	Pan Wt. (g)	Wet (g)	Dry (g)	Wt% Solids	SVF (Φ)
1	4	30.52	65.26	56.65	75.22%	0.52
2	24	31.60	74.49	63.48	74.33%	0.51
3	68	30.49	77.38	64.89	73.36%	0.50
4	z6	31.50	67.10	57.23	72.28%	0.48
5	25	30.56	68.29	57.04	70.18%	0.46
6	z13	31.35	64.76	53.60	66.60%	0.42
7						

Additional Notes:

10:14 01/08/13
Manual Report Analysis/Regression

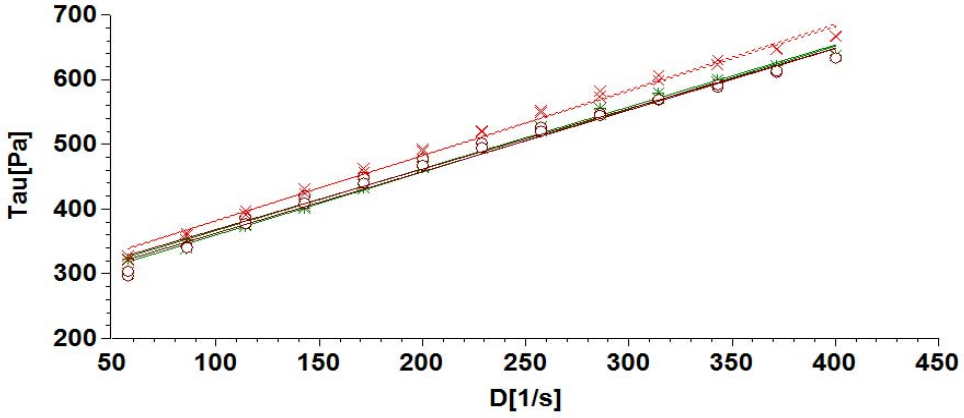


Analysis-results
Analysis data source: 13-1426-0010 SPTP-4 Ref 1-3.dat Block:1
filter activated: D[1/s]>40
step1: Bingham: Y=437.1+1.4402*X ;B=0.99282; S=14.2
step1: Bingham yieldstress[Pa]=437.0973
step1: Bingham viscosity[Pas]=1.4402
step2: Bingham: Y=380.58+1.5021*X ;B=0.99771; S=8.36
step2: Bingham yieldstress[Pa]=380.5812
step2: Bingham viscosity[Pas]=1.5021

filter activated: D[1/s]>40
step1: Bingham: Y=402.72+1.4751*X ;B=0.9971; S=9.25
step1: Bingham yieldstress[Pa]=402.7189
step1: Bingham viscosity[Pas]=1.4751
step2: Bingham: Y=451.8+1.3486*X ;B=0.98235; S=21
step2: Bingham yieldstress[Pa]=451.8005
step2: Bingham viscosity[Pas]=1.3486

filter activated: D[1/s]>40
step1: Bingham: Y=424.98+1.3851*X ;B=0.97829; S=24
step1: Bingham yieldstress[Pa]=424.9784
step1: Bingham viscosity[Pas]=1.3851
step2: Bingham: Y=437.22+1.3645*X ;B=0.98923; S=16.5
step2: Bingham yieldstress[Pa]=437.2177
step2: Bingham viscosity[Pas]=1.3645
End of report

11:11 01/08/13
Manual Report Analysis/Regression

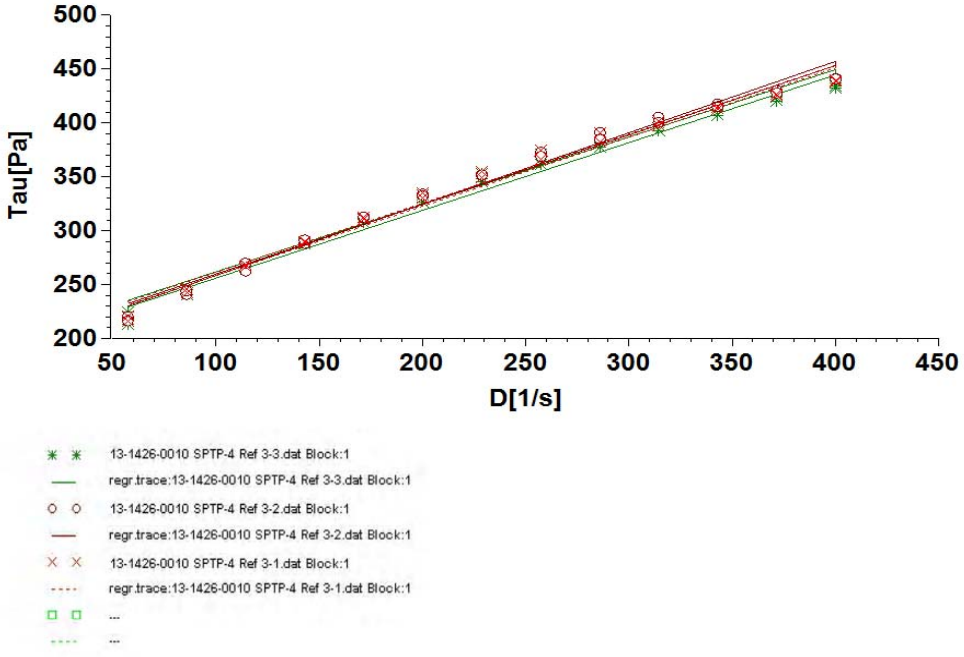


Analysis-results
Analysis data source: 13-1426-0010 SPTP-4 Ref 2-1.dat Block:1
filter activated: D[1/s]>40
step1: Bingham: Y=271.08+0.95671*X ;B=0.9948; S=8.04
step1: Bingham yieldstress[Pa]=271.0842
step1: Bingham viscosity[Pas]=0.9567
step2: Bingham: Y=262.56+0.97356*X ;B=0.99353; S=9.13
step2: Bingham yieldstress[Pa]=262.5644
step2: Bingham viscosity[Pas]=0.9736

filter activated: D[1/s]>40
step1: Bingham: Y=274.93+0.93425*X ;B=0.9814; S=14.9
step1: Bingham yieldstress[Pa]=274.9252
step1: Bingham viscosity[Pas]=0.9343
step2: Bingham: Y=267.57+0.95141*X ;B=0.99179; S=10.1
step2: Bingham yieldstress[Pa]=267.5689
step2: Bingham viscosity[Pas]=0.9514

filter activated: D[1/s]>40
step1: Bingham: Y=280.17+1.0144*X ;B=0.99323; S=9.73
step1: Bingham yieldstress[Pa]=280.1724
step1: Bingham viscosity[Pas]=1.0144
step2: Bingham: Y=282.65+0.99866*X ;B=0.99251; S=10.1
step2: Bingham yieldstress[Pa]=282.6542
step2: Bingham viscosity[Pas]=0.9987
End of report

11:45 01/08/13
Manual Report Analysis/Regression

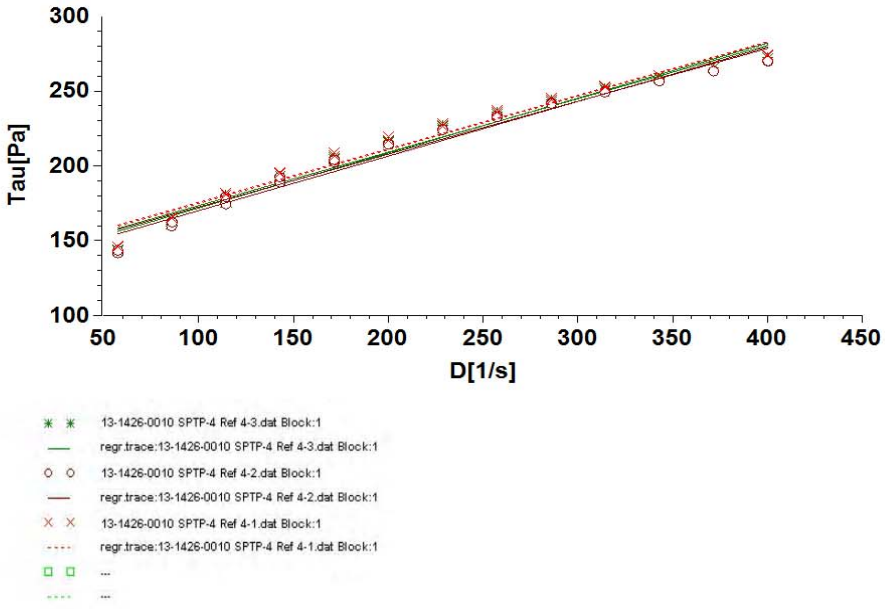


Analysis-results
Analysis data source: 13-1426-0010 SPTP-4 Ref 3-3.dat Block:1
filter activated: D[1/s]>40
step1: Bingham: Y=199.43+0.62472*X ;B=0.9851; S=8.93
step1: Bingham yieldstress[Pa]=199.4283
step1: Bingham viscosity[Pas]=0.6247
step2: Bingham: Y=193.21+0.62813*X ;B=0.98719; S=8.32
step2: Bingham yieldstress[Pa]=193.2052
step2: Bingham viscosity[Pas]=0.6281

filter activated: D[1/s]>40
step1: Bingham: Y=192.28+0.66161*X ;B=0.98609; S=9.13
step1: Bingham yieldstress[Pa]=192.2763
step1: Bingham viscosity[Pas]=0.6616
step2: Bingham: Y=195.33+0.6446*X ;B=0.98721; S=8.53
step2: Bingham yieldstress[Pa]=195.3254
step2: Bingham viscosity[Pas]=0.6446

filter activated: D[1/s]>40
step1: Bingham: Y=197.58+0.63941*X ;B=0.98285; S=9.81
step1: Bingham yieldstress[Pa]=197.5775
step1: Bingham viscosity[Pas]=0.6394
step2: Bingham: Y=194.18+0.64173*X ;B=0.98825; S=8.13
step2: Bingham yieldstress[Pa]=194.1806
step2: Bingham viscosity[Pas]=0.6417
End of report

13:33 01/08/13
Manual Report Analysis/Regression

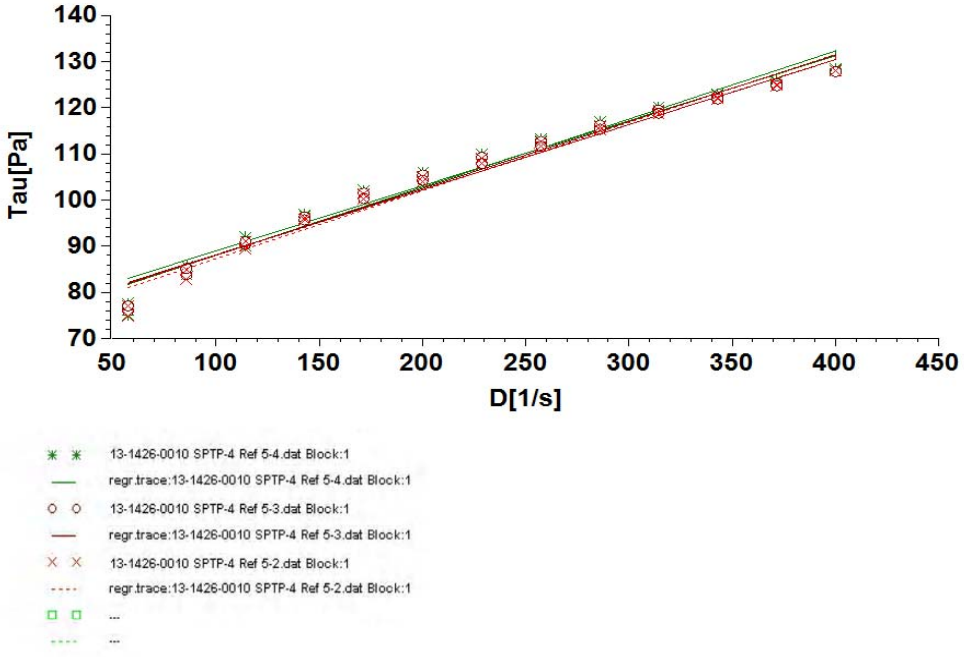


Analysis-results
Analysis data source: 13-1426-0010 SPTP-4 Ref 4-3.dat Block:1
filter activated: D[1/s]>40
step1: Bingham: Y=135.15+0.3671*X ;B=0.9722; S=7.21
step1: Bingham yieldstress[Pa]=135.1464
step1: Bingham viscosity[Pas]=0.3671
step2: Bingham: Y=137.76+0.35695*X ;B=0.97466; S=6.69
step2: Bingham yieldstress[Pa]=137.7607
step2: Bingham viscosity[Pas]=0.357

filter activated: D[1/s]>40
step1: Bingham: Y=133.62+0.3648*X ;B=0.97299; S=7.06
step1: Bingham yieldstress[Pa]=133.6241
step1: Bingham viscosity[Pas]=0.3648
step2: Bingham: Y=137.19+0.35336*X ;B=0.97368; S=6.75
step2: Bingham yieldstress[Pa]=137.1868
step2: Bingham viscosity[Pas]=0.3534

filter activated: D[1/s]>40
step1: Bingham: Y=139.98+0.35737*X ;B=0.97075; S=7.21
step1: Bingham yieldstress[Pa]=139.9822
step1: Bingham viscosity[Pas]=0.3574
step2: Bingham: Y=139.1+0.35838*X ;B=0.97624; S=6.5
step2: Bingham yieldstress[Pa]=139.0976
step2: Bingham viscosity[Pas]=0.3584
End of report

14:03 01/08/13
Manual Report Analysis/Regression

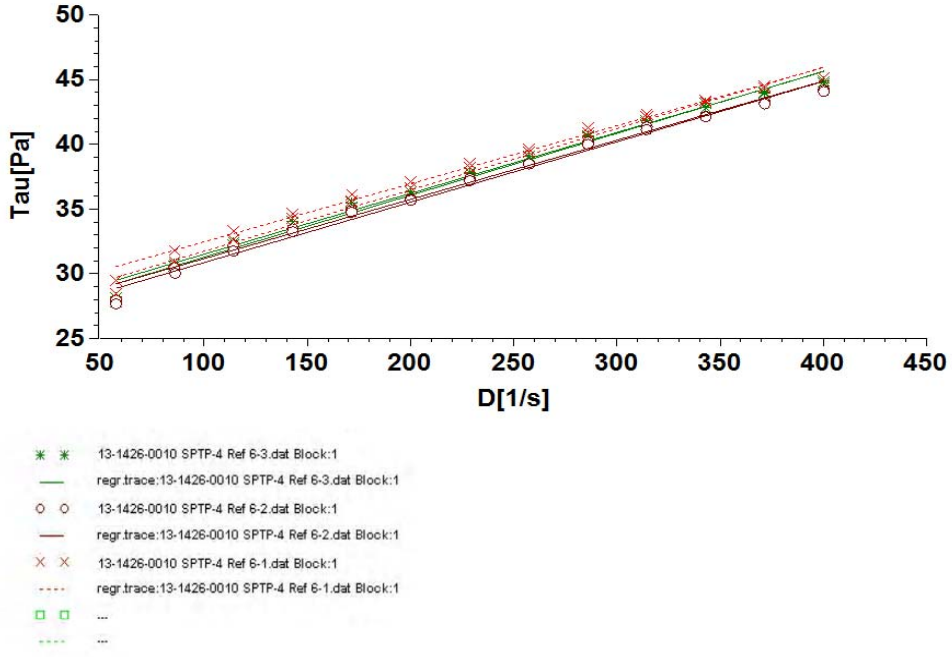


Analysis-results
Analysis data source: 13-1426-0010 SPTP-4 Ref 5-4.dat Block:1
filter activated: D[1/s]>40
step1: Bingham: Y=73.24+0.14747*X ;B=0.96645; S=3.19
step1: Bingham yieldstress[Pa]=73.2401
step1: Bingham viscosity[Pas]=0.1475
step2: Bingham: Y=74.914+0.14068*X ;B=0.97949; S=2.37
step2: Bingham yieldstress[Pa]=74.9144
step2: Bingham viscosity[Pas]=0.1407

filter activated: D[1/s]>40
step1: Bingham: Y=73.588+0.14446*X ;B=0.97122; S=2.89
step1: Bingham yieldstress[Pa]=73.5876
step1: Bingham viscosity[Pas]=0.1445
step2: Bingham: Y=74.059+0.14067*X ;B=0.98201; S=2.21
step2: Bingham yieldstress[Pa]=74.059
step2: Bingham viscosity[Pas]=0.1407

filter activated: D[1/s]>40
step1: Bingham: Y=72.518+0.14737*X ;B=0.96901; S=3.06
step1: Bingham yieldstress[Pa]=72.5182
step1: Bingham viscosity[Pas]=0.1474
step2: Bingham: Y=73.848+0.14135*X ;B=0.9829; S=2.17
step2: Bingham yieldstress[Pa]=73.8479
step2: Bingham viscosity[Pas]=0.1413
End of report

14:27 01/08/13
Manual Report Analysis/Regression



Analysis-results
Analysis data source: 13-1426-0010 SPTP-4 Ref 6-3.dat Block:1
filter activated: D[1/s]>40
step1: Bingham: Y=26.804+0.047061*X ;B=0.98971; S=0.558
step1: Bingham yieldstress[Pa]=26.8036
step1: Bingham viscosity[Pas]=0.0471
step2: Bingham: Y=26.489+0.047895*X ;B=0.98941; S=0.576
step2: Bingham yieldstress[Pa]=26.4894
step2: Bingham viscosity[Pas]=0.0479

filter activated: D[1/s]>40
step1: Bingham: Y=26.6+0.045744*X ;B=0.99004; S=0.533
step1: Bingham yieldstress[Pa]=26.6005
step1: Bingham viscosity[Pas]=0.0457
step2: Bingham: Y=26.195+0.04668*X ;B=0.99013; S=0.542
step2: Bingham yieldstress[Pa]=26.1948
step2: Bingham viscosity[Pas]=0.0467

filter activated: D[1/s]>40
step1: Bingham: Y=27.979+0.044877*X ;B=0.99165; S=0.479
step1: Bingham yieldstress[Pa]=27.979
step1: Bingham viscosity[Pas]=0.0449
step2: Bingham: Y=26.998+0.047422*X ;B=0.99025; S=0.547
step2: Bingham yieldstress[Pa]=26.9976
step2: Bingham viscosity[Pas]=0.0474
End of report

Golder Associates Ltd.

Viscosity / Flow Curve Testing R/S Plus Rheometer

Client:	Giant Mine
Project Number:	13-1426-0010
Date:	8/6/2013
Technologist	CJC/CA

		Status	Reviewer	Date Complete
Data Entry		**Complete**	**CA**	**8/7/2013**
Data Review	**1st Review**	**Complete**	**CA**	**8/7/2013**
	2nd Review	**Complete**	**am**	**8/8/2013**

Sample ID:	13-1426-0010 SPTP-5
Sample Description:	coarse, dark grey sample
Water:	13-1426-0010 water
pH Adjustment:	none
Bob:	CC25 Profiled Bob
Additional Info:	
Specific Gravity	2.85

VISCOSITY DATA

Ramp Up

REF	Trial 1	Trial 2	Trial 3	AVG
1	0.5918	0.6150	0.6285	0.612
2	0.4819	0.5010	0.4837	0.489
3	0.2600	0.2660	0.2597	0.262
4	0.1113	0.1104	0.1111	0.111
5	0.0448	0.0460	0.0450	0.045
6				
7				

Ramp Down

Trial 1	Trial 2	Trial 3	AVG
0.6790	0.7053	0.7036	0.696
0.5385	0.5522	0.5535	0.548
0.2905	0.2915	0.2885	0.290
0.1220	0.1206	0.1235	0.122
0.0526	0.0530	0.0510	0.052

YIELD STRESS DATA

Ramp Up

REF	Trial 1	Trial 2	Trial 3	AVG
1	124.9850	123.4832	122.8009	124
2	101.0324	96.8088	101.4938	100
3	52.3391	50.2659	51.8040	51
4	25.1340	25.2925	26.3825	26
5	11.8365	11.3505	11.2746	11
6				
7				

Ramp Down

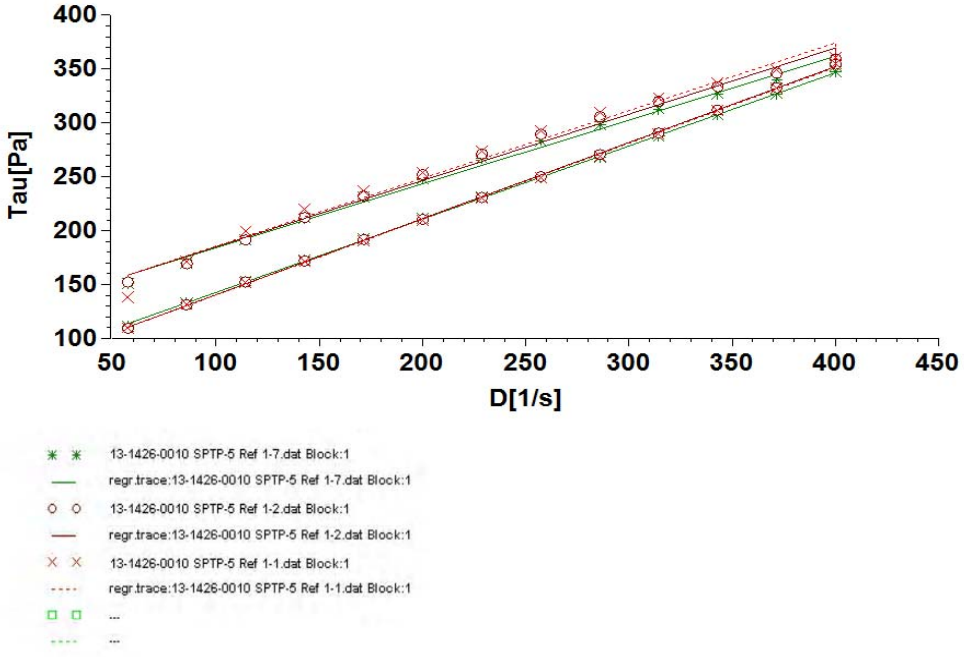
Trial 1	Trial 2	Trial 3	AVG
74.8482	70.1088	69.9602	72
58.8195	58.3922	51.5851	56
31.9418	32.8002	31.4545	32
16.9323	16.8358	16.5970	17
7.7889	7.7898	7.9095	8

WEIGHT PERCENT SOLIDS

REF	Pan #	Pan Wt. (g)	Wet (g)	Dry (g)	Wt% Solids	SVF (Φ)
1	x6	6.01	27.98	23.01	77.38%	0.55
2	32	30.50	63.22	55.35	75.95%	0.53
3	17	30.59	74.70	63.39	74.36%	0.50
4	66	30.69	75.15	62.83	72.29%	0.48
5	Z6	31.55	72.50	60.02	69.52%	0.44
6						
7						

Additional Notes:

13:22 06/08/13
Manual Report Analysis/Regression

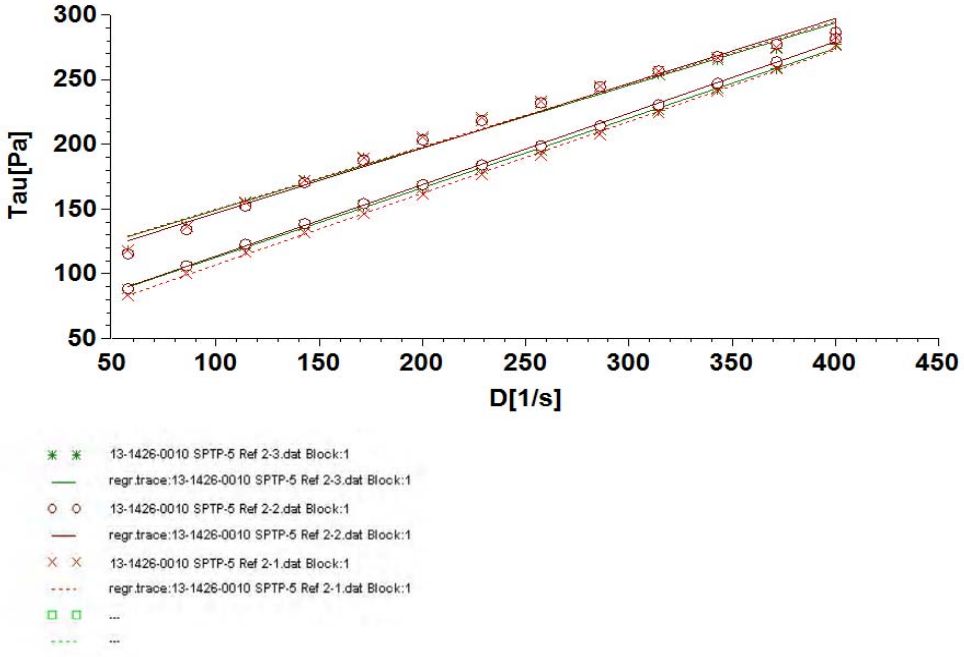


Analysis-results
Analysis data source: 13-1426-0010 SPTP-5 Ref 1-7.dat Block:1
filter activated: D[1/s]>40
step1: Bingham: Y=124.98+0.59184*X ;B=0.99311; S=5.73
step1: Bingham yieldstress[Pa]=124.985
step1: Bingham viscosity[Pas]=0.5918
step2: Bingham: Y=74.848+0.67896*X ;B=0.99984; S=0.988
step2: Bingham yieldstress[Pa]=74.8482
step2: Bingham viscosity[Pas]=0.679

filter activated: D[1/s]>40
step1: Bingham: Y=123.48+0.615*X ;B=0.99214; S=6.36
step1: Bingham yieldstress[Pa]=123.4832
step1: Bingham viscosity[Pas]=0.615
step2: Bingham: Y=70.109+0.70531*X ;B=0.99981; S=1.13
step2: Bingham yieldstress[Pa]=70.1088
step2: Bingham viscosity[Pas]=0.7053

filter activated: D[1/s]>40
step1: Bingham: Y=122.8+0.62851*X ;B=0.98325; S=9.53
step1: Bingham yieldstress[Pa]=122.8009
step1: Bingham viscosity[Pas]=0.6285
step2: Bingham: Y=69.96+0.70358*X ;B=0.99963; S=1.58
step2: Bingham yieldstress[Pa]=69.9602
step2: Bingham viscosity[Pas]=0.7036
End of report

14:02 06/08/13
Manual Report Analysis/Regression

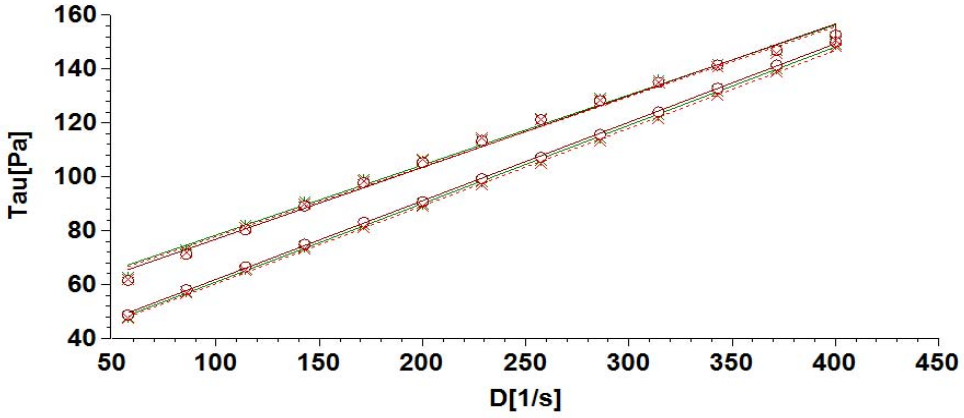


Analysis-results
Analysis data source: 13-1426-0010 SPTP-5 Ref 2-3.dat Block:1
filter activated: D[1/s]>40
step1: Bingham: Y=101.03+0.48193*X ;B=0.98496; S=6.92
step1: Bingham yieldstress[Pa]=101.0324
step1: Bingham viscosity[Pas]=0.4819
step2: Bingham: Y=58.819+0.53846*X ;B=0.99944; S=1.48
step2: Bingham yieldstress[Pa]=58.8195
step2: Bingham viscosity[Pas]=0.5385

filter activated: D[1/s]>40
step1: Bingham: Y=96.809+0.501*X ;B=0.98764; S=6.51
step1: Bingham yieldstress[Pa]=96.8088
step1: Bingham viscosity[Pas]=0.501
step2: Bingham: Y=58.392+0.55216*X ;B=0.99957; S=1.33
step2: Bingham yieldstress[Pa]=58.3922
step2: Bingham viscosity[Pas]=0.5522

filter activated: D[1/s]>40
step1: Bingham: Y=101.49+0.48369*X ;B=0.98294; S=7.41
step1: Bingham yieldstress[Pa]=101.4938
step1: Bingham viscosity[Pas]=0.4837
step2: Bingham: Y=51.585+0.55349*X ;B=0.99928; S=1.72
step2: Bingham yieldstress[Pa]=51.5851
step2: Bingham viscosity[Pas]=0.5535
End of report

14:23 06/08/13
Manual Report Analysis/Regression

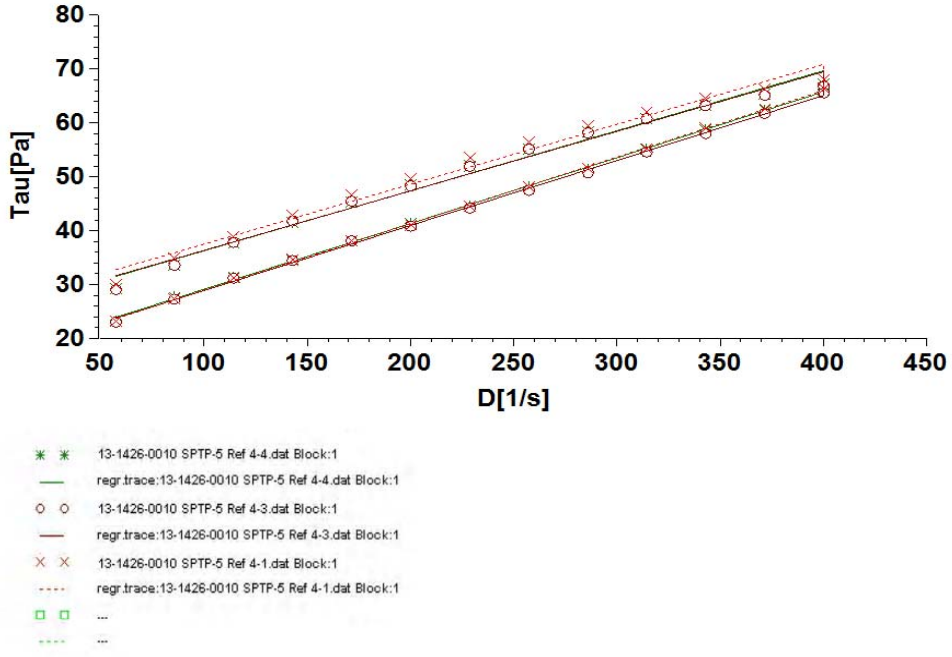


Analysis-results
Analysis data source: 13-1426-0010 SPTP-5 Ref 3-3.dat Block:1
filter activated: D[1/s]>40
step1: Bingham: Y=52.339+0.26*X ;B=0.99255; S=2.62
step1: Bingham yieldstress[Pa]=52.3391
step1: Bingham viscosity[Pas]=0.26
step2: Bingham: Y=31.942+0.29053*X ;B=0.99976; S=0.523
step2: Bingham yieldstress[Pa]=31.9418
step2: Bingham viscosity[Pas]=0.2905

filter activated: D[1/s]>40
step1: Bingham: Y=50.266+0.266*X ;B=0.99372; S=2.46
step1: Bingham yieldstress[Pa]=50.2659
step1: Bingham viscosity[Pas]=0.266
step2: Bingham: Y=32.8+0.29146*X ;B=0.9998; S=0.483
step2: Bingham yieldstress[Pa]=32.8002
step2: Bingham viscosity[Pas]=0.2915

filter activated: D[1/s]>40
step1: Bingham: Y=51.804+0.2597*X ;B=0.99047; S=2.96
step1: Bingham yieldstress[Pa]=51.804
step1: Bingham viscosity[Pas]=0.2597
step2: Bingham: Y=31.454+0.28853*X ;B=0.99959; S=0.678
step2: Bingham yieldstress[Pa]=31.4545
step2: Bingham viscosity[Pas]=0.2885
End of report

14:47 06/08/13
Manual Report Analysis/Regression

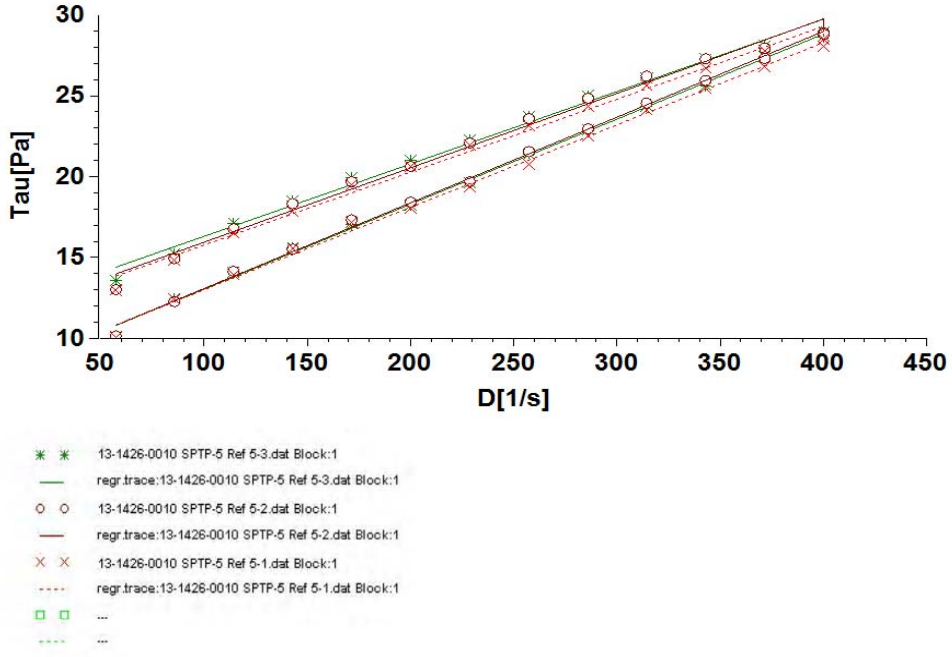


Analysis-results
Analysis data source: 13-1426-0010 SPTP-5 Ref 4-4.dat Block:1
filter activated: D[1/s]>40
step1: Bingham: Y=25.134+0.1113*X ;B=0.98797; S=1.43
step1: Bingham yieldstress[Pa]=25.134
step1: Bingham viscosity[Pas]=0.1113
step2: Bingham: Y=16.932+0.12201*X ;B=0.99945; S=0.333
step2: Bingham yieldstress[Pa]=16.9323
step2: Bingham viscosity[Pas]=0.122

filter activated: D[1/s]>40
step1: Bingham: Y=25.293+0.11041*X ;B=0.98622; S=1.52
step1: Bingham yieldstress[Pa]=25.2925
step1: Bingham viscosity[Pas]=0.1104
step2: Bingham: Y=16.836+0.1206*X ;B=0.99906; S=0.431
step2: Bingham yieldstress[Pa]=16.8358
step2: Bingham viscosity[Pas]=0.1206

filter activated: D[1/s]>40
step1: Bingham: Y=26.382+0.1111*X ;B=0.98488; S=1.6
step1: Bingham yieldstress[Pa]=26.3825
step1: Bingham viscosity[Pas]=0.1111
step2: Bingham: Y=16.597+0.12351*X ;B=0.99937; S=0.362
step2: Bingham yieldstress[Pa]=16.597
step2: Bingham viscosity[Pas]=0.1235
End of report

15:06 06/08/13
Manual Report Analysis/Regression



Analysis-results
Analysis data source: 13-1426-0010 SPTP-5 Ref 5-3.dat Block:1
filter activated: D[1/s]>40
step1: Bingham: Y=11.836+0.044765*X ;B=0.99227; S=0.459
step1: Bingham yieldstress[Pa]=11.8365
step1: Bingham viscosity[Pas]=0.0448
step2: Bingham: Y=7.7889+0.052587*X ;B=0.99802; S=0.272
step2: Bingham yieldstress[Pa]=7.7889
step2: Bingham viscosity[Pas]=0.0526

filter activated: D[1/s]>40
step1: Bingham: Y=11.35+0.046011*X ;B=0.99069; S=0.518
step1: Bingham yieldstress[Pa]=11.3505
step1: Bingham viscosity[Pas]=0.046
step2: Bingham: Y=7.7898+0.052991*X ;B=0.99787; S=0.284
step2: Bingham yieldstress[Pa]=7.7898
step2: Bingham viscosity[Pas]=0.053

filter activated: D[1/s]>40
step1: Bingham: Y=11.275+0.045046*X ;B=0.99272; S=0.448
step1: Bingham yieldstress[Pa]=11.2746
step1: Bingham viscosity[Pas]=0.045
step2: Bingham: Y=7.9095+0.050988*X ;B=0.99677; S=0.337
step2: Bingham yieldstress[Pa]=7.9095
step2: Bingham viscosity[Pas]=0.051
End of report

Golder Associates Ltd.

Viscosity / Flow Curve Testing R/S Plus Rheometer

Client:	Giant Mining Support Services
Project Number:	13-1321-0010
Date:	8/13/2013
Technologist	CA

		Status	Reviewer	Date Complete
Data Entry		**Complete**	**CA**	**8/14/2013**
Data Review	**1st Review**	**Complete**	**CA**	**8/14/2013**
	2nd Review	**Complete**	**ML**	**9/3/2013**

Sample ID:	13-1321-0010 CPTP 01
Sample Description:	coarse, dark grey material
Water:	13-1426-0010 Water
pH Adjustment:	none
Bob:	CC25 Profiled Bob
Additional Info:	
Specific Gravity	2.85

VISCOSITY DATA

Ramp Up

REF	Trial 1	Trial 2	Trial 3	AVG
7"	0.6870	0.6941	0.7015	0.694
10"	0.5546	0.5576	0.5341	0.549

Ramp Down

Trial 1	Trial 2	Trial 3	AVG
0.7428	0.7385	0.7468	0.743
0.5559	0.5831	0.5818	0.574

YIELD STRESS DATA

Ramp Up

REF	Trial 1	Trial 2	Trial 3	AVG
7"	113.9555	107.0076	110.2436	110
10"	67.4374	79.0940	90.4616	79

Ramp Down

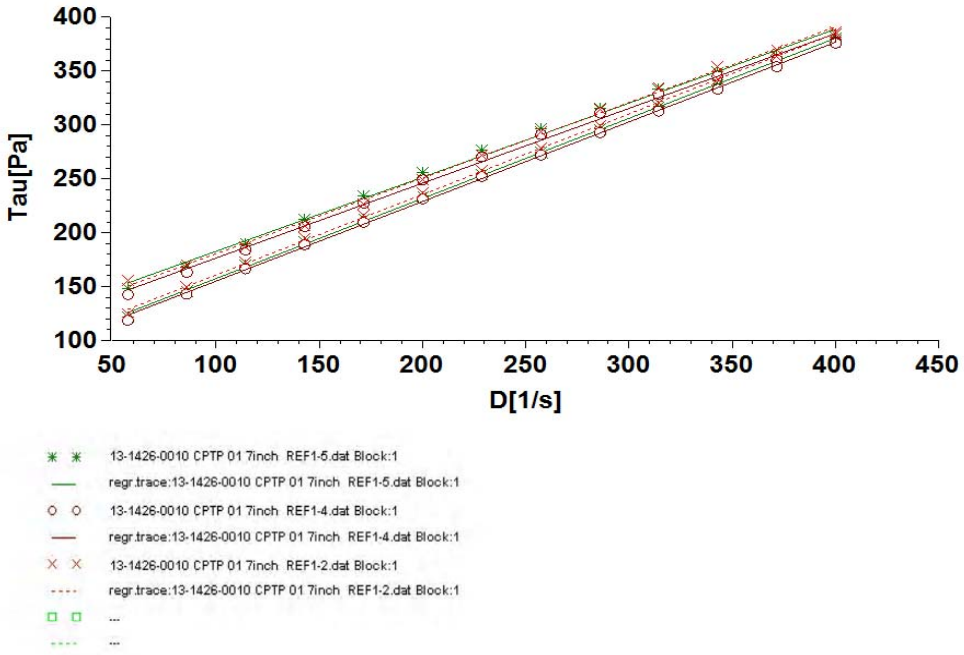
Trial 1	Trial 2	Trial 3	AVG
83.1941	81.2063	86.0897	83
66.5746	65.0049	60.6024	64

WEIGHT PERCENT SOLIDS

REF	Pan #	Pan Wt. (g)	Wet (g)	Dry (g)	Wt% Solids	SVF (Φ)
7"	57	6.75	45.04	36.81	78.51%	0.56
10"	69	6.82	48.00	38.67	77.34%	0.54

Additional Notes:

10:06 13/08/13
Manual Report Analysis/Regression

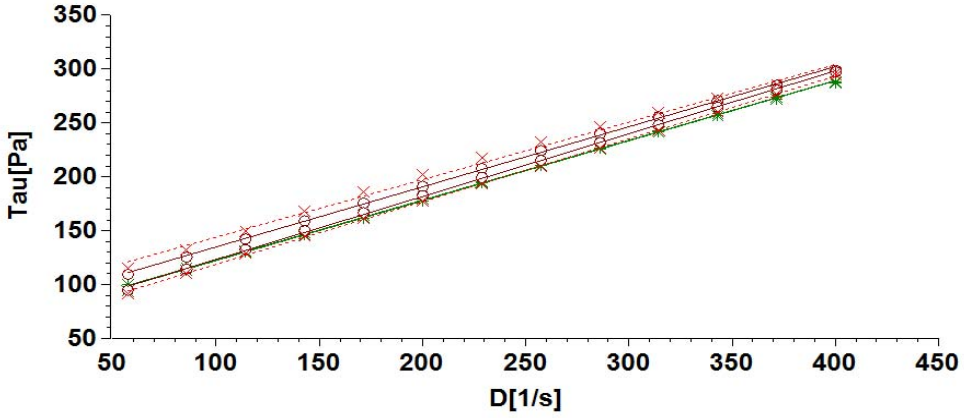


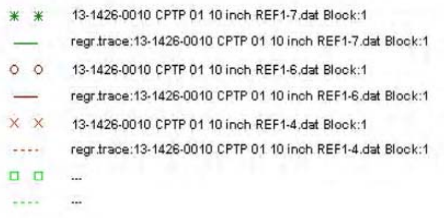
Analysis-results
Analysis data source: 13-1426-0010 CPTP 01 7inch REF1-5.dat Block:1
filter activated: D[1/s]>40
step1: Bingham: Y=113.96+0.68701*X ;B=0.99624; S=4.9
step1: Bingham yieldstress[Pa]=113.9555
step1: Bingham viscosity[Pas]=0.687
step2: Bingham: Y=83.194+0.74276*X ;B=0.99955; S=1.84
step2: Bingham yieldstress[Pa]=83.1941
step2: Bingham viscosity[Pas]=0.7428

filter activated: D[1/s]>40
step1: Bingham: Y=107.01+0.69412*X ;B=0.99693; S=4.47
step1: Bingham yieldstress[Pa]=107.0076
step1: Bingham viscosity[Pas]=0.6941
step2: Bingham: Y=81.206+0.73846*X ;B=0.99942; S=2.07
step2: Bingham yieldstress[Pa]=81.2063
step2: Bingham viscosity[Pas]=0.7385

filter activated: D[1/s]>40
step1: Bingham: Y=110.24+0.70148*X ;B=0.99795; S=3.69
step1: Bingham yieldstress[Pa]=110.2436
step1: Bingham viscosity[Pas]=0.7015
step2: Bingham: Y=86.09+0.74684*X ;B=0.99963; S=1.66
step2: Bingham yieldstress[Pa]=86.0897
step2: Bingham viscosity[Pas]=0.7468
End of report

12:55 13/08/13
Manual Report Analysis/Regression





Analysis-results
Analysis data source: 13-1426-0010 CPTP 01 10 inch REF1-7.dat Block:1
filter activated: D[1/s]>40
step1: Bingham: Y=67.437+0.55463*X ;B=0.99984; S=0.817
step1: Bingham yieldstress[Pa]=67.4374
step1: Bingham viscosity[Pas]=0.5546
step2: Bingham: Y=66.575+0.55593*X ;B=0.99906; S=1.98
step2: Bingham yieldstress[Pa]=66.5746
step2: Bingham viscosity[Pas]=0.5559

filter activated: D[1/s]>40
step1: Bingham: Y=79.094+0.55759*X ;B=0.99941; S=1.58
step1: Bingham yieldstress[Pa]=79.094
step1: Bingham viscosity[Pas]=0.5576
step2: Bingham: Y=65.005+0.58311*X ;B=0.9996; S=1.36
step2: Bingham yieldstress[Pa]=65.0049
step2: Bingham viscosity[Pas]=0.5831

filter activated: D[1/s]>40
step1: Bingham: Y=90.462+0.53406*X ;B=0.99473; S=4.52
step1: Bingham yieldstress[Pa]=90.4616
step1: Bingham viscosity[Pas]=0.5341
step2: Bingham: Y=60.602+0.58181*X ;B=0.99979; S=0.982
step2: Bingham yieldstress[Pa]=60.6024
step2: Bingham viscosity[Pas]=0.5818
End of report

Golder Associates Ltd.

Viscosity / Flow Curve Testing R/S Plus Rheometer

Client:	Giant Mining Support Services
Project Number:	13-1426-0010
Date:	8/14/2013
Technologist	CA

		Status	Reviewer	Date Complete
Data Entry		**Complete**	**CA**	**8/15/2013**
Data Review	**1st Review**	**Complete**	**CA**	**8/15/2013**
	2nd Review	**Complete**	**ML**	**9/3/2013**

Sample ID:	13-1426-0010 CPTP 02
Sample Description:	coarse, dark grey material
Water:	13-1426-0010 Water
pH Adjustment:	none
Bob:	CC25 Profiled Bob
Additional Info:	
Specific Gravity	2.86

VISCOSITY DATA

Ramp Up

REF	Trial 1	Trial 2	Trial 3	AVG
7.25"	0.8956	0.8908	0.8464	0.878
10"	0.7681	0.7641	0.7657	0.766

Ramp Down

Trial 1	Trial 2	Trial 3	AVG
0.9894	1.0377	1.0564	1.028
0.8977	0.8807	0.8971	0.892

YIELD STRESS DATA

Ramp Up

REF	Trial 1	Trial 2	Trial 3	AVG
7.25"	184.5833	190.8189	218.8424	198
10"	165.7810	157.1368	171.9295	165

Ramp Down

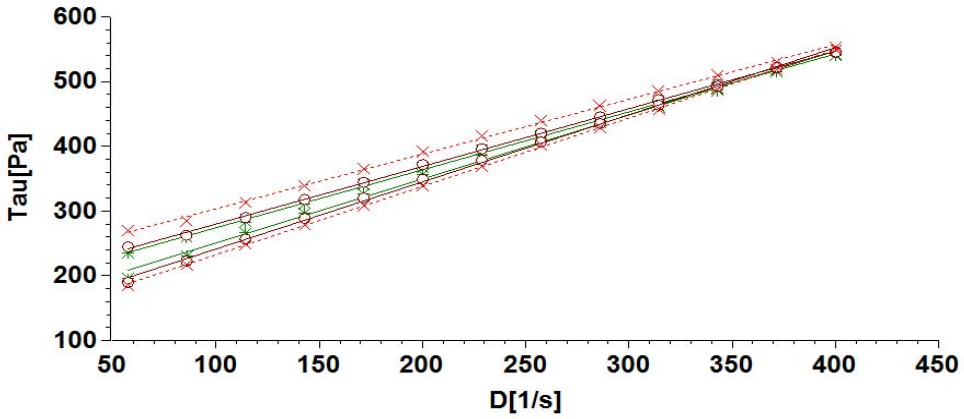
Trial 1	Trial 2	Trial 3	AVG
151.5568	137.5879	126.8997	139
97.6788	105.7071	105.9426	103

WEIGHT PERCENT SOLIDS

REF	Pan #	Pan Wt. (g)	Wet (g)	Dry (g)	Wt% Solids	SVF (Φ)
7.25"	X3	6.25	35.17	28.91	78.35%	0.56
10"	4	30.49	73.00	63.37	77.35%	0.54

Additional Notes:

10:58 14/08/13
Manual Report Analysis/Regression

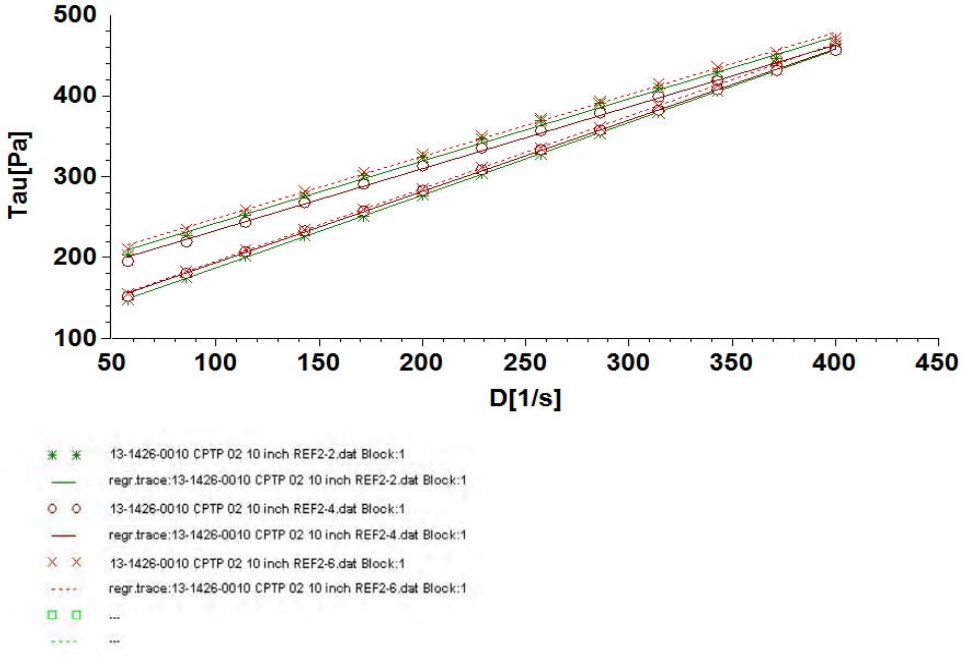


Analysis-results
Analysis data source: 13-1426-0010 CPTP 02 7.25 inch REF1-2.dat Block:1
filter activated: D[1/s]>40
step1: Bingham: Y=184.58+0.89561*X ;B=0.99943; S=2.49
step1: Bingham yieldstress[Pa]=184.5833
step1: Bingham viscosity[Pas]=0.8956
step2: Bingham: Y=151.56+0.98944*X ;B=0.9967; S=6.62
step2: Bingham yieldstress[Pa]=151.5568
step2: Bingham viscosity[Pas]=0.9894

filter activated: D[1/s]>40
step1: Bingham: Y=190.82+0.89085*X ;B=0.99956; S=2.17
step1: Bingham yieldstress[Pa]=190.8189
step1: Bingham viscosity[Pas]=0.8908
step2: Bingham: Y=137.59+1.0377*X ;B=0.99885; S=4.09
step2: Bingham yieldstress[Pa]=137.5879
step2: Bingham viscosity[Pas]=1.0377

filter activated: D[1/s]>40
step1: Bingham: Y=218.84+0.84635*X ;B=0.9989; S=3.27
step1: Bingham yieldstress[Pa]=218.8424
step1: Bingham viscosity[Pas]=0.8464
step2: Bingham: Y=126.9+1.0564*X ;B=0.99986; S=1.47
step2: Bingham yieldstress[Pa]=126.8997
step2: Bingham viscosity[Pas]=1.0564
End of report

11:38 14/08/13
Manual Report Analysis/Regression



Analysis-results
Analysis data source: 13-1426-0010 CPTP 02 10 inch REF2-2.dat Block:1
filter activated: D[1/s]>40
step1: Bingham: Y=165.78+0.76814*X ;B=0.99648; S=5.3
step1: Bingham yieldstress[Pa]=165.781
step1: Bingham viscosity[Pas]=0.7681
step2: Bingham: Y=97.679+0.89771*X ;B=0.99994; S=0.809
step2: Bingham yieldstress[Pa]=97.6788
step2: Bingham viscosity[Pas]=0.8977

filter activated: D[1/s]>40
step1: Bingham: Y=157.14+0.76413*X ;B=0.99835; S=3.61
step1: Bingham yieldstress[Pa]=157.1368
step1: Bingham viscosity[Pas]=0.7641
step2: Bingham: Y=105.71+0.8807*X ;B=0.99973; S=1.67
step2: Bingham yieldstress[Pa]=105.7071
step2: Bingham viscosity[Pas]=0.8807

filter activated: D[1/s]>40
step1: Bingham: Y=171.93+0.76568*X ;B=0.99833; S=3.64
step1: Bingham yieldstress[Pa]=171.9295
step1: Bingham viscosity[Pas]=0.7657
step2: Bingham: Y=105.94+0.89711*X ;B=0.99992; S=0.931
step2: Bingham yieldstress[Pa]=105.9426
step2: Bingham viscosity[Pas]=0.8971
End of report

APPENDIX C

Photos

Client : PWGSC Giant Mine	**Project Number : 13-1426-0010**
Site Name : Sudbury Laboratory	

Photograph 1

13-1426-0010 STPT – 1 TP1 as received

Observations:
-till + some clay
-no clumps of clay after mixing, easy to mix
-material sticks to itself once water is added and sample is homogenized
-bleeds water as soon as you stop mixing

Photograph 2

13-1426-0010 STPT – 1 TP1 as received
-sample shown halfway down the pail
-larger clay clumps

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Client : PWGSC Giant Mine	**Project Number : 13-1426-0010**
Site Name : Sudbury Laboratory	

Photograph 3 13-1426-0010 STPT – 1 TP1 homogenized	
Photograph 4 13-1426-0010 STPT – 2 TP2 as received Observations: -till + some clay -no clumps of clay after mixing, easy to mix -material sticks to itself once water is added and sample is homogenized -bleeds water as soon as you stop mixing	

Client : PWGSC Giant Mine	**Project Number : 13-1426-0010**
Site Name : Sudbury Laboratory	

Photograph 5 13-1426-0010 STPT – 2 TP2 as received -sample shown halfway down the pail	
Photograph 6 13-1426-0010 STPT – 2 TP2 homogenized	

Client : PWGSC Giant Mine	**Project Number : 13-1426-0010**
Site Name : Sudbury Laboratory	

Photograph 7

13-1426-0010 STPT – 3 as received

Observations:
-till + some clay
-no clumps of clay after mixing, easy to mix
-material sticks to itself once water is added and sample is homogenized
-bleeds water as soon as you stop mixing

Photograph 8

13-1426-0010 STPT – 3 as received
-sample shown halfway down the pail
-medium size clay clumps

Client : PWGSC Giant Mine	**Project Number : 13-1426-0010**
Site Name : Sudbury Laboratory	

Photograph 9 13-1426-0010 STPT – 3 homogenized	
Photograph 10 13-1426-0010 STPT – 4 as received Observations: -some clay clumps -water on top of sample when received -sample harder to mix compared to others since sample was more compact in pail -more time needed to homogenize sample -no clumps after sample was mixed -bleeds water as soon as	

Client : PWGSC Giant Mine	**Project Number : 13-1426-0010**
Site Name : Sudbury Laboratory	

Photograph 11 13-1426-0010 STPT – 4 as received -sample shown halfway down the pail	
Photograph 12 13-1426-0010 STPT – 4 homogenized	

Client : PWGSC Giant Mine	**Project Number : 13-1426-0010**
Site Name : Sudbury Laboratory	

Photograph 13

13-1426-0010 STPT – 5 as received

Observations:
-some clay clumps
-no clumps of clay after mixing, easy to mix
-material sticks to itself once water is added and sample is homogenized
-bleeds water as soon as you stop mixing

Photograph 14

13-1426-0010 STPT – 5 as received
-sample shown halfway down the pail

Client : PWGSC Giant Mine	**Project Number : 13-1426-0010**
Site Name : Sudbury Laboratory	

Photograph 15

13-1426-0010 STPT – 5 homogenized

Photograph 16

13-1426-0010 STPT – 6 as received

Observations:
-some clay clumps
-no clumps of clay after mixing, easy to mix
-material sticks to itself once water is added and sample is homogenized
-bleeds water as soon as you stop mixing

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Client : PWGSC Giant Mine	**Project Number : 13-1426-0010**
Site Name : Sudbury Laboratory	

Photograph 17 13-1426-0010 STPT – 6 as received -sample shown halfway down the pail -larger clumps of clay	
Photograph 18 13-1426-0010 STPT – 6 homogenized	

Client : PWGSC Giant Mine	**Project Number : 13-1426-0010**
Site Name : Sudbury Laboratory	

Photograph 19

13-1426-0010 CPTP 01 as received

Observations:
-mostly till, only a few clay clumps
-no clumps of clay after mixing, easy to mix
-material sticks to itself once water is added and sample is homogenized
-bleeds water as soon as you stop mixing

Photograph 20
13-1426-0010 CPTP 01 as received
-sample shown halfway down the pail

Client : PWGSC Giant Mine	**Project Number : 13-1426-0010**
Site Name : Sudbury Laboratory	

Photograph 21

13-1426-0010 CPTP 02 as received

Observations:
-mostly till, only a few clay clumps
-no clumps of clay after mixing, easy to mix
-material sticks to itself once water is added and sample is homogenized
-bleeds water as soon as you stop mixing

Photograph 22
13-1426-0010 CPTP 02 as received
-sample shown halfway down the pail

Client : PWGSC Giant Mine	**Project Number : 13-1426-0010**
Site Name : Sudbury Laboratory	

Photograph 23

13-1426-0010 CPTP 02 homogenized

Photograph 24

13-1426-0010 SPTP 1-2-3 as received

Observations:

- mostly till with some small to large clay chunks
- larger clay chunks easy to break up as long as material is above a 7" – 8" slump
- after thoroughly homogenizing material small clay balls are present throughout the entire sample
- clay balls can be easily broken up between fingers and after sitting undisturbed for 48 hrs all clay balls were broken up and not visible after re-homogenzing the sample

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Client : PWGSC Giant Mine	**Project Number : 13-1426-0010**
Site Name : Sudbury Laboratory	

Photograph 25

13-1426-0010 SPTP

4-5-6 as received

Observations:
- much higher clay content than SPTP 1-2-3 sample
- more effort and time needed to homogenize sample
- after thoroughly homogenizing larger clay chunks, some an inch in diameter were still present and could not be broken up and mixed into sample
- clay chunks after mixing could not be broken between fingers, only squished and slightly displaced
- however like SPTP 1-2-3 sample these clay chunks broke up after sitting undisturbed for 48 hrs and were not visible after re-homogenizing sample

Photograph 26

13-1426-0010 SPTP

-4 - 178mm slump

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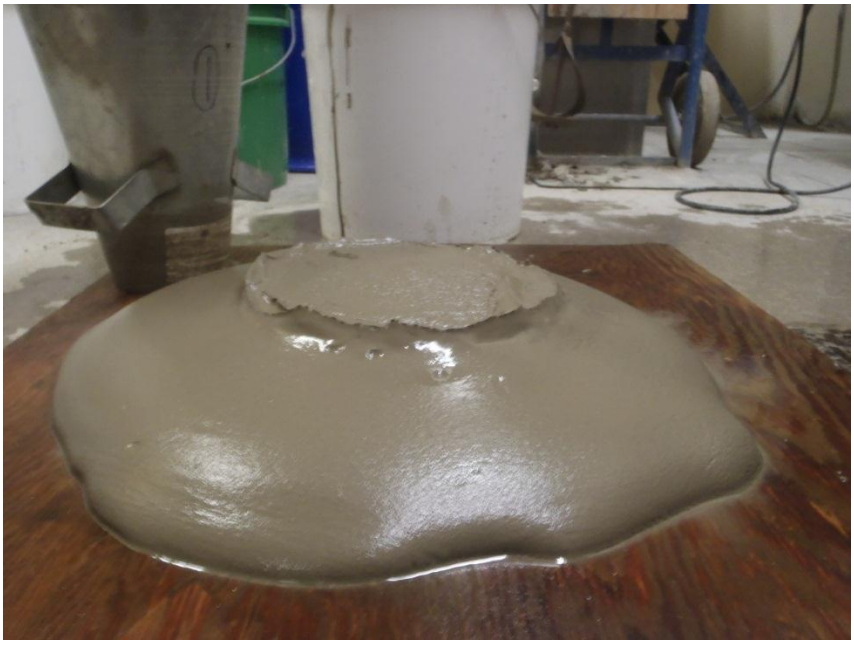
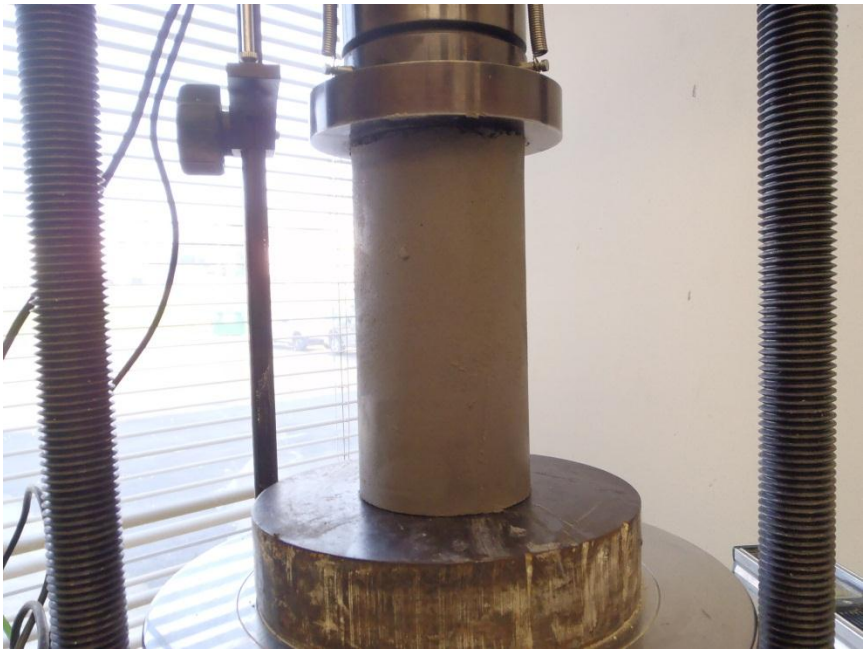
Client : PWGSC Giant Mine	**Project Number : 13-1426-0010**
Site Name : Sudbury Laboratory	

Photograph 27 13-1426-0010 SPTP -4 - 254mm slump	
Photograph 28 13-1426-0010 SPTP -5 - 178mm slump	

Client : PWGSC Giant Mine	**Project Number : 13-1426-0010**
Site Name : Sudbury Laboratory	

Photograph 29 13-1426-0010 SPTP -5 - 254mm slump	
Photograph 30 13-1426-0010 Mix 1 – 7 day UCS	

Client : PWGSC Giant Mine	**Project Number : 13-1426-0010**
Site Name : Sudbury Laboratory	

Photograph 31 13-1426-0010 Mix 1 – 7 day UCS	
Photograph 32 13-1426-0010 Mix 2 – 7 day UCS	

Client : PWGSC Giant Mine	**Project Number : 13-1426-0010**
Site Name : Sudbury Laboratory	

Photograph 33

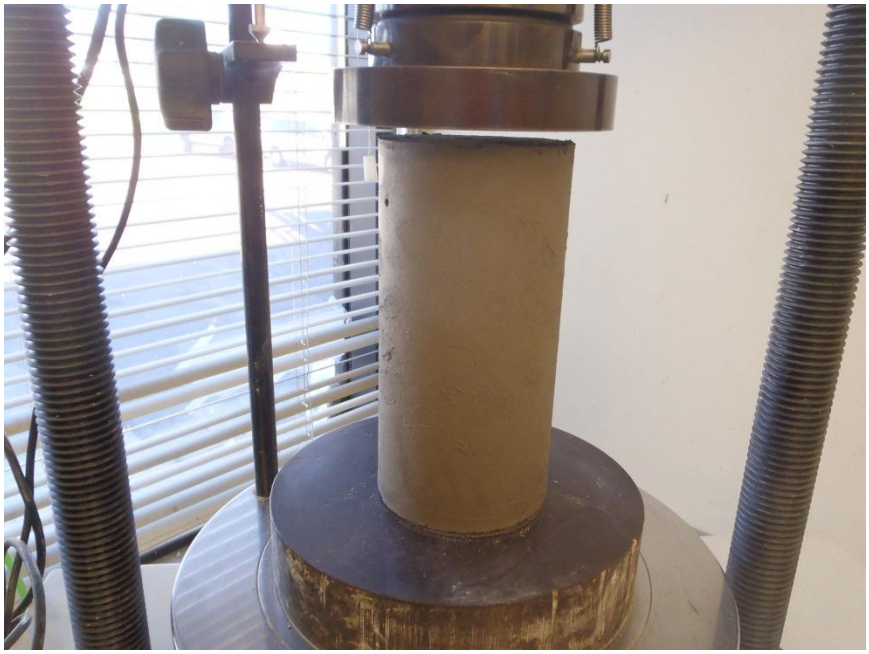
13-1426-0010

Mix 2 – 7 day UCS

Photograph 34

13-1426-0010

Mix 3 – 7 day UCS



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Client : PWGSC Giant Mine	**Project Number : 13-1426-0010**
Site Name : Sudbury Laboratory	

Photograph 35

13-1426-0010

Mix 3 – 7 day UCS

Photograph 36

13-1426-0010

Mix 4 – 7 day UCS

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Client : PWGSC Giant Mine	**Project Number : 13-1426-0010**
Site Name : Sudbury Laboratory	

Photograph 37 13-1426-0010 Mix 4 – 7 day UCS	
Photograph 38 13-1426-0010 Mix 5 – 7 day UCS	

Client : PWGSC Giant Mine	**Project Number : 13-1426-0010**
Site Name : Sudbury Laboratory	

Photograph 39

13-1426-0010

Mix 5 – 7 day UCS

Photograph 40

13-1426-0010

Mix 6 – 7 day UCS

Client : PWGSC Giant Mine	**Project Number : 13-1426-0010**
Site Name : Sudbury Laboratory	

Photograph 41 13-1426-0010 Mix 6 – 7 day UCS	
Photograph 42 13-1426-0010 Mix 7 – 7 day UCS	

Client : PWGSC Giant Mine	**Project Number : 13-1426-0010**
Site Name : Sudbury Laboratory	

Photograph 43

13-1426-0010

Mix 7 – 7 day UCS

Photograph 44

13-1426-0010

Mix 8 – 7 day UCS

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Client : PWGSC Giant Mine	**Project Number : 13-1426-0010**
Site Name : Sudbury Laboratory	

Photograph 45

13-1426-0010

Mix 8 – 7 day UCS

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