

May 24, 2012

Mr. Ken McKinnon YESAB Suite 200-309 Strickland Street Whitehorse Yukon Y1A 2J9

24 2017

Subject:

Mactung mine project proposal (2008-0304). Response to YESAB additional Information request dated May 8,2012.

Please find enclosed with this letter a technical memo that was prepared by EBA Engineering, A Tetra Tech Company (EBA) on behalf of North American Tungsten Corporation (NATC). NATC fully endorses the content of the memo and hopes that the information contained therein allows YESAB to proceed with preparing the draft screening report for the Mactung Project.

If you have any further questions, please do not hesitate to contact me at the address below.

Sincerely yours,

Tracy Thomas Community and Environmental Affairs Cell: 867.332.5858 Email: <u>tthomas@natungsten.com</u>

CC: Stephen Leahy, NATC Glen Rudman, EBA Keith MaGuire, YESAB Michael Muller, YESAB

> 128D COPPER ROAD, WHITEHORSE, YT Y1A 2Z6 PHONE: 867-633-2160 • FAX: 867-633-2314 www.northamericantungsten.com

## TECHNICAL MEMO

**ISSUED FOR USE** 

SUBJECT:	NATC Response to YESAB's additional inforr proposed Mactung mine.	nation request dated Mag	y 8, 2012 pertaining to the
FROM:	Stephen Leahy, Tracy Thomas (NATC)	EBA FILE:	W23101211.003
<b>C</b> :	Michael Muller, Keith Maguire (YESAB), Doug Watt (NATC), Glenn Rudman (EBA)	MEMO NO.:	As dated
TO:	Ken McKinnon, YESAB	DATE:	May 23, 2012

#### **I.0 INTRODUCTION**

The following information is provided by North American Tungsten Corporation Ltd. (NATC) and their agents, EBA, A Tetra Tech Company (EBA) in response to the letter request from YESAB for additional information dated May 8, 2012. The information pertains to the water treatment plant to be installed at the proposed Mactung Mine as well as further clarification on the backfilling and sealing of the mine stopes.

The responses are provided in the same order as the information requests in the letter dated May 8, 2012.

#### 2.0 PROPOSED WATER TREATMENT PLANT

The information received by NATC from potential water treatment plant suppliers is based on parameters previously provided in reports submitted to YESAB in July and October 2011. The information is presented again below.

#### 2.I Flows

The proposed water treatment plant (WTP) will be designed to meet the flow parameters indicated in the site water balance tables provided in the response document dated July 15, 2011. As detailed engineering and mine design will determine if the WTP is best installed to treat the reservoir discharge water or just the mill discharge water, the highest and lowest flow rates were provided to potential WTP suppliers. The lowest anticipated flow rate would be approximately 47 L/s, a relatively constant rate discharged from the mill all year round. The highest anticipated flow rate would be approximately 160 L/s discharged from the reservoir at peak times during the year (May to September). However, the total maximum outflow rate from the reservoir of 215 L/s was provided to WTP suppliers to ensure that the highest predicted maximum flow rate could be treated.

#### 2.2 Water Quality Parameters

As previously stated by NATC, according to the water quality prediction model provided to YESAB in October, 2011 none of the constituents in the reservoir are anticipated to exceed MMER criteria. However, NATC obtained treatment information from WTP suppliers based on those effluent constituents that remained of continued concern to YESAB, namely arsenic, cadmium, chromium, copper, lead, selenium and zinc. As YESAB will be aware, MMER does not have regulatory criteria for cadmium, chromium and selenium.



Furthermore, it is generally understood that any CCME guideline values (for the protection of aquatic life) that may be applied to the downstream receiving environment, as agreed with the regulators, will be set at a negotiated distance downstream of the ravine dam discharge point. The precise location of the CCME monitoring point and the target concentrations for those constituents will be determined during the application process for the Type A Water Licence. In conformance with the MMER, the current target final effluent discharge concentrations for arsenic, copper, lead and zinc are as follows:

- Arsenic less than 0.5 mg/l
- Lead less than 0.2 mg/l
- Zinc less than 0.5 mg/l
- Copper less than 0.3 mg/l
- Total suspended solids (TSS) 500 to 750 mg/l

These regulatory criteria were provided to potential WTP suppliers. These criteria have been key inputs into the preliminary WTP design phase, and will remain the target criteria unless different values are agreed to between NATC and the regulators during the water licence application phase.

As indicated in the attached documentation, the current proposed WTP system will use a combination of pH modification for metals precipitation, decantation (Actiflo design by Veolia) pH adjustment, and drum filtration. The appended brochure from Veolia provides further information about this particular system (Attachment 1) including examples of other mine water treatment plants that have successfully employed this process system. A preliminary flow diagram for the Mactung Water Treatment Plant is provided in Attachment 2.

#### 2.3 Waste Generated by the Water Treatment Plant

Assuming that a WTP is operated at the proposed Mactung mine, a waste sludge will be generated. This waste will be disposed of (buried) in the dry stack tailings storage facility or transported off-site to a permitted treatment or storage facility most likely located in southern Canada.

#### 2.4 Water Quality Management Plan

A comprehensive Water Quality Management Plan (WQMP) will be completed during the Type A Water Licence and Quartz Mining Licence application phases. The WQMP will be prepared to inform the design and operation of the WTP, and monitor the effectiveness of the WTP. The WQMP will include and address the following topics:

#### **Background Information**

Information on the baseline water quality and quantity at the site and the expected water quality of the mill and reservoir water will be included in this section, based on the water quality prediction model. The potential constituents of concern, their origin, characteristics and fate will be included in this section.

#### **WTP Objectives**

The objectives of the WTP will include:

- The target concentrations for selected constituents;
- The timeline for construction and operation of the WTP.

#### Location of the WTP

• The proposed location and rationale for the choice of location.

#### Construction

- Construction criteria;
- Construction sequencing.

#### Operation

- When operation of the plant may be needed;
- The trigger concentrations for plant operation;
- Lead-in time to prepare the plant for operation;
- Plant operation description;
- Waste sludge management (collection, storage, disposal).

#### Maintenance and Monitoring

- Maintenance schedule (for operation and non-operation periods);
- Monitoring Criteria and schedule;
- How the plant will be monitored for its effectiveness, if it is used.

#### **Plant Safety and Malfunction Preparedness**

- Safety within the plant;
- Staff training and qualifications to operate the plant;
- Trouble shooting the plant.

#### Decommissioning

• Information to be considered when the plant is decommissioned.

#### 3.0 **BACKFILLING AND SEALING OF STOPES**

#### 3.1 Backfilling Stopes

The conceptual sequence of operations to backfill the long hole stopes is presented in Figures 1, 2 and 3 and described below.

**Stage 1:** If available, a layer of waste rock will be placed on the floor of the empty stope using the lower portal for access. If no waste rock is placed the sequence will start with Stage 2.

**Stage 2:** Seal off the lower access portal with a shotcrete bulkhead and/or concrete plug. The pillar thickness through which the lower stope portal is located is approximately 4 m thick, which is adequate to construct a structural element (shotcrete bulkhead and/or concrete plug) that will both provide resistance to prevent the flow of retained tailings into the adjacent mine workings and provide a low permeable barrier to water egress from the backfilled stope. This will also further limit the available oxygen to the backfilled material.

**Stage 3:** Dump filtered tailings from the upper access into the stope. This will either be achieved by end dumping directly into the stope or by dumping outside the upper access and pushing the tailings into the stope using a low ground pressure dozer.

**Stage 4:** Continue to backfill the stope with filtered tailings and/or intermixed waste rock from the upper access. A low ground pressure dozer will be used to spread the backfill into the lateral extents of the stope.

**Stage 5:** Continue to backfill the stope with filtered tailings and/or intermixed waste rock from the upper access. A low ground pressure dozer will be used to spread the backfill into the lateral extents of the stope.

**Stage 6:** Backfill the upper stope void space using filtered tailings and a low ground pressure dozer.

**Stage 7:** Continue to backfill the upper stope void space using filtered tailings and a low ground pressure dozer.

**Stage 8:** Complete backfilling of the upper stope void space retreating towards the upper access portal. Once the stope backfilling is complete, install a shotcrete bulkhead or concrete plug to seal off the upper access portal.

The mechanized cut-and-fill stopes will, if required, be backfilled in a similar manner.

#### 3.2 Sealing Access to the Stopes

The shotcrete bulkheads and/or concrete plugs will provide the necessary resistance to prevent the flow of retained tailings out of the backfilled stope into the adjacent mine workings and will effectively inhibit air (oxygen) circulation. The proposed pillar thickness between individual stopes is four (4) m, which is considered adequate to enable the design of a structural element to provide the necessary shear resistance to support non-structural filtered tailings and be a low permeability barrier to groundwater egress.

#### 4.0 CLOSURE

EBA trusts that this additional information will meet the needs of the YESAB.

Prepared by:

Mulo

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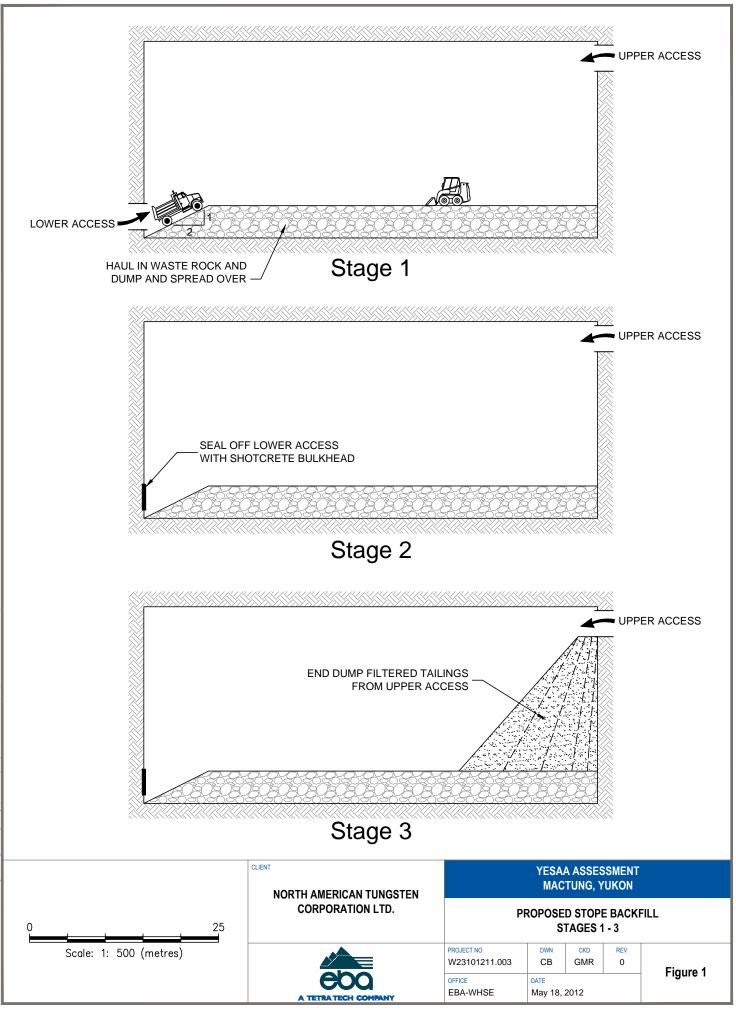
Nigel Goldup, P.Eng. Senior Project Director, Arctic Region EBA Engineering Consultants Ltd. Direct Line: 780.451.2130 x301 Email: ngoldup@eba.ca

Pultor

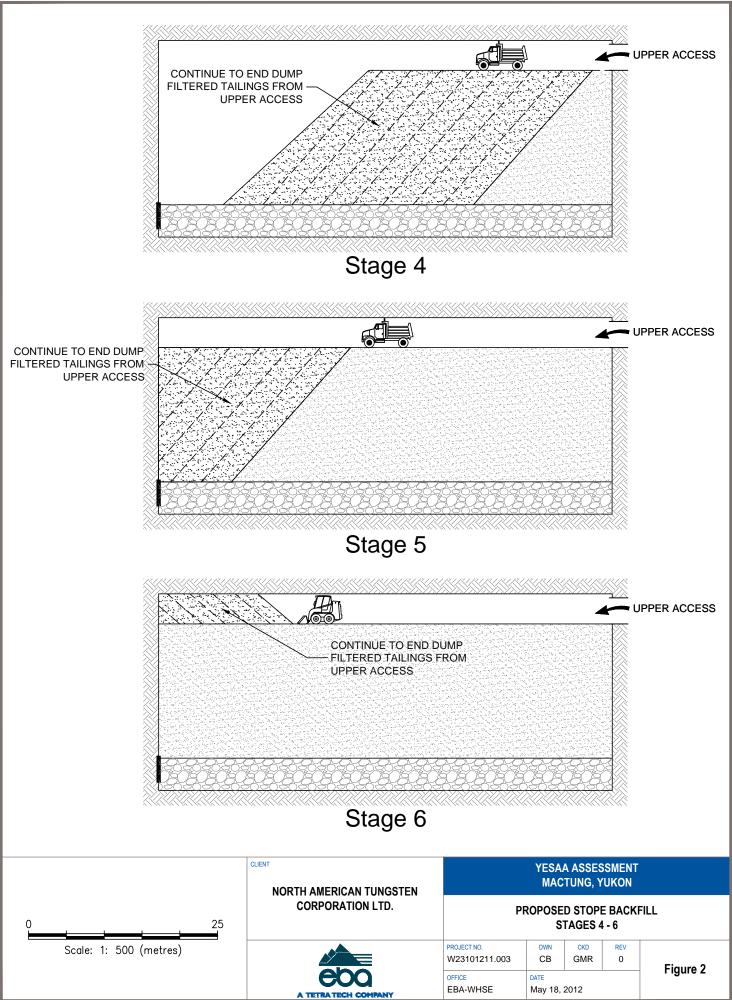
Rick Hoos., M.Sc., R.P.Bio. Principal Consultant, Mining Group EBA Engineering Consultants Ltd. Direct Line: 604.685.0017 x239 Email: grudman@eba.ca

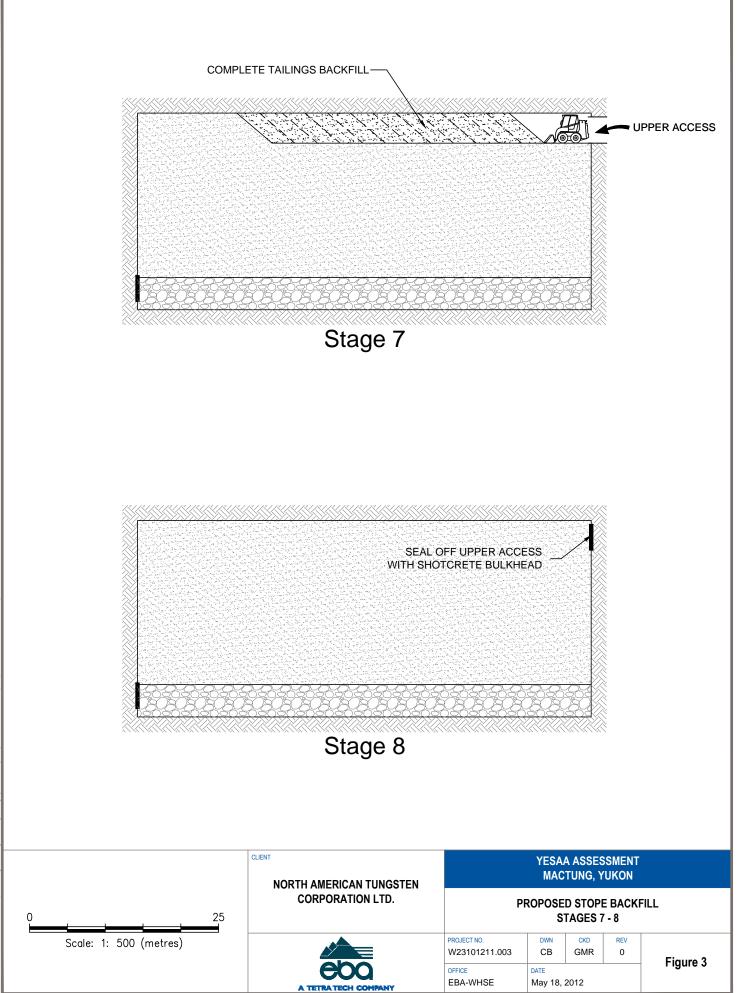
Rodney Ambrosie, P.E. Executive Vice President Wenck Associates Inc. Direct Line: 01.297.9600 Email: rambrosie@wenck.com

Attachments: Veolia Water Solutions and Technologies Industrial Application Process Flow Diagram – Nat Mactung WTP



C:\Users\cameron.buchan\Desktop\Working Drawings\For Nigel.dwg [FIGURE 1] May 18, 2012 - 3:45:20 pm (BY: BUCHAN, CAMERON)





C:Ubserstcameron.buchan/Desktop/Working Drawings/For Niget.dwg [FIGURE 3] May 18, 2012 - 3:45:55 pm (BY: BUCHAN, CAMERON)

EBA FILE: W23101211.003 | MAY 23, 2012 | ISSUED FOR USE

## **ATTACHMENT I**



Veolia Water Solutions and Technologies Industrial Applications

Manitoba Science, Technology, Energy and Mines Mines Branch July 6, 2009





# **COMPANY OVERVIEW**



## **COMPANY OVERVIEW**

#### WORLD LEADER IN ENVIRONMENTAL SERVICES

Present in more than 100 countries with 310,000+ employees. 2008 Revenue = \$42 billion

4

# VEOLIA WATER SOLUTIONS AND TECHNOLOGIES

The technological **division of Veolia Water**, VWS is **the leader** in terms of:

- volume of activity
- number of references
- quality of offer (technology portfolio)
- → 120 subsidiaries in over 55 countries
- → \$2.8 billion in revenue in 2008





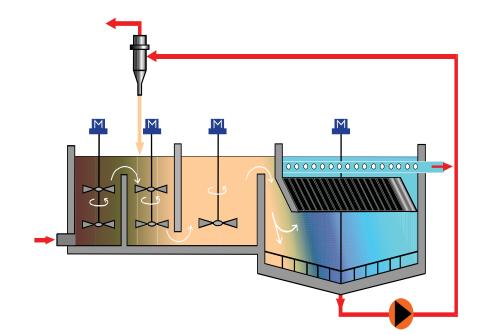
# **TECHNOLOGIES**



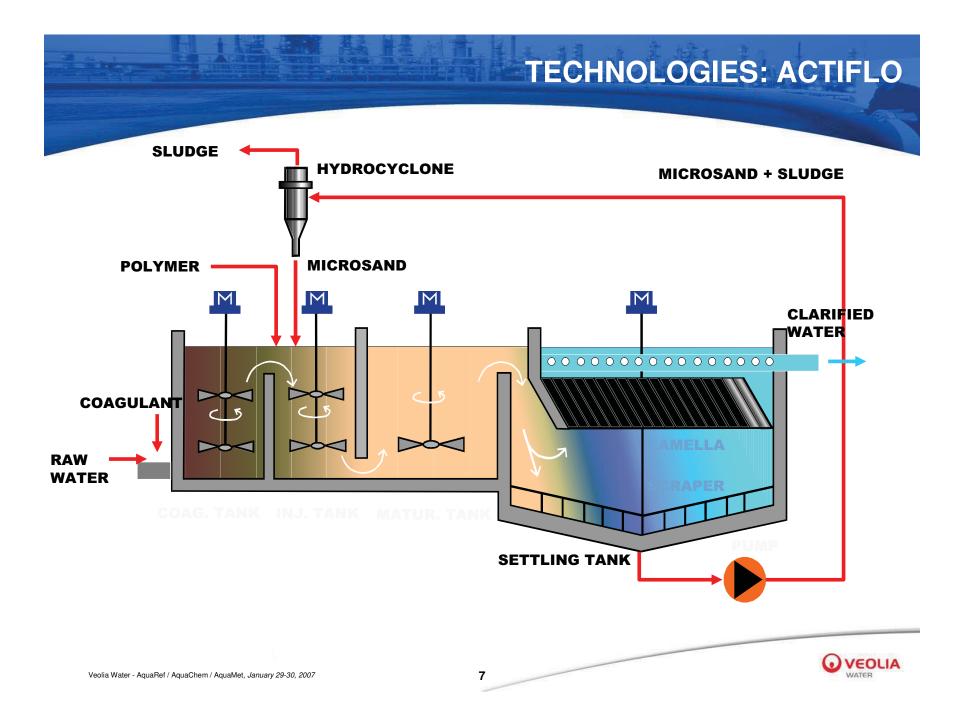


ACTIFLO is a patented clarification process that relies on :

Efficient coagulation
Enhanced flocculation
Ballasted floc
Lamella tube settling
Microsand recirculation







## **ACTIFLO®** Treatment Simulation

Left to right (Conventional, polymer assisted, and ballasted sedimentation)

8









Conventional Clarification (0.5 gpm/sf)



Veolia Water - AquaRef / AquaChem / AquaMet, January 29-30, 2007

9

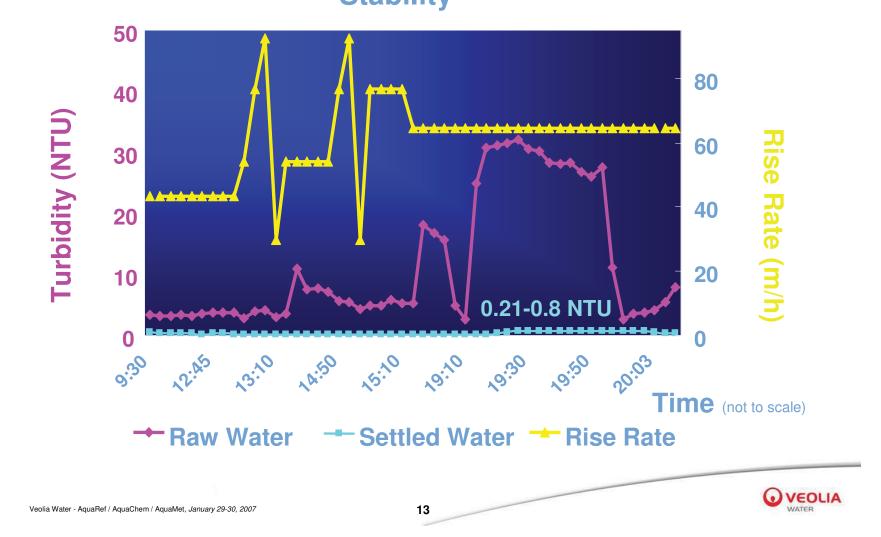
Parameters		Units	Mixed 95% FC/ 5% SM	TECHNOL	OGIES: ACTIFLO
Operational parameters					
1011 dry polymer dosage	•	mg/L	0.65		
Total neutralization time Neutralization time in the Set pH in the neutralizati		min. min. 	6 4 10.5		
Flow rate Rise rate		m³/h m/h	39 52	Mining	Application
Analytical parameters					••
Total suspended solids* CW r		mg/L mg/L %	147 3.3 98	Actific	o Results
Nickel*	AFW CW Removal	TCU TCU %	7.89 0.19 98		
Copper*	AFW CW Removal	mg/L mg/L %	0.287 0.048 	Nickel	98% removal
lron*	AFW CW Removal	mg/L mg/L %	27.6 0.26 99	Copper	83% removal
Turbidity	AFW CW	NTU NTU	110 0.764	Iron	99% removal
Alkalinity (as CaCO₃)	Removal AFW CW	% mg/L mg/L	→ 99 100 80	Turbidity	99% removal
Temperature	CW	°C	1.7	Temperat	ure near freezing!
Calcium*	AFW CW	mg/L mg/L	386 369		
Sulfates*	AFW CW	mg/L mg/L	1539 1482		
pН	CW		10.6		WATER

	n in	Demonstrate		Oxidant			
	Paran	Parameters	Units	KMnO₄		NaOCI	
		Туре		FeCl3	FeCh	FeCh	
	Coagulant	Dosage	mg/L	30	30	30	
	<b>.</b>	Type		1011	1011	1011	
	Polymer	Dosage	møL	0.2	0:2	0.2	
		Туре		KMnO4	KMnO4	NaOC	
	Oxidation	Dosage	mg/L	0.25	0.5	1.25	
		Contact time	min.	2	2	5	
	DIT	RW		7.63	7.63	7.63	
	PH	CW		7.08	7,22	7.02	
		RW	NTU	1.84	1.84	1.84	
	Turbidity	CW	NTU	1.60	2.03	0.93	
Mining		% removal	%	13.0	NA	49.5	
		RW	ACU	41	41	41	
96% Arsenic	Apparent	CW	ACU	20	25	22	
	COLOM	% removal	%	51.2	39.0	46.3	
		RW	mg/L	0.686	0.686	0.686	
Removal ——	→ Total arsenic*	CW	mg/L	0.028	0.028	0.017	
		% removal	%	95.9	95.9	97.5	
		RW	mgL	1.89	1.89	1.89	
	Total iron	CW	mgL	0.39	0.22	0.31	
		% removal	%	79,4	88.4	83.6	
	Total	RW	mg/L	0.2	0.2	0.2	
	manganese	CW	mg/L	0.106	0.14	0.119	
	inaliganese	% removal	%	47.0	30.0	40.5	

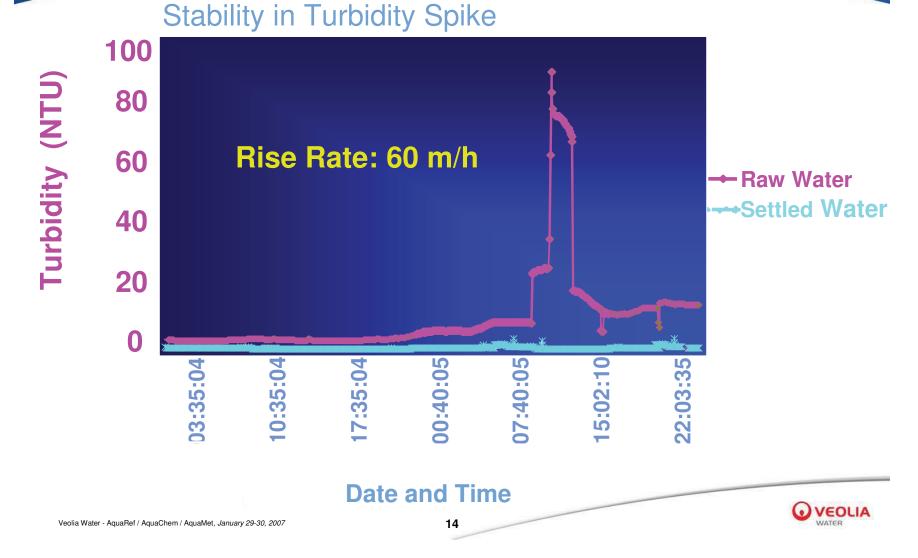


	Coagulant-lime addition se		Simultaneously	Coagulant : 5 min Lime : 5 min.	
	Coagulant Type Dosage		 μL/L mg/L Fe	Fe <sub>2</sub> (SO <sub>4)3</sub> 325 60	Fe₂(SO₄)₃ 325 60
	Lime	Dosage	mg/L	120	120
	Polymer	Type Dosage	 mg/L	Magnafloc 10 0.5	Magnafloc 10 0.5
	рН	ETP CW ETP		7.46 6.90	7.46 7.10
Actiflo Data: Mining Sb, Mo, Cu Removal	Turbidity	CW Removal	NTU NTU <b>%</b>	1.39 0.28 <b>79</b>	1.39 0.31 <b>77</b>
	Total Arsenic (As)*	ETP CW <b>Removal</b>	mg/L mg/L <b>%</b>	0.009 0.002 <b>77</b>	0.009 0.001 <b>88</b>
	Total Antimony (Sb)*	ETP CW <b>Removal</b>	mg/L mg/L <b>%</b>	1.96 0.22 <b>88</b>	1.96 0.17 <b>91</b>
	Total Copper (Cu)*	ETP CW Removal	mg/L mg/L <b>%</b>	0.23 0.05 <b>78</b>	0.23 0.01 <b>95</b>
	Total Lead (Pb)*	ETP CW <b>Removal</b>	mg/L mg/L <b>%</b>	< 0.01 < 0.01 	< 0.01 <b>&lt; 0.01</b> 
	Total Mercury (Hg)*	ETP CW <b>Removal</b>	mg/L mg/L <b>%</b>	< 0.1 < 0.1 	< 0.1 < 0.1 
	Total Molybdenum (Mo)*	ETP CW <b>Removal</b>	mg/L mg/L <b>%</b>	1.61 0.24 <b>85</b>	1.61 0.42 <b>73</b>
	Total Nickel (Ni)*	ETP CW <b>Removal</b>	mg/L mg/L <b>%</b>	0.24 0.16 <b>33</b>	0.24 0.06 <b>75</b>
Veolia Water - AquaRef / AquaChem / AquaMet, <i>January 29-30, 2007</i>	Total Zinc (Zn)*	ETP CW Removal	mg/L mg/L <b>%</b>	0.03 < 0.01 <b>&gt; 66</b>	0.03 < 0.01 <b>&gt; 66</b>

# TECHNOLOGIES: ACTIFLO Stability

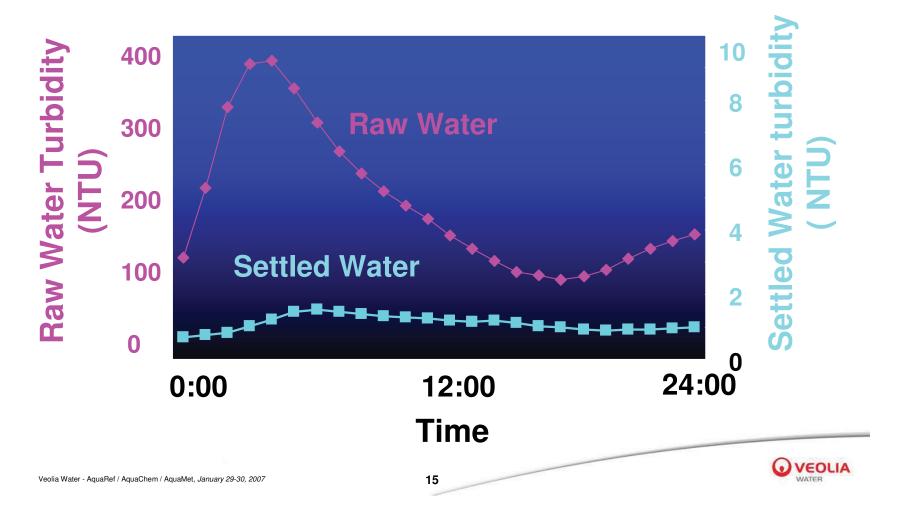


# TECHNOLOGIES: ACTIFLO



# TECHNOLOGIES: ACTIFLO

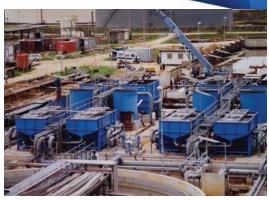
### **Stability in Turbidity Spike**



## **Packaged Systems**







Hi flow, low footprint, portable, packaged plants for any application.







# **TECHNICAL SERVICES**



## **TREATABILITY STUDIES & PILOT PLANTS**









## **ACTIFLO® PILOT PLANT**

## **ACTIFLO Pilot Plant (0.7 MGD)**









# **PILOT PLANTS**

# goldcorp<sub>ins.</sub>





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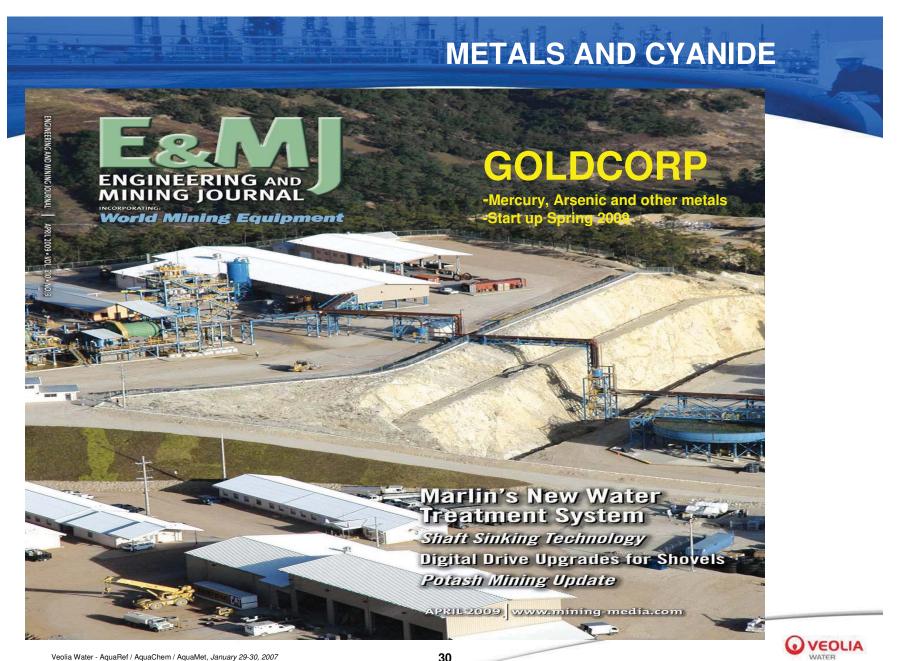






## REFERENCES





## **ACTIFLO - Arsenic**

#### **Goldcorp Wilanour Mine**

- > 8000 m<sup>3</sup>/d (2 MGD)
- > dual train, concrete Actiflo
- Arsenic reduced from 2 mg/L down to 0.02 mg/L
  Start-up spring 2006





an JUBDP Pine.



# **ACTIFLO®**

## **Goldcorp Red Lake Mine**

- > 30,000 m<sup>3</sup>/d (8 MGD)
- dual train Stainless Steel Actiflo Packaged Plant.
- > Each unit 15'W x 38'L
- Arsenic reduced from 2 mg/L down to 0.02 mg/L





#### Start-up spring 2007







# Barrick Gold Williams Mine

- > 2000 m³/d
- Tailings Effluent Treatment
- Single train Actiflo Packaged Plant
- TSS, Mo and Sb removal with option for sludge recirc

## Start-up Winter 2010



Williams Mine - Barrick

Golden Giant Mine (Care & Mtce.)

David Bell Mine-Barrick

33



**ACTIFLO®** 





## **ACTIFLO: Mine Shaft Dewatering**

#### **Campbell Resources– Gold Mine**



## Actiflo Pilot Trailer (Mobile) 2100 m<sup>3</sup> per day Application: Mine Shaft Dewatering - TSS





## **Package Plants**

#### **Troilus Mine – Northwest Quebec**







Model: Actiflo ACP-750 (3500 gpm - 5 MGD) Application: Mining Effluent - TSS



### ACTIFLO – Metals Removal

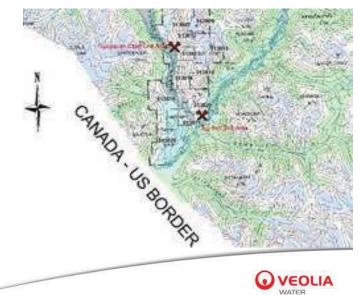
### **Redcorp Resources-Tulsequah Chief Mine**

- > 8000 m<sup>3</sup>/d (2MGD)
- Dual train, packaged Actiflo and Filters
- Metals Removal to meet BC MEND Effluent Limits

#### Start-up summer 2009



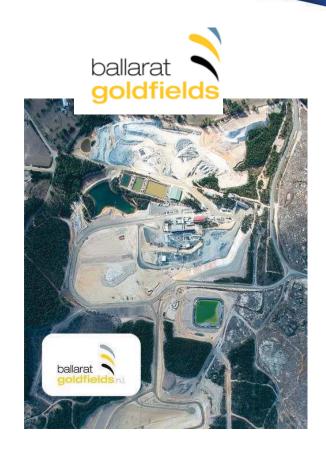






## **ACTIFLO® HEAVY METALS REMOVAL**

- Project: Ballarat Goldfield
- Location: Melbourne Aus.
- Application: Actiflo/Actidisc Treatment of underground mine water at the Ballarat Goldfields to remove heavy metals, arsenic, iron, manganese and other contaminants, with discharge to environment.
- Flow Rate: The new plant with a capacity of 3.89 ML/day





## **ACTIFLO® - Full Scale Turnkey Installation**

#### STORA-ENSO Port Hawksbury, NS Paper Plant





- > Turnkey, process water plant
- Guaranteed flow: 60,000 m<sup>3</sup>/d (16mgd)
- Guaranteed performance: < 0.25 NTU Color < 5 UCV
- Commissionning: 2002
- Equipment: Actiflo<sup>®</sup>, Dusenflo<sup>®</sup>, dosage, pumping, instrumentation & control.
- Scope of work: Engineering, excavation, construction, electricity, building, operation assistance

#### Project Value: \$7 600 000







## **PROCESS WATER: URANIUM MINE**

**Project:** SXR Uranium One – VWS South Africa : Finance, Build, Operate, Maintain – 5 years

Location: Dominion South Africa Start up: 2006 Application: Plant Process Water production





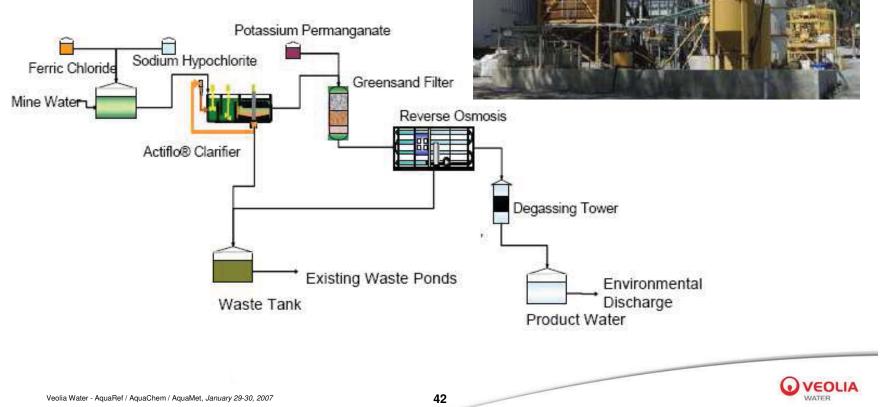




# METALS REMOVAL

#### **Bendigo Gold Mine – Australia**

#### 7000 m<sup>3</sup>/d (2 MGD) Metals removal



DENSESIudge™ High Density Sludge Technology N.A.WS Reputation & Experience

# Veolia Water



2003 Turnkey design of 7.0 MGD 2-Stage Acid Mine Drainage Treatment System Horseshoe Bend WTP, Butte Montana

More efficient use of neutralizing agent

Reduces the volume of sludge generated from treating metal bearing wastewater

Reduces the quantity of filter cake generated (50 % decrease)

Reduces sludge dewatering time

For mine drainage wastes, provides capability to remove manganese and iron at a reduced pH Consistent pH control

Decreases sludge blanket in clarifiers

Generates a metal oxide that may be reclaimed

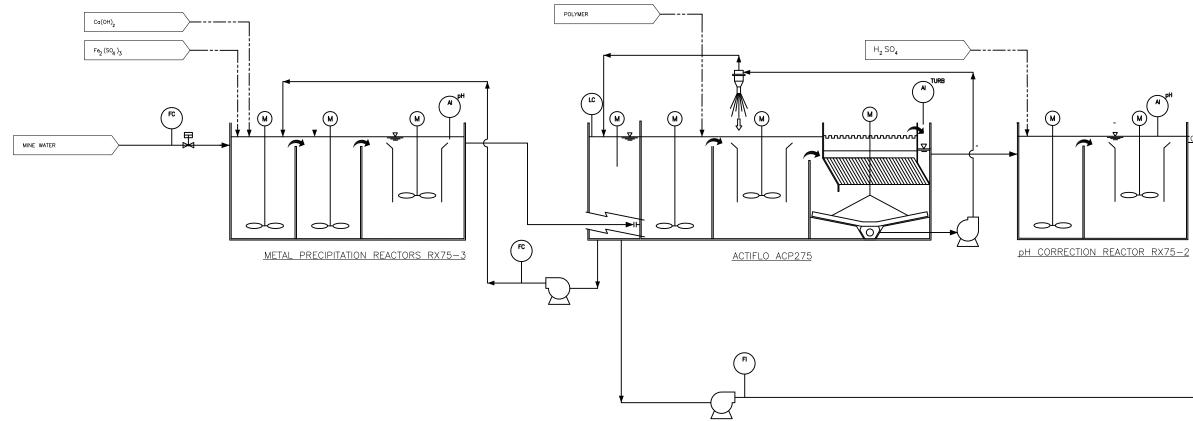
Reduced scaling from gypsum formation



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## **ATTACHMENT 2**





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