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December 1, 2014

Project #: 341-8

Wolverine Coal Partnership Wolverine Mine PO Box 2140 Tumbler Ridge, BC VOC 2W0

Attention: Nathan Scarbrough

Senior Mine Engineer, Walter Energy, Inc.

Dear Nathan:

Subject: Wolverine Tailings Facility – 2014 Annual DSI Supplemental Information (Rev 1)

#### INTRODUCTION

Wolverine Coal Partnership (WCP) has requested that Norwest Corporation (Norwest) provide supplemental information to support the annual tailings dam safety inspection (DSI) conducted by Norwest on October 1, 2014. This information is provided following a teleconference meeting on November 26, 2014 between WCP, Norwest and the independent review consultant, Tetra Tech EBA (EBA). This meeting was held to discuss the outcomes of EBA's review of the annual tailings DSI which was presented in a draft report, dated November 24, 2014.

#### **EBA COMMENTS**

The following section describes EBA's comments as listed in the November 24, 2014 draft report of the independent review along with Norwest's response and supplemental information where applicable.

#### Comment #1 - Winter CCR Pile

EBA states: "The current winter CCR stockpile should be considered in assessment of tailings facility storage capacity and the potential impact on TSF stability."

The remaining capacity of the tailings facility was calculated to be 1,732,000m³ (based on August 2014 survey data) if the northern abutment is completed to an elevation of 852m, or 592,000m³ based on the current lowest crest elevation of 848m. These volumes were determined by comparing a surface generated from the 2014 survey provided by WCP and the projected ultimate beach surface (assumed to have a 1% slope). Both surfaces were developed assuming the current winter CCR pile would not be moved and hence the associated volume reduction is accounted for in the estimate.



Stability assessments that include the winter CCR stockpile have not been completed to date. Norwest believes the winter stockpile may indirectly impact TSF stability, and we have provided a recommendation to reduce the crest elevation to 852m based on the following:

- Loss of valuable capacity for fine tailings within the tailings impoundment.
- Height of pile exceeds maximum dyke height recommended for valley foundation conditions. It
  would require a site specific foundation investigation to support leaving the pile in place
  permanently.

Norwest will work with WCP to provide a stability assessment of the TSF which includes the winter CCR stockpile in its current configuration.

# Comment #2 - Freeboard Capacity

EBA states: "The prescribed 2m of freeboard should be confirmed as adequate to contain the design storm with consideration of the winter CCR stockpile."

Since the plant shutdown in May 2014, freeboard has increased to over 7m as there has been no tailings or water discharged into the impoundment. Whilst the tailings facility is under care and maintenance, there are no immediate concerns with the freeboard allowance. Prior to resuming tailings discharge, Norwest will work with WCP to revise the design storm based on up-to-date hydrology data. This will be used to determine if the 2m freeboard is adequate to contain the design storm inflow (with the CCR pile in place).

#### Comment #3 - Dam Risk Classification

Comment under review by EBA following supplementary information provided by Norwest.

# **Comment #4 – Construction Records**

EBA states: "Documentation of embankment construction including quality control and assurance tests should be undertaken if it is not already being done."

There has been no placement of CCR on the tailings dam since the 2011/2012 construction season, and therefore construction records have not been included in the DSI. A revision of Drawing 1 (presented in the DSI) is enclosed to clarify that CCR material has not been placed on the tailings embankment since 2012. Any changes to the embankments since 2012 are attributed to embankment slope reclamation activities.

# Comment #5 – Current Embankment Stability Analysis

EBA states: "The embankment stability analysis should incorporate current piezometer data."

Norwest are currently working with WCP to finalize a toe ditch buttress design. The toe buttress design includes an updated stability analysis based on current dam conditions, construction drawing and report to be issued in December 2014.



# Comment #6 – Measurement of Seepage Flow Quantity

EBA states: "Measurement of seepage flow quantity should be considered as part of the monitoring program."

Based on measurements of piezometers in the near surface permeable bouldery gravel unit, Norwest believe there is little to no seepage through embankment fill materials and that the groundwater table is approximately at foundation elevation. Observations from the downstream toe ditch also suggest there is little to no seepage inflow from the tailings impoundment and that any standing water is due to surface runoff and infiltration. Therefore, Norwest believe that measurements of actual impoundment seepage flows will be difficult to obtain. However, Norwest will work with WCP to adjust the current monitoring regime to provide estimates of flow quantities at observable points (where practical) along the downstream side of the tailings dam. This may include measurements at the ditch culverts to detect changes in outflows (and accounting for surface water).

#### Comment #7 – Inclusion and review of time displacement plots

EBA states: "Inclusion and review of time-displacement plots for selected inclinometer data should be considered to identify data trends."

Norwest currently review time-displacement plots during quarterly monitoring data review and as part of the annual inspections. Time-displacement for zones of interest within slope inclinometers TF-SI-002, -004 and -005 are presented in Figure 1 (see enclosed). This data is also summarized in Table 3.1 of the 2014 DSI report.

## Comment #8 - Water Quality and Climate Data

EBA states: "A summary of seepage water quality and recent climate data should be incorporated into future DSI."

As discussed in Comment #6, Norwest believe that there is little to no seepage through the embankment fills or entering into the downstream toe ditch. However, WCP do currently collect water quality data from samples collected in the downstream toe ditch. Norwest will work with WCP to provide a summary of the water quality and climate data into future DSI's. Water quality data collected in 2014 (provided by WCP) is presented in Appendix A.

#### Miscellaneous

EBA also noted the absence of physical and chemical tailings characteristics. A summary of chemical testing conducted on tailings samples (provided by WCP) is presented in Appendix B. Norwest understand there was no physical testing performed on tailings samples during 2014.

### **2014 ANNUAL INSPECTION REPORT RECOMMENDATIONS**

#### **Toe Ditch Buttress Construction**

Norwest made a recommendation in the 2014 DSI report to complete the within 3 to 6 months. Upon discussion with WCP, Norwest understand that undertaking this construction during the upcoming



winter may not be practical. Accordingly, Norwest have recommended that the toe buttress construction be deferred until after the 2014/2015 winter season.

# Winter CCR Stockpile Height Reduction

Norwest made a recommendation in the 2014 DSI report to reduce the height of the winter CCR stockpile within 3 to 6 months. Upon discussion with WCP, Norwest understand that reducing the stockpile height during the care and maintenance period may not be practical. Accordingly, Norwest have recommended that the stockpile height reduction be deferred until such time that the mine reopens, provided that there are no concerns identified during the upcoming stability assessment (discussed in Comment #1 above).

#### **SUMMARY**

Following recent discussions with WCP and EBA on the 2014 annual tailings dam safety inspection, Norwest have provided comments on EBA's independent review. Table 1 below summarizes the remaining action items following EBA's review. In addition, Norwest have also recommended that the winter stockpile height reduction may be deferred until the mine re-opens, pending stability assessment results (noted in Comment #1 above).

Table 1
Summary of Remaining Action Items

EBA Comment	Action Item (in bold)
#1 – Winter CCR Pile	Remaining capacity reported in DSI includes current winter CCR stockpile.  Winter CCR pile stability assessment to be undertaken by Norwest / WCP.
#2 – Freeboard Capacity	Freeboard capacity to be assessed by Norwest / WCP prior to resuming tailings discharge into the impoundment.
#3 – Dam Risk Classification	Action item to be recommended by EBA.
#4 – Construction Records	CCR was not placed in 2014 and no construction records were generated. This has been clarified on revised Drawing 1 (enclosed).
#5 – Current Embankment Stability Analysis	To be submitted as part of toe ditch buttress design.
#6 – Measurement of Seepage Flow Quantity	Measurement of downstream flows as part of monitoring regime to be assessed by Norwest / WCP.
#7 – Inclusion and review of time displacement plots	Time-displacement data for 2014 included in Figure 1 (enclosed). Time-displacement data also to be included in future annual dam inspection reports.
#8 – Water Quality and Climate Data	Summary of water quality and climate data to be included in future annual dam inspection reports.



#### **CLOSURE**

The purpose of this letter is to provide the Wolverine Coal Partnership with Norwest's comments following the dam safety inspection review by EBA. As mutual protection to WCP, the public, and ourselves, this letter, figures and data are submitted for exclusive use by WCP. We specifically disclaim any responsibility for losses or damages incurred through the use of our work for a purpose other than as described in the letter. Our letter should not be reproduced in whole or in part without our express written permission, other than as required in relation to this regulatory submission.

Yours sincerely,

**NORWEST CORPORATION** 

Greg Lewsley, P.Eng.

**Geotechnical Engineer** 

Sean Ennis, P.Eng. Dec, 2014

Vice President, Mining

S. ENNIS

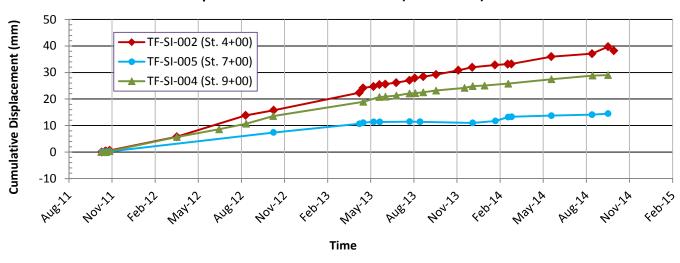
## Enclosures:

Figure 1 Slope Inclinometer Time-Displacement Plots Appendix A TS-1 (Tailings Ditch) Chemical Analysis 2014

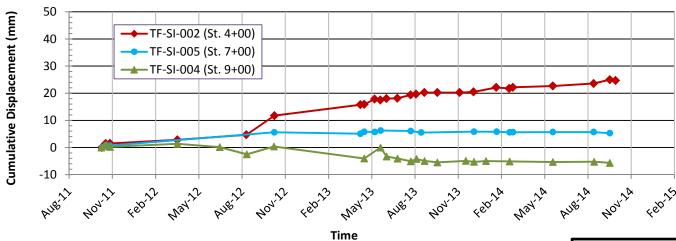
Appendix B **Tailings Chemical Analysis 2014** 

Drawing 1 Tailings Facility As-built August 2014 (Rev 1)

# Perpendicular to Dam Centreline (Direction A)



# Parallel to Dam Centreline (Direction B)



## Notes:

1. Data for TF-SI-006 has not been shown as there is no significant movement in this slope inclinometer to date.



**WALTER ENERGY** 

**WOLVERINE MINE** 

TAILINGS FACILITY SLOPE INCLINOMETER TIME-DISPLACEMENT PLOTS

NORWEST

341-8

FIGURE 1

REV. 0



# Appendix A TS-1 (Tailings Ditch) Chemical Analysis 2014

# Tailings Dam Toe Ditch Analysis - 2014

Tailings Dam Toe Ditch Analys	13 2014											
Sample ID: TS-1	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Physical Tests				·	,				·			
Colour, True	<5.0	<5.0		<5.0	<5.0	<5.0	5.1	<5.0	<5.0	<5.0	<5.0	
Conductivity	1220	1310		1200	1100	899	955	958	962	893	852	
Hardness (as CaCO3)	693	817		698	665	530	563	571	563	526	478	
рН	8.06	8.03		8.05	7.86	7.87	8.18	7.97	8.16	8.06	7.93	
Total Suspended Solids	<3.0	<3.0		<3.0	15.1	48.6	26.1	<3.0	<3.0	<3.0	3	
Total Dissolved Solids	919	1020		899	830	647	710	682	737	669	590	
Turbidity	4.31	1.99		1.48	2.37	3.86	1.54	1.33	2.65	1.21	1.44	
Anions and Nutrients												
Alkalinity, Total (as CaCO3)	303	329		000	319	200	299	010	299	001	313	
Ammonia, Total (as N)				299		300		312		321		
Bromide (Br)	0.137	0.183		0.129	0.125	0.118	0.098	0.11	0.0882	0.137	0.127	
Chloride (Cl)	<0.50	<0.50		< 0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	
Fluoride (F)	18.9	20.9		13.1	9.7	6.5	< 5.0	< 5.0	<5.0	5	8.3	
` '	<0.20	0.29		<0.20	<0.20	<0.20	0.27	0.21	0.39	<0.20	<0.20	
Nitrate (as N)	0.1	0.325		0.598	0.26	0.164	0.203	0.053	0.08	0.076	0.085	
Nitrite (as N)	<0.010	<0.010		0.011	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	
Total Kjeldahl Nitrogen	0.273	0.245		0.269	0.311	0.21	0.261	0.231	0.243	0.192	0.178	
Orthophosphate-Dissolved (as P)	<0.0010	<0.0010		<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	
Phosphorus (P)-Total	0.0026	0.0074		<0.0020	0.0047	0.0197	0.0105	<0.0020	<0.0020	<0.0020	<0.0020	
Sulfate (SO4)	410	453		414	372	225	273	268	282	236	206	
Organic / Inorganic Carbon												
Total Organic Carbon	2.83	2.1		2.31	2.29	1.8	2.38	2.11	2.21	1.47	1.65	
Total Metals	2.00						2.00					
Aluminum (Al)-Total												
Antimony (Sb)-Total	I -	-		-	-	-	-	]	-	-	-	
Arsenic (As)-Total	I -	-		-	-	-	-	] -	-	-	-	
Barium (Ba)-Total	I -	-		-	-	-	-	] -	-	-	-	
Beryllium (Be)-Total	_	-		-	-	-	-	]		-		
Bismuth (Bi)-Total	<u> </u>	_		_	_	_	_			_		
Boron (B)-Total	_	_		_	_	_	_	_	_	_		
Cadmium (Cd)-Total	_	-		_	_	_	_	_	_	_	_	
Calcium (Ca)-Total	-	-		_	_	_	_		_	_	_	
Chromium (Cr)-Total	_	-		_	-	-	-	_	_	_	_	
Cobalt (Co)-Total	_	-		_	-	-	-	_	-	-	-	
Copper (Cu)-Total	_	-		_	_	_	_	_	_	_	_	
Iron (Fe)-Total	_	-		_	-	-	-	_	-	-	-	
Lead (Pb)-Total	-	-		_	-	-	-	_	_	-	-	
Lithium (Ĺi)-Total	-	-		_	-	-	-	_	-	-	-	
Magnesium (Mg)-Total	-	-		-	-	-	-	-	-	-	-	
Manganese (Mn)-Total	-	-		-	-	-	-	-	-	-	-	
Molybdenum (Mo)-Total	-	-		-	-	-	-	-	-	-	-	
Nickel (Ni)-Total	-	-		-	-	-	-	-	-	-	-	
Phosphorus (P)-Total	-	-		-	-	-	-	-	-	-	-	
Potassium (K)-Total	-	-		-	-	-	-	-	-	-	-	
Selenium (Se)-Total	-	-		-	-	-	-	-	-	-	-	
Silicon (Si)-Total	-	-		-	-	-	-	-	-	-	-	
Silver (Ag)-Total	-	-		-	-	-	-	-	-	-	-	
Sodium (Na)-Total	-	-		-	-	-	-	-	-	-	-	
Strontium (Sr)-Total	-	-		-	-	-	-	-	-	-	-	
Thallium (TI)-Total	-	-		-	-	-	-	-	-	-	-	
Tin (Sn)-Total	-	-		-	-	-	-	-	-	-	-	
Titanium (Ti)-Total	-	-		-	-	-	-	-	-	-	-	
Uranium (U)-Total	-	-		-	-	-	-	-	-	-	-	
Vanadium (V)-Total	-	-		-	-	-	-	-	-	-	-	
Zinc (Zn)-Total	-	-		-	-	-	-	-	-	-	-	
Dissolved Metals												
Aluminum (Al)-Dissolved	< 0.0030	< 0.0030		<0.0030	< 0.0030	< 0.0030	< 0.0010	< 0.0030	<0.0030	<0.0030	<0.0030	
Antimony (Sb)-Dissolved	0.0003	0.00049		0.00068	0.00045	0.00019	0.0002	0.00022	0.0002	0.00018	0.00015	
Arsenic (As)-Dissolved	0.00057	0.00039		0.00039	0.00045	0.00055	0.00066	0.00072	0.00069	0.00079	0.00059	
Barium (Ba)-Dissolved	0.0866	0.103		0.0859	0.0876	0.0833	0.0765	0.0705	0.0669	0.0598	0.0596	
Beryllium (Be)-Dissolved	<0.00010	<0.00010		<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	
Bismuth (Bi)-Dissolved	<0.00050	<0.00050		<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	
Boron (B)-Dissolved	0.03	0.031		0.027	0.032	0.025	0.03	0.028	0.027	0.032	0.026	
Cadmium (Cd)-Dissolved Calcium (Ca)-Dissolved	0.000121	0.000156		0.000137	0.000152	0.000115	0.00008	0.000088	0.000055	0.000067	0.000035	
Chromium (Cr)-Dissolved	184 <0.00010	216 <0.00010		186 <0.00010	177 <0.00010	140 <0.00010	149 <0.00010	152 <0.00010	151 -0.00010	140 0.00012	129 <0.00010	
Cobalt (Co)-Dissolved	0.00010	<0.00010 0.00455		<0.00010 0.00413	0.00010	<0.00010 0.00303	<0.00010 0.00254	0.00010	<0.00010 0.00305	0.00012	<0.00010 0.00157	
Copper (Cu)-Dissolved	<0.00449	< 0.00455		<0.00413	<0.0034	<0.00303	0.00234	<0.00326	< 0.00305	<0.00428	<0.00157	
Iron (Fe)-Dissolved	< 0.00030	< 0.00030		< 0.00030	< 0.00030	< 0.00030	< 0.00032	< 0.00030	<0.00030	<0.00030	<0.00030	
Lead (Pb)-Dissolved	<0.00050	<0.00050		<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	
Lithium (Li)-Dissolved	0.022	0.0231		0.0202	0.0189	0.0163	0.019	0.0173	0.0178	0.0178	0.016	
Magnesium (Mg)-Dissolved	56.9	67.3		56.6	54.3	43.5	46.1	46.3	45.2	42.7	38.1	
Manganese (Mn)-Dissolved	0.523	0.699		0.521	0.523	0.427	0.416	0.563	0.422	0.436	0.244	
Molybdenum (Mo)-Dissolved	0.00401	0.00439		0.0044	0.00418	0.00361	0.00377	0.00413	0.00416	0.00364	0.00347	
Nickel (Ni)-Dissolved	0.022	0.0212		0.0177	0.0175	0.0175	0.0162	0.0144	0.0136	0.0146	0.0121	
Phosphorus (P)-Dissolved	<0.30	<0.30		<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	
Potassium (K)-Dissolved	2.3	2.5		2.4	2.3	<2.0	2.05	<2.0	2	<2.0	<2.0	
Selenium (Se)-Dissolved	0.0005	0.00048		0.00087	0.00036	0.00025	0.00023	0.00023	0.00023	0.00023	0.00087	
Silicon (Si)-Dissolved	2.92	3.18		2.7	2.88	2.72	2.42	2.83	2.45	2.98	2.85	
Silver (Ag)-Dissolved	<0.000010	<0.000010		<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	
Sodium (Na)-Dissolved	11.2	12.8		11.3	11.8	11.3	11	11.4	10.9	10.5	9.5	
Strontium (Sr)-Dissolved	1.01	1.18		1.06	1	0.724	0.801	0.929	0.86	0.75	0.722	
Thallium (TI)-Dissolved	0.000029	0.000031		0.00003	0.000033	0.000027	0.000029	0.000025	0.000023	0.000023	0.000018	
Tin (Sn)-Dissolved	<0.00010	<0.00010		<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	
Titanium (Ti)-Dissolved	0.014	0.011		0.029	0.015	0.013	0.01	<0.010	0.014	0.017	0.016	
Uranium (U)-Dissolved	0.0074	0.00793		0.00793	0.0067	0.0042	0.00511	0.00462	0.00498	0.00497	0.00422	
Vanadium (V)-Dissolved	<0.0010	<0.0010		<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	
Zinc (Zn)-Dissolved	0.0076	0.0077		0.006	0.0074	0.0066	0.0056	0.0052	0.004	0.0042	0.0039	
Hydrocarbons												
EPH10-19	-	-		-	-	-	-	<0.25	-	-	-	
EPH19-32	-	-		-	-	-	-	<0.25	-	-	-	



# Appendix B Tailings Chemical Analysis 2014

Tailings Chemical Analysis - 2014					Initial Analysis															-	
		_		Sample Location	on		d														
	Sample Descriptio Dat		Easting	Northing	Elevation	Sample Type (CCR,Tails,WR,WC,J 2,FMC)	%	%	Initial wt of Sample + Filter (g)	(g)	Weight adjustment (%)	Total S %	wt Corrected Sulphide %	Carbon %	CaNP	Siderite Corrected NP	AP	NPR	NPR <1.3	Sulphur Species >0.05	PAG or NONPAG
ARD-9518		13-Jan-14				Tailings	0.31102	0.30389	1.56	1.5217	0.98	0.32	0.01	0.80	66.50	23.3	0.22	106.9	NO	YES	non-PAG
ARD-9519		17-Feb-14				Tailings	0.55368	0.5449	1.60	1.5593	0.98	0.47	0.01	0.91	76.16	26.7	0.27	99.6	NO	YES	non-PAG
ARD-9520		1-Mar-14				Tailings	1.0289	0.94262	1.5965	1.575	0.99	0.99	0.09	0.44	36.96	12.9	2.66	4.9	NO	YES	non-PAG
ARD-9521	PLANT	8-Apr-14	1			Tailings	0.58885	0.56032	1.6533	1.5965	0.97	0.52	0.03				0.86			YES	
ARD-9522																					
ARD-9523																					
ARD-9524																					
ARD-9525																					
	Tailings Dam	25-Jan-14	61205			Tailings	0.32732	0.3202	1.5528	1.4871	0.96	0.31	0.01	1.39	115.46	40.4	0.21	189.6	NO	YES	non-PAG
	Tailings Dam	7-Apr-14	61202	7 6103719	8/0	Tailings	0.70951	0.65857	1.6386	1.6115	0.98	0.69	0.05	0.54	45.02	15.8	1.57	10.1	NO	YES	non-PAG
ARD-10438 ARD-10439					1																
ARD-10439																					
ARD-10440																					
ARD-10441																					
ARD-10443																					
ARD-10444																					
ARD-10445																					_
ARD-10446					1																
ARD- 10447																					
ARD- 10448					1																
ARD- 10449																					
ARD- 10450																					

