Klohn Crippen Berger

Resolution Copper Mining LLC

Resolution Copper Project

Near West Tailings Storage Facility

Geotechnical Site Characterization Report

Volume 2 of 4 – Appendices I and II

CANADA'S BEST MANAGED COMPANIES Platinum member

ISO 9001
ISO 14001
OHSAS 18001

M09441A18.730

October 2017

APPENDIX I

Drill Hole and Test Trench Details

Appendix I
Drill Hole and Test Trench Details

I-1 PROJECT TEAM AND RESPONSIBILITIES

The project team and responsibilities are summarized in Table I-1.

Table I-1 Project Team Members

Team Member	Role
Resolution Copper Mining LLC (RCM)	Owner
Klohn Crippen Berger Ltd. (KCB)	TSF Design Consultant
Golder Associates Inc. (Golder)	Site Investigation Consultant
Montgomery and Associates (M&A)	Hydrogeology Consultant
Duke HydroChem, LLC	Geochemistry Consultant
Boart Longyear	Geotechnical Drilling Contractor
National Drilling	Hydrogeology Drilling Contractor
HGI Hydrogeophysics (HGI)	Down Hole Shear Wave Contractor
Southwest Geophysics Inc.	Down Hole Geophysics Contractor
DalMolin Excavating	Test Trench Excavation Contractor
ATL, Inc.	Geotechnical Laboratory
ALS Laboratories	Geochemical Laboratory
Shephard-Wesnitzer, Inc. (SWI)	Surveying Contractor

I-2 GEOTECHNICAL DRILLING DETAILS

Drill hole depths and lithologic unit contacts are summarized in Table I-2.

Table I-2 Summary of Geotechnical Drill Holes

Hole ID	Northing (State Plane NAD 83)	Easting (State Plane NAD 83)	Hole Top Elevation (fasl)	Hole Depth (ft)	Depth to Top of Unit (ft)	Top of Unit Elevation (ft)	Geologic Unit
DH16-01	838455.3	923218.8	2406.7	451.0	0.0	2406.7	Tss
					25.0	2381.7	Tcg
					358.0	2048.7	Tb
					427.0	1979.7	Ym
DH16-02	840617.7	919190.4	2391.1	260.0	0.0	2391.1	Qs
					4.5	2386.6	Tcg
					248.2	2142.9	Tal
DH16-03	842613.8	918055.2	2487.7	164.0	0.0	2487.7	Qs
					3.5	2484.2	Tcg
					161.0	2326.7	Tal

Hole ID	Northing (State Plane NAD 83)	Easting (State Plane NAD 83)	Hole Top Elevation (fasl)	Hole Depth (ft)	Depth to Top of Unit (ft)	Top of Unit Elevation (ft)	Geologic Unit
DH16-04	840820.5	916971.3	2429.4	220.0	0.0	2429.4	Xp
					103.5	2325.9	Yd
					142.0	2287.4	Xp
DH16-05	838306.7	916380.8	2251.0	250.0	0.0	2251.0	Qal
					6.0	2245.0	Yd
					30.0	2221.0	Xp
					80.5	2170.5	Yd
					118.7	2132.3	Xp
DH16-06	841669.4	924865.5	2561.6	249.0	0.0	2561.6	Tcg
DH16-07	843639.6	926190.8	2496.6	249.0	0.0	2496.6	Qs
					3.5	2493.1	Tcg
					122.7	2373.9	Tp
DH16-08	842210.9	922847.6	2441.6	34.0	0.0	2441.6	Qs
					6.0	2435.6	Tcg
DH16-09	845384.4	927715.4	2619.7	250.0	0.0	2619.7	Tp
DH16-10	845876.6	929846.5	2699.5	254.0	0.0	2699.5	Tp
DH16-11	850298.7	924155.5	2704.0	254.0	0.0	2704.0	Qs
					7.5	2696.5	Yd
DH16-12	847001.8	923395.5	2669.1	293.0	0.0	2669.1	Tcg
DH16-13	849356.6	921449.2	2733.8	249.0	0.0	2733.8	Tcg
					148.6	2585.2	Tal
DH16-14	845266.2	910364.5	2316.0	238.5	0.0	2316.0	Qs
					4.5	2311.5	Xp
DH16-15	845116.3	920175.6	2667.7	290.0	0.0	2667.7	Tcg
DH16-16	845081.2	912658.1	2284.5	250.0	0.0	2284.5	Qal
					7.0	2277.5	Xp
					190.0	2094.5	Yd
DH16-17	851183.5	924179.7	2671.9	199.0	0.0	2671.9	Xp
DH16-18	842318.9	909644.3	2222.0	249.5	0.0	2222.0	Qal
DH16-18	842318.9	909644.3	2222.0	249.5	13.5	2208.5	Xp
DH16-19	846100.6	916858.5	2443.4	249.0	0.0	2443.4	Yd
					42.3	2401.1	Ym
					49.7	2393.7	Yd
DH16-20	844754.3	915215.3	2369.5	250.0	0.0	2369.5	Yd
					41.0	2328.5	Ym
					45.0	2324.5	Yd
					47.0	2322.5	Ym
					133.5	2236.0	Yds
DH16-21	845595.1	917417.3	2406.9	249.0	0.0	2406.9	Qs
					15.0	2391.9	Yd
					87.0	2319.9	Ym
					95.0	2311.9	Yd

Hole ID	Northing (State Plane NAD 83)	Easting (State Plane NAD 83)	Hole Top Elevation (fasl)	Hole Depth (ft)	Depth to Top of Unit (ft)	Top of Unit Elevation (ft)	Geologic Unit
DH16-22	841504.9	912414.7	2306.6	250.0	0.0	2306.6	Qs
					3.0	2303.6	Xp
DH17-23	843657.7	916937.3	2419.8	29.0	0.0	2419.8	Tal
DH17-24	841496.8	912408.1	2305.6	75.0	0.0	2305.6	Xp
DH17-25	843072.1	914518.6	2350.4	249.0	0.0	2350.4	Yp
DH17-26	834202.6	924372.3	2383.8	250.0	0.0	2383.8	Tss
					147.0	2236.8	Tb
DH17-27	832979.7	923496.8	2334.9	250.0	0.0	2334.9	Qs
					6.4	2328.5	Tb
					192.0	2142.9	Tt
					247.0	2087.9	Xp
DH17-28	835608.2	929093.2	2496.9	250.0	0.0	2496.9	Tcg
DH17-29	838455.3	923218.8	2406.7	62.0	0.0	2406.7	Tss
					22.0	2384.7	Tcg
DH17-30	833494.3	931598.7	2477.4	249.0	0.0	2477.4	Qal
					14.0	2463.4	Tcg
DH17-31	845411.4	939682.6	2877.3	249.0	0.0	2877.3	Qs
					15.0	2862.3	Tal
					155.0	2722.3	Ym
					227.3	2650.0	Yd
DH17-32	837484.1	915574.4	2233.6	250.0	0.0	2233.6	Qal
					34.7	2198.9	Xp
					52.0	2181.6	Yd
					56.5	2177.1	Xp
DH17-33	842127.9	937283.4	2704.0	250.0	0.0	2704.0	Qs
					5.0	2699.0	Tcg
					82.0	2622.0	Tt
DH17-34	837284.7	937527.1	2639.0	250.0	0.0	2639.0	Qal
					6.0	2633.0	Tcg
DH17-35	842860.6	933752.2	2699.4	250.0	0.0	2699.4	Qs
					3.0	2696.4	Yd
					134.0	2565.4	Ym
DH17-36	838459.9	923196.9	2406.4	100.0	0.0	2406.4	Qs
					2.0	2404.4	Tcg
DH17-37	839409.5	936283.7	2643.2	250.0	0.0	2643.2	Qs
					11.0	2632.2	Tcg
DH17-38	838101.6	926241.0	2404.2	250.0	0.0	2404.2	Qs
					11.0	2393.2	Tcg

I-3 RATIONALE FOR PIEZOMETER ZONE SELECTION

Table I-3 Rationale for Piezometer Zone Selection

Drill Hole	Installation Target / Rationale
DH16-01	Deep well in limestone across same interval as DS16-01. DH16-01 to serve as a monitoring well for pumping test in DS16-01.
DH16-02	Long screen in the shallow Gila conglomerate to allow permeability testing in the vadose zone. Also will allow characterization of the first 90 ft of Gila. This was prioritized over instrumenting a deeper water producing feature.
DH16-03	Two part screen both in shallow Gila conglomerate, from 10 to 30 ft, and from 40 to 60 ft on a high permeability crack in the Gila conglomerate at 55 ft. The purpose was we could use a packer to seal between the two screens to perform slug tests in the shallow Gila conglomerate, while still monitoring the high permeability crack at 55 ft.
DH16-04	Well screened below 100 ft to allow downhole seismic shear wave measurements of the grouted portion of the standpipe. All of the overlying rock was presumed to be hydraulically connected due to the close fracturing.
DH16-05	Two part screen installed in Pinal Schist (some quartzite and intrusives). Will allow slug testing of zone from 25 to 45 ft once packer is installed. Will ensure water samples and levels can be measured if static water level is below 45 ft. If water level is shallow (less than 45 ft), lower zone can be backfilled with bentonite pellets.
DH16-06	Screened below 100 ft to allow downhole shear wave measurements of the grouted portion of the standpipe. Screen top set near a fracture in Gila at 125 ft that drill fluid circulation was lost on.
DH16-07	Screened across groundwater table and in shallow weathered zone of Gila conglomerate.
DH16-08	Screened across the assumed groundwater table, with a long screen to ensure a portion of it is below the groundwater table.
DH16-09	Screened across groundwater table and zone of lost drilling fluid circulation at 161 ft.
DH16-10	Screened across groundwater table and zone of lost drilling fluid circulation at 244 ft.
DH16-11	Screened across assumed groundwater table in slightly weathered to fresh diabase.
DH16-12	Long screen across assumed groundwater table, sand pack brought up 30 ft above top of screen to try to intersect higher permeability zone.
DH16-13	Screened across groundwater table in tuff with low to moderate permeability.
DH16-14	Screened across assumed groundwater table in low permeability Pinal schist.
DH16-15	Screened across assumed groundwater table in Gila conglomerate, up to 190 ft to capture discontinuity at 195 ft.
DH16-16	Screened over the same interval as the adjacent DS hole in order to carry out a pumping test or a possible tracer test between the two holes.
DH16-17	Screened across assumed groundwater table.
DH16-18	Paired DS hole completed below 180 ft, water level at about 30 ft. Installed a shallow well as the DS hole already has pressure transducer at 150 ft and is screened below 180 ft.

Drill Hole	Installation Target / Rationale
DH16-19	Well screened below 100 ft to allow downhole seismic shear wave measurements of the grouted portion of the standpipe. A long screen was selected to maximize the response in low permeability Diabase.
DH16-20	Target piezometer on low permeability limestone across the groundwater table from low RQD zone at 100ft.
DH16-21	Screened across the assumed groundwater table.
DH16-22	Well screened below 100 ft to allow downhole seismic shear wave measurements of the grouted portion of the standpipe. DH17-24 was drilled on the same pad in order to install a shallow piezometer across the groundwater table.
DH17-23	Screened over a long interval to be below the assumed groundwater table, but also to intersect a zone of lost drill fluid circulation at 52 ft.
DH17-24	Screened across the assumed groundwater table.
DH17-25	Screened across the assumed groundwater table.
DH17-26	Screened below groundwater table to prioritize water chemistry in deeper pervious formation over shallow zone. A shallow piezometer was installed in DH17-27 to ensure coverage of shallow zone.
DH17-27	Screened across the assumed groundwater table, but screen brought up into shallow zone to capture zone of moderate permeability between 32 ft and 62 ft.
DH17-28	Screened across the assumed groundwater table.
DH17-29	Hole backfilled with grout to surface due to permitting issues.
DH17-30	Screened across the assumed groundwater table.
DH17-31	Screened across groundwater table with long screen across high permeability tuff and limestone for potential water quality monitoring.
DH17-32	Screened across groundwater table with long screen in schist for potential water quality monitoring.
DH17-33	Screened just below groundwater table across zones of lost drill fluid circulation at 47 ft and 52 ft in Gila conglomerate.
DH17-34	Hole was grouted to surface as the adjacent DS hole was screened across the shallow zone.
DH17-35	A long screen was installed across the assumed groundwater table.
DH17-36	A long screen was installed across the assumed groundwater table.
DH17-37	Screened just below groundwater table across zones of lost drill fluid circulation at 67 ft and 82 ft in Gila conglomerate.
DH17-38	A long screen was installed across the assumed groundwater table.

I-4 TEST TRENCHING DETAILS

Test trench details and lithologic contacts are presented in Table I-4.

Table I-4 Test Trench Details

Hole ID	Northing (State Plane NAD 83)	Easting (State Plane NAD 83)	Hold Top Elevation (fasl)	Hole Depth (ft)	Depth to Top of Unit (ft)	Top of Unit Elevation (ft)	Geologic Unit
TP16-01	834600.50	921637.50	2327.10	10.00	0.00	2327.10	Qoa (lu)
TP16-02	835966.40	922810.40	2351.50	7.50	0.00	2351.50	Qoa
TP16-03	836125.10	922950.10	2354.20	8.00	0.00	2354.20	Qoa
TP16-04	837235.40	921929.40	2351.40	4.50	0.00	2351.40	Qoa (lu)
					1.00	2350.40	Tss
TP16-05	837632.60	921190.70	2345.30	5.00	0.00	2345.30	Qoa (lu)
					1.00	2344.30	Tss
TP16-06	847387.10	928654.10	2633.00	9.00	0.00	2633.00	Qs
TP16-07	845349.60	917532.30	2393.40	9.00	0.00	2393.40	Qs
					6.00	2387.40	Yd
TP16-08	844241.60	913961.20	2316.70	7.00	0.00	2316.70	Qs
TP16-09	843939.30	913917.90	2307.20	7.00	0.00	2307.20	Qs
					4.00	2303.20	Yds
TP16-10	845170.80	912879.80	2273.30	8.00	0.00	2273.30	Qal
TP16-11	844417.00	911511.10	2250.80	10.50	0.00	2250.80	Qal
TP16-12	843840.90	911316.00	2242.10	13.50	0.00	2242.10	Qal
					13.00	2229.10	Xp
TP16-13	842154.70	909538.70	2217.00	11.00	0.00	2217.00	Qal
					9.00	2208.00	Xp
TP16-14	842064.60	909746.30	2208.00	14.50	0.00	2208.00	Qal
TP16-15	834508.40	923857.00	2373.50	5.50	0.00	2373.50	Qoa (lu)
					0.50	2373.00	Tss
TP16-16	834132.20	924736.70	2403.30	5.50	0.00	2403.30	Qoa (lu)
					2.50	2400.80	Tss
TP16-17	833875.10	925733.40	2408.80	2.50	0.00	2408.80	Qoa (lu)
					1.00	2407.80	Tss
TP16-18	832690.50	930624.50	2458.40	15.00	0.00	2458.40	Qoa (lu)
					2.50	2455.90	Qoa
TP16-19	832629.90	930828.50	2445.80	14.50	0.00	2445.80	Qal
TP16-20	833496.80	931618.40	2477.40	8.00	0.00	2477.40	Qal
TP16-21	833442.60	931802.70	2470.20	11.00	0.00	2470.20	Qal
TP16-22	835815.60	934410.90	2556.20	11.00	0.00	2556.20	Qal
TP16-23	835935.40	934229.40	2548.80	13.00	0.00	2548.80	Qal

Hole ID	Northing (State Plane NAD 83)	Easting (State Plane NAD 83)	Hold Top Elevation (fasl)	Hole Depth (ft)	Depth to Top of Unit (ft)	Top of Unit Elevation (ft)	Geologic Unit
TP16-24	836446.10	940434.80	2744.00	13.00	0.00	2744.00	Qal
TP16-25	837182.30	936863.40	2623.70	10.00	0.00	2623.70	Qal
					10.00	2613.70	Tcg
TP16-26	842383.30	937412.30	2702.90	10.00	0.00	2702.90	Qoa
					10.00	2692.90	Tcg
TP16-27	839004.50	936129.10	2626.40	8.00	0.00	2626.40	Qal
TP16-28	831625.60	927466.50	2389.80	3.00	0.00	2389.80	Qoa (lu)
					1.00	2388.80	Tss
TP17-29	837056.10	923562.30	2392.80	9.00	0.00	2392.80	Qoa (lu)
					3.00	2389.80	Qoa
					6.00	2386.80	Tss
TP17-30	837446.70	923939.60	2402.70	10.00	0.00	2402.70	Qoa (lu)
					2.00	2400.70	Qoa
					6.00	2396.70	Tss
TP17-31	842237.00	922823.00	2441.40	7.50	0.00	2441.40	Qs
TP17-32	843668.00	926165.00	2498.50	3.50	0.00	2498.50	Tcg
TP17-33	841667.00	924850.00	2568.50	3.50	0.00	2568.50	Tcg
TP17-34	838469.00	923191.00	2407.90	3.00	0.00	2407.90	Tcg
TP17-35	840639.00	919194.00	2391.30	4.50	0.00	2391.30	Tcg
TP17-36	842616.00	918064.00	2488.10	2.50	0.00	2488.10	Tcg
TP17-37	845108.00	920153.00	2665.60	3.50	0.00	2665.60	Tcg
TP17-38	846998.00	923369.00	2671.30	3.50	0.00	2671.30	Tcg
TP17-39	849377.00	921436.00	2735.90	3.00	0.00	2735.90	Tcg

I-5 PROCESS WATER CHEMISTRY

The chemistry of tailings process water used in laboratory testing is provided in Appendix I-A, ALS Laboratory Results for Process Water.

APPENDIX I-A

ALS Laboratory Results for Process Water

June 01, 2017 Service Request No:T1700676

Christopher Kowalchuk
Klohn Crippen Berger
500-2955 Virtual Way
Vancouver, BC V5M 4X6

Laboratory Results for: Process Water

Dear Christopher,

Enclosed are the results of the sample(s) submitted to our laboratory April 17, 2017
For your reference, these analyses have been assigned our service request number **T1700676.**

All analyses were performed according to our laboratory's quality assurance program. All results are intended to be considered in their entirety, and ALS Environmental is not responsible for use of less than the complete report. Results
apply only to the items submitted to the laboratory for analysis and individual items (samples) analyzed, as listed in the report.

Please contact me if you have any questions. My extension is 7102. You may also contact me via email at Wendy.Hyatt@alsglobal.com.

Respectfully submitted,

ALS Group USA, Corp. dba ALS Environmental

Wendy Hyatt
Client Services
Manager

ADDRESS 3860 S. Palo Verde Road, Suite 302, Tucson, AZ 85714
PHONE +1 520 573 1061 | FAX +1 520 573 1063
ALS Group USA, Corp.
dba ALS Environmental

Client: Klohn Crippen Berger **Service Request:**T1700676
Project: Process Water

SAMPLE CROSS-REFERENCE

SAMPLE #	CLIENT SAMPLE ID	DATE	TIME
T1700676-001	Process Water	4/12/2017	

Data Qualifiers

Lab Standard

+	Possible Tedlar bag artifact.
A	TIC is a suspected aldol-condensation product
B	Analyte found in the associated method blank as well as in the sample.
BC	Reported results are not blank corrected.
BH	The back section of the tube yielded higher results than the front.
BT	Results indicated possible breakthrough; back section >=10% front section.
C	Result identification confirmed.
D	Compound identified in an analysis at a secondary dilution factor
D	Spike was diluted out
DE	Reported results are corrected for desorption efficiency.
E	Estimated value. Concentration above calibration range
E	The percent difference for the serial dilution was greater than 10%, indicating a possible matrix interference in the sample.
H1	Sample analysis performed past holding time. See case narrative.
H2	Initial analysis within holding time. Reanalysis for the required dilution was past holding time.
H3	Sample was received and analyzed past holding time.
H4	Sample was extracted past required extraction holding time, but analyzed within analysis holding time. See case narrative.
I	Internal standard not within the specified limits. See case narrative.
J	Estimated Value. Concentration found below MRL.
K	A deflection in the QC ion may indicate interference with the quantitation of this ion. The concentration of this analyte should be considered as an estimate.
K	Analyte was detected above the method reporting limit prior to normalization.
L1	Laboratory control sample recovery outside the specified limits; results may be biased high.
L2	Laboratory control sample recovery outside the specified limits; results may be biased low.
L3	Laboratory control sample recovery outside the specified limits.
M	Matrix interference; results may be biased high.
M	The duplicate injection precision not met.
M1	Matrix interference due to coelution with a non-target compound; results may be biased high.
N	Presumptive evidence of a compound for TICs that have been identified based on a mass spectral library search.
N	The Matrix Spike sample recovery is not within control limits. See case narrative.
P	Indicates chlorodiphenyl ether interference present at the retention time of the target compound.
P	Pesticide/Aroclor target analyte > 40% difference for detected concentrations between GC columns
Q	Indicates as estimated value because the P and P + 2 theoretical abundance ratio does not meet method criteria.
R	Duplicate Precision not met.
R1	Duplicate precision not within the specified limits; however, the results are below the MRL and considered estimated.
S	Surrogate recovery not within specified limits.

Data Qualifiers

Lab Standard

S	The reported value was determined by the Method of Standard Additions (MSA).
T	Analyte is a tentatively identified compound, result is estimated.
U	Compound was analyzed for, but was not detected (ND).
V1	The continuing calibration verification standard was outside (biased high) the specified limits for this compound.
V2	The continuing calibration verification standard was outside (biased low) the specified limits for this compound.
W	Result quantified, but the corresponding peak was detected outside the generated retention time window.
W	The post-digestion spike for furnace AA analysis is out of control limits, while sample absorbance is less than 50% of spike absorbance.
X	See case narrative.
Y	Recovery outside limits
Y	The chromatogram resembles a petroleum product but does not match the calibration standard.
Z	The chromatogram does not resemble a petroleum product.
i	The MRL/MDL has been elevated due to a matrix interference.

Client: Klohn Crippen Berger
500-2955 Virtual Way
Vancouver, BC V5M 4X6

Attn: Christopher Kowalchuk
Project: Process Water **Date Received:** 4/17/17

Certificate of Analysis

Sample ID:	Sample Date & Time	Lab #:	pH	EC	Alkalinity as CaCO3	Acidity as CaCO3
			150.1	SM 2510B	SM 2320B	305.1
			units	uMHOS/cm	mg/L	mg/L
Process Water	4/12/17	T1700676-001	7.97	3,340	144	0

Sample ID:	Sample Date & Time	Lab #:	Bromide	Chloride	Fluoride	Sulfate
			9056 Ion Chromatography			
			As Received ppm	As Received ppm	As Received ppm	As Received ppm
Process Water	4/12/17	T1700676-001	<5	110	<5	1,837

Sample ID:	Sample Date & Time	Lab #:	Cation Sum	Anions Sum	Cation Anion Balance	
			meq/L	meq/L	%	
Process Water	4/12/17	T1700676-001	42.68	44,25	-1.8%	

EC = Electrical Conductivity

Client: Klohn Crippen Berger
500-2955 Virtual Way
Vancouver, BC V5M 4X6

Attn: Christopher Kowalchuk
Project: Process Water **Date Received:** 4/17/17

Certificate of Analysis

Total Metals by EPA 3052/6010C ICP-OES	ID	Process Water				
	Units	T1700676-001				
Aluminum	ppm	0.49				
Antimony	ppm	< 0.11				
Arsenic	ppm	< 0.01				
Barium	ppm	0.03				
Beryllium	ppm	< 0.003				
Cadmium	ppm	< 0.01				
Calcium	ppm	340.81				
Chromium	ppm	< 0.01				
Cobalt	ppm	< 0.05				
Copper	ppm	< 0.01				
Iron	ppm	0.58				
Lead	ppm	< 0.02				
Lithium	ppm	< 0.03				
Magnesium	ppm	136.51				
Manganese	ppm	< 0.01				
Molybdenum	ppm	< 0.11				
Nickel	ppm	< 0.05				
Phosphorus	ppm	< 0.11				
Potassium	ppm	37.19				
Selenium	ppm	< 0.05				
Silicon	ppm	1.17				
Sodium	ppm	309.23				
Strontium	ppm	0.03				
Tin	ppm	< 0.02				
Titanium	ppm	< 0.02				
Vanadium	ppm	< 0.01				
Zinc	ppm	0.03				
Zirconium	ppm	< 0.02				

Note: Values reported on an as received basis.

APPENDIX II

Geotechnical Investigation Field Summary Report

In preparation, to be submitted