Main Points – On how to write a JHA.	***Hierarchy of Hazard Management – Control Measures***
1. Define the task – what is to be done. 2. Review previous JHA if any – have we done it before? 3. Identify the steps – what is to be done. 4. Identify the hazards of each step. 5. Identify who or what could be harmed. 6. Give the task a risk rating – Consequence + Frequency 7. Develop solutions to eliminate or control hazards in each step. 8. Review the risk rating after the control system has been implemented. 9. If risk rating unacceptable review the solutions till risk rating acceptable. 10. Agree who will implement the control system. 11. Document the JHA and discuss with the relevant personnel.	These steps outline what should be planned for when deciding what control measures are to be put in place. Whenever possible the highest step should be used first and then progress down the list. 1. Eliminate the hazard. 2. Substitution. 3. Reducing the frequency of a hazardous task. 4. Enclosing the hazard. 5. Additional procedures. 6. Additional supervision. 7. Additional training. 8. Instructions / information. 9. Some personal protective equipment.

Safety ● Quality ● Sustainability ● Innovation

APPENDIX C –

OWS OPERATIONS JOB HAZARD ANALYSIS

Job Hazard Analysis Form

PROJECT/TASK: Operating OWS		CONTRACTOR: BIM							JOB No.:
SUPERVISOR:		LOCATION:							DATE:
JOB STEP Break the job into steps. Listing work which may be hazardous.	**HAZARDS** List the hazard or type of harm identified with each step.	**Inherent** Consequence	**Inherent** Likelihood	**Inherent** Risk Ranking	**CONTROL MEASURE** List the necessary control measures to be followed to eliminate/reduce the identified hazards.	**Residual** Consequence	**Residual** Likelihood	**Residual** Risk Ranking	**ACTION** Person who will ensure this happens
Starting System	Leaks of fuel or contaminated water				Operator will address all active alarms.				
	Energized equipment failure				Pre inspection of all electrical equipment and pumps.				
	Skin contact with contaminated water				Wear hip waiters and rubber gloves when installing sump in berm				
Operating system	Exceeding maximum pressure in pumps and tanks				Operators/technician monitor all pressure valves and shut down system if any exceedances occur.				
	Leaks of fuel or contaminated water				Continuously monitor all lines and fittings to make sure they are secured properly				

	Slips, trips and falls Congested work area				Proper footwear, be aware of surroundings Communicate with other occupants, be aware of all valves and hoses when walking through seacan				

Job Hazard Analysis Attendees: ______________________________

	Name	Signature	Date
Written by:			
Reviewed by:			

Score	*TABLE OF CONSEQUENCE*		
	People	**Plant**	**Environment**
5 – Very High/ Catastrophic	Multiple Fatalities.	Greater than $10 Million Loss	Catastrophe, destruction of sensitive environment, worldwide attention. Likely EPA prosecution. More than 30 days delay.
4 – High/ Major	Fatality or Permanent Disabilities.	$1 Million to $10 Million Loss	Disaster, high levels of media attention, high cost of clean up. Offsite environmental harm; more than 10 days delay.
3 – Moderate	Major Injuries – Incapacitations or requiring time of work.	$100 Thousand to $1 Million Loss	Major spills, onsite release, substantial environmental nuisance, more than 1day delay. (Leads to an additional resources call out i.e. SES).
2 – Low/ Minor	Significant Injuries – Medical Treatments, non-permanent injury.	$10 Thousand to $100 Thousand Loss	Significant spills. (Leads to a call out of Site Emergency Response Group).
1 – Very Low/ Insignificant	Minor Injuries – First Aid Treatments (cuts/bruises).	Less than $10 Thousand Loss	Low environmental impact. Minor Spills less than 80 Litres.

Score	*LIKELIHOOD*
5 – Almost Certain	The event is expected to occur in most circumstances. Likely to occur frequently - More than 1 per year.
4 – Likely/ Probable	The event will probably occur in most circumstances. Likely to occur several times – 1 per year.
3 – Moderate/ Occasional	The event should occur at some time. Likely to occur some time – 1 per 5 years.
2 – Remote/ Unlikely	The event could occur at some time. Unlikely but possible. 1 per 10 years.
1 – Rare/ Very Unlikely	The event may occur only in exceptional circumstances. Assumed it may not be experienced. 1 per 100 years.

Risk Rating = Consequence + Likelihood

Consequence	Risk Rating				
5	6	7	8	9	10
4	5	6	7	8	9
3	4	5	6	7	8
2	3	4	5	6	7
1	2	3	4	5	6
	1	**2**	**3**	**4**	**5**
	Likelihood				

Risk Rating - Definitions

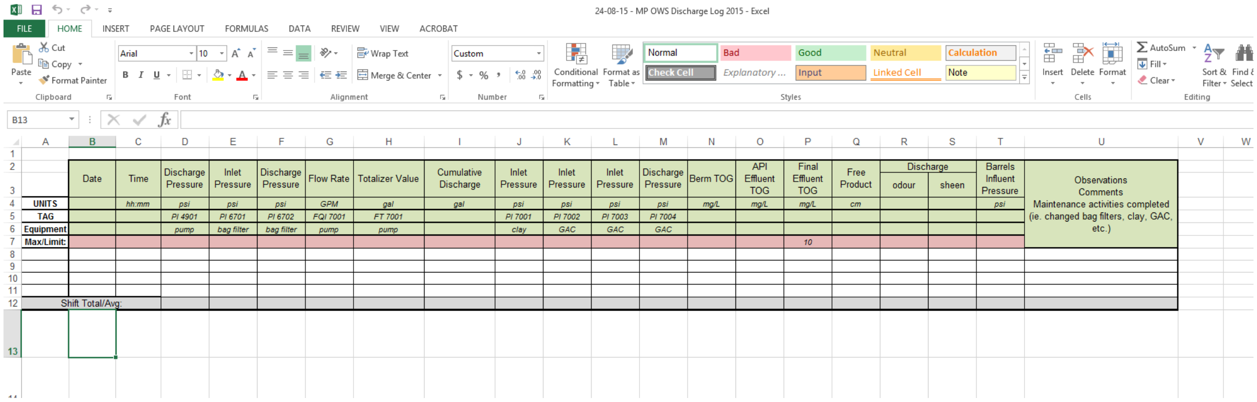
Risk Rating	Definitions	*Action Required*
8 - 10	Intolerable	Task not to start till the risk is eliminated or reduced. Bring to the immediate attention of management. Formal assessment required. MUST reduce the risk as a matter of priority.
7	High	Bring to the immediate attention of management. Task not to start till the risk is eliminated or reduced. Further Assessment required. MUST reduce the risk as a matter of priority.
6	Significant Risk	Bring to the attention of supervision. Review risks and ensure that they are reduced to as low as reasonably practicable. To be dealt with as soon as possible, preferably before the task commences. Introduce some form of hardware to control risk.
5	Moderate Risk	Needs to be controlled but not necessarily immediately, an action plan to control the risk should be drawn up. Review effectiveness of controls. Ensure responsibilities for control are specified.
2-4	Low Risk	If practical reduce the risk. Ensure personnel are competent to do the task. Manage by routing procedure. Monitor for change

A JHA considers a variety of activities/tasks involved in a job scope and analyses the key hazards (sources of harm) and their consequences (types of harm) eg. Sources of harm – lifting a heavy pipe - manual handling. Types of harm – Back strain.

Main Points – On how to write a JHA.	***Hierarchy of Hazard Management – Control Measures***
1. Define the task – what is to be done. 2. Review previous JHA if any – have we done it before? 3. Identify the steps – what is to be done. 4. Identify the hazards of each step. 5. Identify who or what could be harmed. 6. Give the task a risk rating – Consequence + Frequency 7. Develop solutions to eliminate or control hazards in each step. 8. Review the risk rating after the control system has been implemented. 9. If risk rating unacceptable review the solutions till risk rating acceptable. 10. Agree who will implement the control system. 11. Document the JHA and discuss with the relevant personnel.	These steps outline what should be planned for when deciding what control measures are to be put in place. Whenever possible the highest step should be used first and then progress down the list. 1. Eliminate the hazard. 2. Substitution. 3. Reducing the frequency of a hazardous task. 4. Enclosing the hazard. 5. Additional procedures. 6. Additional supervision. 7. Additional training. 8. Instructions / information. 9. Some personal protective equipment.

APPENDIX D –

OWS DISCHARGE LOG - DAILY LOG SHEET



	Date	Time	Discharge Pressure	Inlet Pressure	Discharge Pressure	Flow Rate	Totalizer Value	Cumulative Discharge	Inlet Pressure	Inlet Pressure	Inlet Pressure	Discharge Pressure	Berm TOG	API Effluent TOG	Final Effluent TOG	Free Product	Discharge odour	Discharge sheen	Barrels Influent Pressure	Observations Comments Maintenance activities completed (ie. changed bag filters, clay, GAC, etc.)
UNITS		hh:mm	psi	psi	psi	GPM	gal	gal	psi	psi	psi	psi	mg/L	mg/L	mg/L	cm			psi	
TAG			PI 4901	PI 6701	PI 6702	FQI 7001	FT 7001		PI 7001	PI 7002	PI 7003	PI 7004								
Equipment			pump	bag filter	bag filter	pump	pump		clay	GAC	GAC	GAC								
Max/Limit:															10					
Shift Total/Avg:																				

Electronic file located on Mine Site Environmental Server:

FINAL File System\2.0 ENV MANAGEMENT, MONITORING PLANS (BIM INTERNAL)\2.08 Oily Water Separators

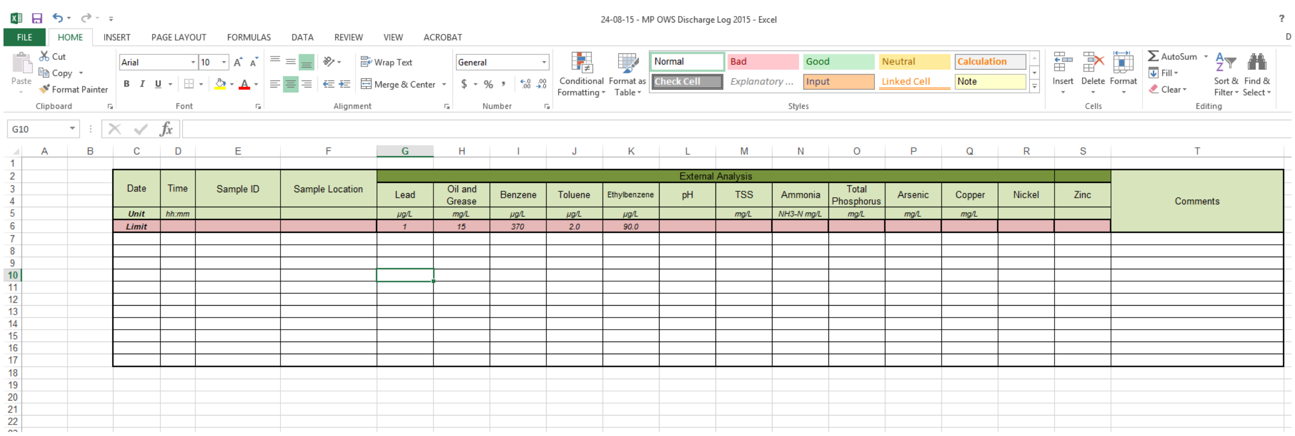
APPENDIX E –

BOTTLE SET REQUIREMENTS FOR SAMPLING STATIONS

Monitoring Group	Station			Parameters	Bottles	Total Bottles	Notes
Group 1	All water taking and discharge			Water withdrawal/discharge volumes in cubic meters			Daily
Group 2	MS-01 MS-01a	MP-01 MP-01a	SP-01 SP-01a	pH, TSS alkalinity, BOD TKN, N-NH3, TP, COD O&G Faecal coliforms (effluent only)	1 x 1L Plastic or glass for on site analysis of pH and TSS 1 x 1L Plastic for alkalinity, BOD 1 x 250mL glass with H2SO4 preservative for NH3, TKN, TP, COD 2 x 500mL glass with HCL preservative for Oil & Grease 1 x 300mL sterile PET with sodium thiosulfate filled to shoulder for feacal coliforms	6 Effluent 5 Influent	On Site
Group 3	MS-01 MS-01a MS-MRY-04 MS-MRY-04a MS-06+ MS-07 MS-08 MS-09 MS-MRY-09 MS-MRY-10 MQ-C	MP-01 MP-01a MP-Q1	SP-01 SP-01a SP-03 SP-07	Acute Toxicity	1 x 20L pail a. Acute lethality to Rainbow Trout, *Oncorhynchus mykiss* (as per Environment Canada's Environmentla Protection Series Biological Test Method EPS/1/RM/13) b. Acute lethality to *Daphnia magna* (as per Environment Canada's Environmentla Protection Series Biological Test Method EPS/1/RM/14)	1	Sterile Aquatox Pail
Group 4	MS-02	MP-02 MP-03	SP-02	pH, TSS, TDS N-NH3, TP benzene, ehtylbenzene, toluene O&G total metals: As, Cu, Pb, Ni, Zn	1 X 1L plastic or glass for on site lab analysis of pH and TSS 1 X 250ml glass bottle with H2SO4 preservative for NH3 3 X 40ml septa vials with no headspace for benzene, ethylbenzene and toluene 2 X 500ml glass with HCL preservatives for oil and grease 1 X 125ml HDPE with HNO3 preservative	8	On Site
Group 5	MS-03 MS-04 MS-05 (add TSS) MS-MRY-6	MP-03 MP-04 (add TSS)	SP-04 SP-05 SP-06 (add TSS)	pH, TSS benzene, ethylbenzene, toluene Total Lead (Pb) O&G total petroleum hydrocarbons (TPH)	1 x 1L plastic or glass for on-site lab analysis of pH and TSS 3 X 40ml septa vials with no headspace and sodium bisulfate preservative for BTE, TPH (F1) 1 X 125ml HDPE with HNO3 preservative for total lead 2 X 500ml glass bottles with HCL preservative for Oil & Grease 2 X 500ml amber glass bottles with sodium bisulfate preservative for TPH (F2-F4)	9	On Site
Group 6	MS-MRY-13A MS-MRY-13B		SP-08	pH, TSS, TDS alkalinity, conductivity, DOC O&G phenols, TOC total petroleum hydrocarbons (TPH - F1) total petroleum hydrocarbons (TPH - F2-F4) total full list of metals total mercury	1 X 1L plastic or glass for on site analysis of pH and TSS, turbidity, TDS 1 X 1L Plastic for alkalinity conductivity, DOC 2 X 500ml glass with HCL preservative for oil & grease 1 X 250ml glass with H2SO4 preservative for phenols(4AAP), TOC 3 X 40ml septa vials with no headspace and sodium bisulfate preservative for TPH (F1) 2 X 500ml amber glass bottles with sodium bisulfate preservative for TPH (F2-F4) 1 X 125ml HDPE with HNO3 preservative for total metals 1 X 120ml square glass with HCL preaservative for total mercury.	12	On Site
Group 7	MS-06+ MS-07 MS-09 MS-MRY-09 MS-MRY-10 MS-MRY-11 MS-08 MS-08-US MS-MRY-10a	MP-07?	SP-07	pH, TSS, TDS, turbidity alkalinity, hardness, DOC, sulphate, fluoride, chloride TKN, N-NH3, N-NO3, TOC, TP Total Full List Metals Dissolved Full List Metals Total mecury Dissolved mercury	1 X 1L plastic or glass for on site analysis of pH and TSS, turbidity, TDS 1 X 1L Plastic for alkalinity, anions, DOC 1 X 250ml glass with H2SO4 preservative for tkn,nh3,toc, TP 1 X 125ml HDPE with HNO3 for total metals 1 X 125ml HDPE field filtered and preserved with HNO3 preservative for dissolved metals 1 X 120ml square glass with HCL for total mercury 1 X 120ml glass field filtered and preserved with HCL for dissolved mercury	7	On Site
Group 7a	MS-MRY-10a MS-08-US MS-08						
Group 8	MS-C MQ-C	MP-C MP-Q1		N-NH3 N-NO3, conductivity pH, TSS O&G	1 X 1L plastic or glass for on site analysis of pH and TSS, turbidity 1 X 250ml glass with H2SO4 preservative for NH3 1 X 1L plastic or glass for NO3, conductivity 2 X 500ml glass with HCL preservative for oil & grease.	5	On SIte

APPENDIX F –

OWS DISCHARGE LOG - EXTERNAL RESULTS SHEET



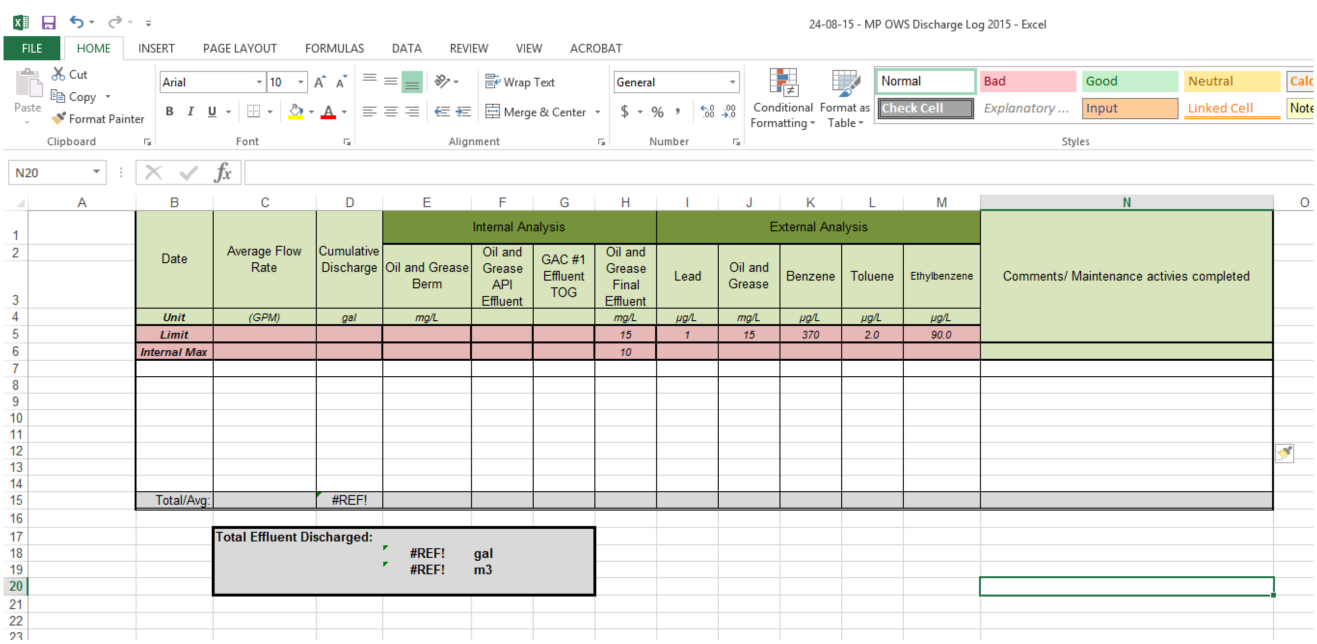
Date	Time	Sample ID	Sample Location	External Analysis													Comments
				Lead	Oil and Grease	Benzene	Toluene	Ethylbenzene	pH	TSS	Ammonia	Total Phosphorus	Arsenic	Copper	Nickel	Zinc	
Unit	hh:mm			µg/L	mg/L	µg/L	µg/L	µg/L		mg/L	NH3-N mg/L	mg/L	mg/L	mg/L			
Limit				1	15	370	2.0	90.0									

Electronic file located on Mine Site Environmental Server:

[FINAL File System\2.0 ENV MANAGEMENT, MONITORING PLANS (BIM INTERNAL)\2.08 Oily Water Separators]

APPENDIX G –

OWS DISCHARGE LOG – SUMMARY SHEET



Date	Average Flow Rate	Cumulative Discharge	Internal Analysis: Oil and Grease Berm	Internal Analysis: Oil and Grease API Effluent	Internal Analysis: GAC #1 Effluent TOG	Internal Analysis: Oil and Grease Final Effluent	External Analysis: Lead	External Analysis: Oil and Grease	External Analysis: Benzene	External Analysis: Toluene	External Analysis: Ethylbenzene	Comments/ Maintenance activies completed
Unit	*(GPM)*	*gal*	*mg/L*			*mg/L*	*µg/L*	*mg/L*	*µg/L*	*µg/L*	*µg/L*	
Limit						*15*	*1*	*15*	*370*	*2.0*	*90.0*	
Internal Max						*10*						
Total/Avg:		#REF!										

Total Effluent Discharged:
#REF! gal
#REF! m3

Electronic file located on Mine Site Environmental Server:

FINAL File System\2.0 ENV MANAGEMENT, MONITORING PLANS (BIM INTERNAL)\2.08 Oily Water Separators

Appendix H
MDMER Sampling and Reporting Requirements Memo (Minnow)

minnow environmental inc.

Memorandum

Date: May 20, 2015

To: Jim Millard (Baffinland Iron Mines Corp.)

c.c.: Oliver Curran (Baffinland Iron Mines Corp.), Cynthia Russel and Pierre Stecko (Minnow Environmental Inc.).

From: Paul LePage (Minnow Environmental Inc.)

RE: Overview of MMER Sampling and Reporting

The Mary River Project is expected to become subject to the Metal Mining Effluent Regulations (MMER) under Canada's *Fisheries Act* in June 2015 upon the release of a cumulative amount of greater than 50 cubic meters (m^3) of effluent per day to the receiving environment. As a result, under the MMER, Baffinland Iron Mines Corporation (Baffinland) will be required to initiate Effluent and Water Quality Monitoring studies.

Minnow Environmental Inc. (Minnow) has prepared this memorandum to provide an overview of the information that must be submitted to Environment Canada once the Mary River Project becomes subject to the MMER. This memorandum has been organized according to the timeline for which the ensuing monitoring information is initially due to Environment Canada to meet Baffinland's MMER obligations.

<u>Information Required Within 60 Days of Initiation of Effluent Discharge</u>

Information that must be submitted to Environment Canada within 60 days following the release of effluent above the trigger level (i.e., 50 m^3/day) includes the following:

- Name and address of the mine owner and operator;
- Name and address of the mine parent company;
- Final discharge point(s) plans, specifications, and general description;
- Final discharge point(s) coordinates, reported in latitude and longitude degrees, minutes and seconds; and,
- Name of water body receiving final effluent discharge(s).

For the Mary River Project, the final discharge points may initially include MS-09 (East Pond) and MS-06 (Ore Stockpile Runoff) locations. The MS-09 pond will collect runoff from the Early Revenue Phase (ERP) waste rock stockpile, whereas the MS-06 pond will collect surface runoff from mine site infrastructure and treated sewage water. Notably, effluent from sewage treatment facilities is not required to be monitored/reported under the MMER, but there may be requirements for monitoring to meet Baffinland's territorial (permitting) obligations. It is also noteworthy that records regarding effluent flow monitoring equipment (e.g., model numbers and year, manufacturer specifications for key equipment/components) and a calibration log must be maintained by the mine, but this information is not required to be routinely reported to Environment Canada.

The information indicated above must be submitted to the Environment Canada MMER Authorization Officer assigned to the Mary River Project, as follows:

Ms. Susanne Forbrich, Regional Director
Environmental Protection Operations Directorate
Prairie and Northern Region
Eastgate Offices
9250 – 49th Street
Edmonton, AB T6B 1K5
Susanne.forbrich@ec.gc.ca
(780) 951 - 8866

Sampling Required Following Initiation of Effluent Discharge

Effluent and water quality monitoring must be initiated upon the mine becoming subject to the MMER, and consists of:

- effluent deleterious substances monitoring;
- effluent acute toxicity testing;
- effluent volume monitoring;
- effluent characterization;
- effluent sublethal toxicity testing; and,
- receiving environment water quality.

Effluent deleterious substance (and pH) monitoring must be conducted weekly, at least 24 hours apart, at the final effluent discharge point during periods of effluent discharge. Analytical parameters measured for deleterious substance monitoring, required laboratory detection limits, and monthly mean limits are provided in Table 1. Baffinland will not be required to monitor effluent cyanide concentrations, as long as this substance is not used as a process reagent within the operations area. In addition, the monitoring frequency for radium-226 may be reduced in the event that concentrations are below 0.037 Bq/L for 10 consecutive sampling events.

Table 1: Effluent monitoring frequency and parameters associated with deleterious substances, acute toxicity and characterization monitoring components under the MMER.

Monitoring Component	Monitoring Frequency	Substance	Method Detection Limit[a]	Mean Monthly Limit
Deleterious Substances	weekly	Arsenic	0.010 mg/L	0.50 mg/L
		Copper	0.010 mg/L	0.30 mg/L
		Lead	0.010 mg/L	0.20 mg/L
		Nickel	0.010 mg/L	0.50 mg/L
		Zinc	0.010 mg/L	0.50 mg/L
		Total Suspended Solids	2.0 mg/L	15.0 mg/L
		Radium-226[b]	0.01 Bq/L	0.37 Bq/L
		pH	-	-
Acute Toxicity	Monthly	Rainbow Trout – Pass/Fail	-	-
		Daphnia magna – Pass-Fail	-	-
Effluent Characterization	four-times per year	Aluminum	0.05 mg/L	-
		Cadmium	0.00001 mg/L	-
		Iron	0.1 mg/L	-
		Mercury[b]	0.001 mg/L	-
		Molybdenum	0.005 mg/L	-
		Ammonia	0.05 mg/L	-
		Nitrate	0.05 mg/L	-
		Hardness	1 mg/L	-
		Alkalinity	2 mg/L	-
		Specific Conductance	-	-
Effluent Sublethal Toxicity	two-times per year	Fathead minnow	-	-
		Ceriodaphnia	-	-
		Duckweed	-	-
		Green alga	-	-

[a] Method detection limits for deleterious substances stipulated under the MMER, whereas those for effluent characterization are recommended by Minnow to allow comparison to relevant guidelines (e.g., Canadian Water Quality Guidelines)

[b] Sampling frequency can be reduced once the mine can demonstrate radium-226 concentrations less than 0.037 Bq/L over 10 consecutive sampling events, and mercury concentrations less than 0.0001 mg/L over 12 consecutive sampling events.

Acute toxicity testing must be conducted monthly, during periods of effluent discharge, to assess the influence of mine effluent on rainbow trout and *Daphnia magna* based on 'Pass/Fail' endpoints. Should samples be shown to be acutely lethal (i.e., ≥50% mortality), sampling frequency must be increased.

Effluent volume must be monitored in cubic meters (m^3), and reported in m^3/day, m^3/month and m^3/year, as appropriate. The effluent volume data will be used to calculate monthly loadings for each of the deleterious substances.

Effluent characterization must be conducted four times each calendar year, not less than one month (30 days) apart, while the mine is depositing effluent. In the event that effluent is discharged for only short periods each calendar year, the monitoring frequency will be reduced. It is recommended that effluent characterization be conducted at the same time as monitoring for deleterious substances and, if possible, receiving environment water quality monitoring. The list of substances required for effluent characterization is included in Table 1.

Effluent sublethal toxicity sampling must initially be conducted two-times annually using the effluent that contributes the greatest loadings of deleterious substances to the receiving environment. For each sampling event, sublethal toxicity tests must be conducted using fathead minnow (*Pimephales promelas*; 7-day survival and growth test), a cladoceran invertebrate (*Ceriodaphnia dubia*; 7-day survival and reproduction test), duckweed (*Lemna minor*; 7-day growth inhibition test), and a green alga (*Psuedokirchneriella subcapitata*; 3-day growth inhibition test) using standard test methods (Environment Canada 2007a,b,c, 2011).

Receiving environment water quality monitoring must be conducted four times each calendar year, not less than one month (30 days) apart, while the mine is depositing effluent. At a minimum, the sampling areas for receiving environment water quality monitoring at the Mary River Project must include an effluent-exposed station situated downstream of the effluent discharge(s) and a reference station located upstream of any mine effluent-related influences. Monitoring requirements for the receiving environment monitoring include field measurements of water temperature, dissolved oxygen, pH and specific conductance, as well as sampling for the substances required for deleterious substance and effluent characterization monitoring (see Table 1).

In terms of initiation of effluent and receiving environment water quality sampling, the following schedule is indicated in the MMER:

Deleterious Substances:	Within one week of the mine becoming subject to MMER.
Effluent Acute Toxicity:	Within one month of the mine becoming subject to MMER.
Effluent Volume:	Within one week of the mine becoming subject to MMER.

Effluent Characterization: Within six months of the mine becoming subject to MMER.
Effluent Sublethal Toxicity: Within six months of the mine becoming subject to MMER.
Receiving Water Monitoring: Within six months of the mine becoming subject to MMER.

For practicality, effluent volume should be monitored daily. In addition, given that effluent is likely to be discharged over a relatively short period of ice-free conditions from approximately June to September at the Mary River Project, the effluent characterization, effluent sublethal toxicity and receiving environment water quality monitoring must all be completed within six months of the Mary River Project becoming subject to the MMER. Thus, Baffinland must be prepared to organize and conduct this sampling in the summer 2015 open-water period.

Reporting Schedule and Content

Effluent monitoring reports are due to the Environment Canada Authorization Officer for all tests and monitoring conducted during each calendar quarter not later than 45 days after the end of the quarter, and annually not later than March 31st of the following calendar year. The quarterly reports will include all information related to effluent deleterious substances and pH (concentration and monthly mean concentration data), the number of days effluent was discharged and the volume of effluent discharged (monthly), mass loadings estimates from effluent for the deleterious substances, effluent acute toxicity data, effluent characterization data, effluent sublethal toxicity data and receiving environment water quality monitoring data. These reports will generally be provided electronically, with the analytical data also required to be entered into the Regulatory Information Submission System (RISS) database. A hypothetical schedule for sampling and reporting, based on an initial effluent discharge date of 30 June 2015, is provided as Table 2.

For the annual effluent and water quality monitoring report, key information that should be provided to the Authorization Officer includes:

a) The dates on which each sample was collected for effluent characterization, sublethal toxicity testing and water quality monitoring:

- four dates for effluent characterization (4 times per calendar year and not less than 1 month apart), while the mine is depositing effluent;
- four dates for water quality monitoring (4 times per calendar year and not less than 1 month apart), while the mine is depositing effluent;
- dates for sublethal toxicity testing (2 times each calendar year for 3 years and once each year after the third year, with the first testing to occur on an effluent sample collected not later than 6 months after the mine becomes subject to the MMER). The sublethal toxicity testing date(s) should match the date(s) for

Table 2: Example sampling and reporting schedule for Baffinland's Mary River Project under a hypothetical effluent discharge date of June 30, 2015.

Component		Sampling Initiation	Sampling Frequency (when discharging)	Year 1 Reporting Period				
				First Quarter Report	Second Quarter Report	Third Quarter Report	Fourth Quarter Report	Annual Report
				July, Aug, Sept 2015	Oct, Nov, Dec 2015	Jan, Feb, Mar 2016	Apr, May, Jun 2016	Jun 30 to Dec 31 2015
Effluent	Deleterious Substances and pH	July 1st - 8th, 2015	every week[a]	13 weeks of data; 3 monthly averages	13 weeks of data; 3 monthly averages	no effluent discharge likely (freeze-up)	no effluent discharge likely (freeze-up)	26 weeks of data; 6 monthly averages
	Acute Toxicity	July 1st - 8th, 2015	every month	3 sampling events	1 sampling event (assume Nov, Dec freeze up)	no effluent discharge likely (freeze-up)	no effluent discharge likely (freeze-up)	4 sampling events
	Effluent Volume (datalogger?)	July 1st - 8th, 2015	daily	continuous data 3 monthly averages	continuous data for Oct monthly averages	no effluent discharge likely (freeze-up)	no effluent discharge likely (freeze-up)	3 months of continuous data; 4 monthly averages
	Effluent Characterization Sampling	July 2015	four times annually[b]	3 sampling events[b]	1 sampling event (assume Nov, Dec freeze up)	no effluent discharge likely (freeze-up)	no effluent discharge likely (freeze-up)	4 sampling events[b]
	Sub-lethal toxicity	July 2015	twice annually[b]	2 sampling events	none required	no effluent discharge likely (freeze-up)	no effluent discharge likely (freeze-up)	2 sampling events
Receiving Environment	Downstream (effluent-exposed) Station	July 2015	four times annually[b]	3 sampling events[b]	1 sampling event (assume Nov, Dec freeze up)	no effluent discharge likely (freeze-up)	no effluent discharge likely (freeze-up)	4 sampling events[b]
	Upstream (reference) Station	July 2015	four times annually[b]	3 sampling events[b]	1 sampling event (assume Nov, Dec freeze up)	no effluent discharge likely (freeze-up)	no effluent discharge likely (freeze-up)	4 sampling events[b]
MMER Reporting	Reporting Date	-	-	due by Nov. 14, 2015	due by Feb. 14, 2016	due by May 15, 2016	due by July 15, 2016	due by Mar 31, 2016

[a] Weekly monitoring samples must be collected a minimum of 24 hours apart

[b] Sampling events must be spaced at least one month (30 days) apart from one another, and thus fewer than four sampling events may occur in instances in which effluent is discharged over short periods.

effluent characterization, as the sublethal toxicity sample must be an aliquot of the effluent characterization sample; and,

- if the required number of tests were not conducted, indicate the reason why (i.e., the number of days that the effluent was being discharged or the habitat conditions that prevented the collection of effluent characterization and/or water quality monitoring samples).

b) The locations of the final discharge points from which samples were collected for effluent characterization, noting that effluent characterization is conducted at all identified final discharge points (FDPs).

c) The location of the final discharge point from which samples were collected for sublethal toxicity testing and the data on which the selection of the final discharge point was based:

- Indicate from which FDP the effluent was collected for the sublethal toxicity testing and why that FDP was chosen for mines with more than one FDP (e.g., effluent that discharges into a sensitive receiving environment, has the greatest mass loading).

d) The latitude and longitude of sampling areas for receiving environment water quality monitoring, in degrees, minutes and seconds, and a description that is sufficient to identify the location of the sampling areas (possibly supplemented with maps).

e) The results of effluent characterization, sublethal toxicity testing and water quality monitoring:

- Include the results from all analyses completed on effluent (chemical and physical parameters), sublethal toxicity testing and receiving environment water quality monitoring.
- Include results from all required parameters, as well as any optional site-specific parameters that were measured.
- For sublethal toxicity testing, the laboratory reports should be included as an appendix in the annual report.

f) The methodologies used to conduct effluent characterization and water quality monitoring, and the related method detection limits:

- Some sampling methods are outlined in the Guidance Document for the Sampling and Analysis of Metal Mining Effluent: Final Report available at http://dsp-psd.pwgsc.gc.ca/Collection/En49-24-1-39E.pdf.

- Indicate the methodology used (e.g., inductively coupled plasma combined with mass spectrometry [ICP-MS], graphite furnace atomic absorption spectrometry [GFAAS]) for effluent characterization and water quality monitoring.
- Indicate the method detection limits for the methodology used—for MMER deleterious substances, the method detection limits identified in Table 1 should be met. Note that the Canadian Council of Ministers of the Environment's Canadian Environmental Quality Guidelines (e.g., Water Quality Guidelines for the Protection of Aquatic Life) or additional territorial/site-specific water quality guidelines should also be considered for comparisons of the receiving environment water quality monitoring.

g) A description of quality assurance and quality control measures that were implemented and the data related to the implementation of those measures:

Conclusions

I trust the information provided in this memorandum provides you with sufficient overview of the MMER sampling and reporting that Baffinland will be required to fulfil to meet its MMER obligations. Once organized, Minnow would be happy to review your monitoring schedules to verify that MMER compliance will be met. Should you require further details or wish to discuss any aspect of this information, please do not hesitate to contact me at your convenience.

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References

Environment Canada. 2007a. Biological Test Method: Test of Reproduction and Survival Using the Cladoceran *Ceriodaphnia dubia*. Environmental Technology Centre, Ottawa, Ontario. Environmental Protection Series. Report EPS 1/RM/21. Second Edition. February 2007.

Environment Canada. 2007b. Biological Test Method: Growth Inhibition Test Using a Freshwater Alga. Environmental Technology Centre, Ottawa, Ontario. Report EPS 1/RM/25. Second Edition. March 2007.

Environment Canada. 2007c. Biological Test Method: Test for Measuring the Inhibition of Growth Using the Freshwater Macrophyte *Lemna minor*. Environmental Technology Centre, Ottawa, Ontario. Environmental Protection Series. Report 1/RM/37. Second Edition. January 2007.

Environment Canada. 2011. Biological Test Method: Test of Larval Growth and Survival Using Fathead Minnows. Environmental Technology Centre, Ottawa, Ontario. Environmental Protection Series. Report 1/RM/22. Second Edition.

Appendix I
Oily Water Treatment Plant (For Vehicle Wash Water) O & M Manuals

(Available upon request)

Appendix J
Waste Pond Water Treatment Plant Operations

Appendix J – BAF-PHl-340-PRO-048 – Waste Pond Water Treatment Plant Operations

Baffinland Iron Mines Corporation

Waste Pond Water Treatment Plant Operations

Rev 1.0

Prepared By: Chet Fong
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Date: 17/08/2018
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DOCUMENT REVISION RECORD

Issue Date MM/DD/YY	Revision	Prepared By	Approved By	Issue Purpose
08/17/18	V1.0	CF		Initial

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1 PURPOSE

This document outlines the basic procedure to safely operate the Water Treatment Plant

2 SCOPE

This document will cover the basic operations of the plant, including start up and shut down, monitoring, treatment, and emergency protocols and procedures for at risk activities at the Water Treatment Plant.

2.1 EXEMPTIONS

This document does not include instructions related to water treatment, which can be found in the plant Operations and Maintenance Manual.

3 RESPONSIBILITES

Any visitor shall request permission to the plant operator prior to entering the work area. In the absence of an operator, permission shall be requested to the mine supervisor.

The Plant operator shall ensure that everyone working in the plant wears the requisite PPE according to the activities being performed (e.g. chemical handling).

4 PROCEDURES

The information in this section is intended as a summary of plant operations. In the case of a discrepancy between this document and the Operations and Maintenance Manual, the latter will take precedence.

For full details on design and plant operation, refer to the operator's manual. In standard operations, the WTP is intended to draw water from the Waste Dump Pond and treat the intake water in 3 steps inside the WTP structure. The water is then discharged to a Geotube Settling Pond, where a fourth treatment step of settlement will occur, before water is either discharged into the environment or, if not compliant, recirculated back to the Waste Dump Pond.

The three steps of treatment involve the injection of chemical into temporary storage tanks.

- Step 1 – Iron Precipitation
- Step 2 – Hydroxide Precipitation and pH Adjustment

- Step 3 – Flocculation
- Step 4 - Filtration

Steps 1-3 occur inside the WTP structure, with the 4th step taking place in the Geotube Settling Pond.

4.1 PLANT OPERATIONS

Plant operations consists primarily of managing flow, dosage and water levels across the pond, sump, and tanks. Flow is managed with a combination of control panel adjustments and manual valve manipulations.

The plant consists of the following components:

1. Intake Pump – pulls water from the Waste Dump Pond into the WTP
2. Onion tanks – water is stored for treatment prior to discharge. There are two trains, which can be run independently or concurrently.
3. Control panel – use to remotely manage pumps – can be set for automatic and manual operations
4. Dosing pumps – use to inject chemical into onion tanks at a fixed rate
5. Dosing tanks – mixing tanks from which chemicals (Lime, Polymer) is depleted at a configurable rate
6. Transfer pumps – used to take treated water from the plant out to the Geotube Pond
7. Geotube Pond – discharge from the plant is deposited here for particulate settlement prior to final discharge.
8. Discharge pump – used to pull treated water from the Geotube Pond to either be discharged into the environment or recirculated back to the Waste Dump Pond.
9. Blower motors – used to agitate water in onion tanks during treatment to ensure more even dispersion of chemicals.

Once the Plant is operational, the operator will commence with monitoring the measured levels of pH and suspended solids with built in instrumentations and gauges. These readings may be corroborated with manual instrumentations such as a YSI meter.

When readings indicate pH readings at the desired values, the operator shall then initiate discharging of water into the Geotube Pond. This water is allowed to percolate through the Geotube, which catches particulates as a filter. Once in the Sump, where any remaining particulates are then captured and settle into the bottom of the pond.

Water is discharged from this Geotube Pond, either directly into the environment or back into the Waste Dump Pond. The maximum flow rate for these discharging is 1200 gal/min, this limit imposed by the flowmeter installed.

At design capacity, the intake pump(s) should be able to pull water into the WTP for treatment at an equal rate to the discharge pump. The plant effectively runs continuously with dosing in-stream.

4.2 Plant Start up

The following steps should be undertaken when starting up the WTP.

1. Ensure blower motors are activated.
2. Ensure all the Valves to the Geotube Sump are open.
3. Ensure the transfer pumps are switched to automatic
4. Check that all the intake valves are open
5. Keep valves open between tanks on each train
6. Start up intake pump and adjust pressure accordingly. To do this, adjust the following:
    a. Rpm of the pump
    b. Valve openings
7. Start Ferric Sulphate Dosing system. Ensure intake is in the Ferric Sulphate barrels, and there are no leaks present. Pumps should be activated.
8. Start Lime Dosing system. Dosing pumps should be activated.
9. Start up Polymer Dosing System. Dosing pumps should be activated

Plant operations can now commence.

4.3 Plant Shut Down

Plant shut down can be undertaken when it is to be unmanned for a longer period of time (eg. More than 2 shifts) within the same system (for winter decommissioning, procedure XXX). To run a plant shut down

1. Shut all intake valves
2. Shut all Ferric Sulphate dosing equipment
3. Shut all Lime dosing equipment
4. shut all Polymer dosing equipment
5. Rinse Lime lines (reference other procedure)

Plant can now be shut down. This procedure can be utilized with the onion tanks full. This should also be done before any interruptions in power due to generator maintenance or other causes.

4.4 Discharging

Discharging be undertaken whenever the plant is running. It is most efficient to run the discharge when there is moderate to high water levels in the Geotube Sump. The intake hose for the Geotube Sump should utilize the ring to ensure that drawn water is from the top of the water surface.

Discharging requires the manual operation of the valves to discharge the water either to the environment or back to the Waste Dump Pond. Readings should also be checked and logged on the flowmeter when discharge begins using the totalizer values.

NOTE: discharge flow rate should be kept below 1200 gal/min, as flow greater than this will not be measureable.

To discharge, the following steps should be undertaken:

1. Ensure enough water to discharge. Water levels should be at least 50 centimetres from the bottom of the sump prior to beginning discharge.
2. Ensure valve on re-circulation line is closed. This will enable the water to discharge into the environment. Where re-circulation is required, close the valve on the discharge line and open the valve on the re-circulation line.
3. If discharging to the environment, check the totalizer reading on the flowmeter prior to discharge. This is not required if re-circulating.
4. On the control panel, Set discharge to “on”
5. While discharging, check discharge pH and Turbidity with sampling tap periodically. Samples can be collected and tested using YSI instrument.
6. When discharging is complete or to be disabled, go to control panel and set discharge to “off”

4.5 Chemical Dosing

Chemical dosing is performed as part of the treatment process. The primary drivers for chemical dosing is:

1. Reduce the pH
2. Reduce the suspended solids

Prior to discharging water back into the environment.

As dosing quantities will vary depending on flow rate and water qualities, refer to user manual for dosing quantities.

Dosing procedures will vary slightly between the stages of treatment. The three stages that require chemical intervention are Ferric Sulphate, Lime, and Polymer.

4.5.1 Ferric Sulphate – Liquid

PPE Required: long chemical resistant gloves, apron, face shield, standard PPE

- Prepare a barrel for dosing by placing the barrel into the duck pond by the ferric sulphate dosing area and removing the top seal.
- Put 2 dosing pumps into 1 barrel (1 per train)
- Switch on dosing pump on the control panel
- On the pump, check frequency and stroke length to ensure dosage is as expected.
- To change barrels, switch off on the dosing pump and change barrel

4.5.2 Lime – Bags

PPE Required: long chemical resistant gloves, respirator, face shield, respirator, standard PPE

- Fill mixing tank with intake water.
- Check filter on accessory intake water line (dedicated line for filling lime and polymer mixing tanks)
- Open valve on AI water line (fill tank). Fill to required water levels
- Ensure mixer is operating
- Add lime to water

4.5.3 Polymer – Bags

PPE Required: standard PPE

- Fill mixing tank with intake water.
- Check filter on accessory intake water line (dedicated line for filling lime and polymer mixing tanks)
- Open valve on AI water line (fill tank). Fill to required water levels
- Ensure mixer is operating
- Add polymer to water

4.6 System Automation

For instruction on System Automation, please refer to the Operations and Maintenance Manual.

4.7 Trouble Shooting

For issue identification, please refer to the checklists in the Operations and Maintenance Manual.

4.8 Accident Response

As the WTP involves the handling of a number of chemicals that may be harmful, precautions must be taken to ensure all personnel who are in the work area are informed of the hazards and the preventative and treatment measures.

4.8.1 Response Equipment Available

The WTP is equipped with a stationary emergency shower, 2 portable emergency shower stations and eyewash stations (dual purpose), 2 fire extinguishers, and 1 stationary eyewash station.

Additionally, the WTP is equipped with spare PPE, face shields, respirators, chemical resistant gloves, hearing protection, and spill kits.

There are also patch kits for the onion tanks, hose and fitting replacements, tools, and a base station radio available at the WTP.

In the event that an incident occurs that requires emergency response, same basic steps should be immediately undertaken. The following lists some of the possible situations and a brief of the response steps.

4.8.2 Spills on the Ground

- Retrieve spill pad kit
- use gloves to handle
- dispose in drum
- Label and dispose.

4.8.3 Spills on Person

- Proceed to stationary emergency shower
- Notify secondary operator
- Secondary operator activates pump switch
- Pull handle and rinse for 10 mins
- If unable to proceed to stationary emergency shower, refer to "emergency response procedure"

4.8.4 Lime in Eyes

- If possible, proceed immediately to emergency eyewash station
- Activate emergency eyewash and rinse for 10 mins.
- Repeat if required
- Notify secondary operator
- If unable to proceed to emergency eyewash station, refer to "emergency response procedure"

4.8.5 Lime Spill

- Retrieve spill pad kit
- use gloves to handle
- dispose in drum
- Label and dispose.

4.9 APPENDICIES

Appendix A – Operations and Maintenance Manual for Mary River Mine Waste Rock Pile Water Treatment Plant

APPENDIX A – OPERATIONS & MAINTENANCE MANUAL FOR MARY RIVER MINE WASTE ROCK PILE WATER TREATMENT PLANT 20180817_v02

OPERATIONS & MAINTENANCE MANUAL FOR MARY RIVER MINE WASTE ROCK PILE WATER TREATMENT PLANT 20180817_v02

Baffinland Iron Mines Corporation

Prepared by:

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1.0 INTRODUCTION

This documents outlines the Operations Manual for Baffinland Iron Mine Corporation's (BIM) Mary River Mine Waste Rock Pile water treatment plant (WTP).

2.0 PLANT OVERVIEW

2.1 General Process Description

The WTP employs a process of coagulation, pH adjustment, flocculation, and filtration to treat acid rock surface runoff collected in the pond at the base of the waste rock pile. The objective of the system operation is to treat water to within the parameters outlined in the Metal Mining Effluent Regulations (MMER), as specified to McCue by BIM, and summarized in Table 1.

Table 1: MMER Effluent Limits

Parameter	Unit	Maximum Authorized Monthly Mean Concentration	Maximum Authorized Concentrations in a Composite Sample	Maximum Authorized Concentration in a Grab Sample
Arsenic	mg/L	0.5	0.75	1.00
Copper	mg/L	0.3	0.45	0.60
Cyanide	NTU	1.00	1.50	2.00
Lead	mg/L	0.20	0.30	0.40
Nickel	mg/L	0.50	0.75	1.00
Zinc	mg/L	0.50	0.75	1.00
Total Suspended Solids	mg/L	15.00	22.50	30.00
Radium 226	Bq/L	0.37	0.74	1.11
pH	SU	6-9.5	6-9.5	6-9.5

The treatment steps are described in Section 2.2. Refer to drawings in Appendix A:

2.2 Brief Process Overview

2.2.1 *System Inlet*

Water is collected at an inlet storage pond (P-001) where it is held for treatment. Two diesel powered centrifugal trash pumps (PU-100A/B) are used to transfer water from the storage pond to an equipment enclosure where the WTP is housed.

At the WTP, the flow can be divided into two separate treatment trains (1 and 2), with each train having a flow meter on the inlet line to monitor flow.

Water is directed into two reactor tanks (TA-110 and TA-210) for processing.

2.2.2 *Step 1 – Iron Precipitation*

Ferric sulphate solution is injected into TA-110 and TA-210 to promote coagulation and precipitation of some heavy metals.

As of system commissioning in June 2018, ferric sulphate liquid solution (12% Fe) is used and injected directly into the process. Each process train utilizes an independent chemical pump to introduce chemical into the system.

The WTS also includes a ferric sulphate make down system, including a holding tank and mixer to allow for makeup of solution using dry ferric sulphate.

Each reactor tank includes a pH sensor to provide continuous monitoring of pH.

Each reactor tank is equipped with four air diffusers which supply air to the process and provide continuous mixing so that solids are kept suspended. Each train is supplied air by a dedicated blower.

2.2.3 *Step 2 – Hydroxide Precipitation and pH Adjustment*

Water flows by gravity from TA-110 and TA-210 to TA-120 and TA-220 respectively. Here, hydrated lime is injected into the process to increase pH and aid in further precipitation of some metals through hydroxide precipitation.

Hydrated lime solution is made manually by adding dry hydrated lime and raw influent water to a mixing tank (TA-020). A mixer is run continuously to ensure the hydrated lime slurry does not solidify.

One hydrated lime chemical pump is utilized to dose each reactor tank with chemical. Two motorized valves (MV-120 and MV-220) are used to control the flow of lime to each reactor tank. Each reactor tank includes a pH sensor to provide continuous monitoring of pH.

Each reactor tank is equipped with four air diffusers which supply air to the process and provide continuous mixing so that solids are kept suspended. Each train is supplied air by a dedicated blower.

2.2.4 *Step 3 – Flocculation*

Water flows by gravity from TA-120 and TA-220 to TA-130 and TA-230 respectively. Here, polymer is injected into the process to aid in flocculation of suspended solids prior to filtration.
Polymer solution is made manually by adding dry polymer and raw influent water to a mixing tank (TA-030). A mixer is run continuously to ensure uniformity of the polymer solution.

Two polymer chemical pumps are utilized to provide polymer dosing to each train. Polymer can be dosed directly into each reactor tank, or inline through a static mixer located directly downstream of the reactor tank.

2.2.5 *Step 4 – Filtration*

Water from TA-130 and TA-230 is pumped to a geotube pond via two diesel powered centrifugal trash pumps (PU-200A/B).

Water is directed to a manifold where it can be distributed to two geotube bags for solids filtration. Two additional geotube bags can be deployed in the pond once the currently operating geotube bags have reached capacity. These spare geotubes are currently stored in a warehouse for future use.

Filtered water leaves the geotube bags and is directed to a collection point at the North West corner of the pond. From here, water is pumped via one diesel trash pump (PU-300) to the Mary River discharge point, or recycled back to the inlet pond. A flow meter is installed on the discharge line to Mary River to allow for data logging of flow.

2.3 Major Equipment List

The WTP layout is provided in appendix A. A list of major equipment is provided in Table 2.

Table 2: Major WTP Equipment

Equipment	Description	Qty	Drawing Reference (If Available)
Pond Transfer Pump	Model: Prime Aire PA4A60-404ST Power: Diesel Driven Capacity: 140m3/hr	2	PU-100 A / PU-100 B
Inlet Flow Meter	Model: GF Signet 3-2551-P1-42	2	FT-100 / FT-200
Ferric Reaction Tank	Material: Polyurethane Size: 5.9m W x 1.5 H Capacity: 24,820 Liters	2	TA-110 / TA-210
Lime Reaction Tank	Material: Polyurethane Size: 5.9m W x 1.5 H Capacity: 24,820 Liters	2	TA-120 / TA-220
Polymer Reaction Tank	Material: Polyurethane Size: 5.9m W x 1.5 H Capacity: 24,820 Liters	2	TA-130 / TA-230
Aeration Blowers	Gast R7100A-3 Blower • 208 V / 3 HP / 60 Hz	2	BL-100A / BL-100B
pH Controller and Sensors	Model: Walchem W900 (Controller) Model: Walchem WEL-PHF-NN (Sensors)	1	pH-110/120/210/220
Motorized Ball Valve	Hayward 1" Ball Valve Model: HRSN2	2	MV-120 and MV-220
Level Transmitter	Model: Echosonic 11 LU27	2	LT-130 / LT-230
Bag Filter	Model: FTI830-2P-150-CS-BS-P13-DP Bag Size: 5 Micron	1	FIL-100
Ferric Chemical Pump	Model: Walchem EHE31E1-VC Power: 115 VAC/1hp/60Hz Capacity: 1 LPM @ 105m TDH	2	PU-010A / PU-010B
Lime Chemical Pump	Model: Flowmotion FR25-HR30HR Power: 230V/3hp/60Hz Capacity: 9.5 LPM @ 105 m TDH	1	PU-020
Polymer Chemical Pump	Model: Flowmotion FR25-HR30HR Power: 230V/3hp/60Hz Capacity: 16.5 LPM @ 105 m TDH	2	PU-030A / PU-030B
Ferric Mixing Tank	Material: Polyurethane Size: Ø 1.2m x 1.3m Height	1	TA-010
Lime Mixing Tank	Material: Polyurethane Size: Ø 1.8m x 1.7m Height	1	TA-020
Polymer Mixing Tank	Material: Polyurethane Size: Ø 1.6m x 1.6m Height	1	TA-030
Coarse Bubble Diffusers	Model: Maxair 24" SS	24	-

2.4 System Automation

The system is automated through a main control panel located in the system enclosure. The system P&ID is provided in Appendix A. Operation is outlined in Table 3.

Table 3: Control Panel Automation

Equipment ID	Equipment Description	Control Logic	PID Control Reference	Controls	Panel Indication
PU – 100 A/B	Inlet Pond Pump	Units can be controlled in Hand or in Auto. Pump will turn on in Hand in Auto or in Hand.	-	-	Pump icon will indicate run status
		Pump will turn off if high level is measured in TA-110 or TA-210	LSH-110 / LSH-210	Auto	High level alarm at panel
		Pump will turn off if high level measured in TA-130 or TA-230	LIT-130 / LIT-230	Auto - High level settable at panel	High level alarm at panel
BL-100 A/B	Blower	Units can be controlled in Hand or in Auto Blower will turn on in Auto or in Hand	-	-	Blower icon will indicate run status
		BL-100 A will turn off if low level is measured by LIT-130	LIT-130	Auto – Low level settable at panel	Low level alarm
		BL-100 B will turn off if low level is measured by LIT-230	LIT-230	Auto – Low level settable at panel	Low level alarm
pH-110	pH Sensor	Continuous monitoring of pH	-	-	Display pH on PLC
pH-210	pH Sensor	Continuous monitoring of pH	-	-	Display pH on PLC

pH-210	pH Sensor	If pH>9.5, close MV-120 - Alarm	MV-120	Auto – pH set point settable at panel	Display pH on PLC
pH-220	pH Dosage	If pH>9, close MV-220 - Alarm	MV-220	Auto – pH set point settable at panel	Display pH on PLC
PU-010A	Ferric Pump	Units can be controlled in Hand or in Auto	-	-	Pump icon will indicate run status
		If FIT-100 measures flow, PU-010A energizes.	FIT-100	Auto	Display run status on PLC
PU-010B	Ferric Pump	Units can be controlled in Hand or in Auto	-	-	Pump icon will indicate run status
		If FIT-200 measures flow, PU-010B energizes.	FIT-100	Auto	Display run status on PLC
PU-020	Lime Pump	Units can be controlled in Hand or in Auto	-	-	Pump icon will indicate run status
		Speed Control (1 train only) If pH-120> 8.5, PU-020 will reduce speed. If pH < 8, pump will increase pump speed. If pH is between 8 to 8.5, pump will maintain pump speed.	pH-110 / pH-120	Auto – pH set point adjustable at panel	Display run status on PLC
		Speed Control Disabled If flow is detected by both trains, speed control is disabled.	FIT-100 / FIT-200	Auto	Display run status on PLC
PU-030 A	Polymer Pump	Units can be controlled in Hand or in Auto	-	-	Pump icon will indicate run status

		Polymer pump energizes if PU-200 A is on	PU-200A	-	Display run status on PLC
PU-030 B	Polymer Pump	Units can be controlled in Hand or in Auto	-	-	Pump icon will indicate run status
		Polymer pump energizes if PU-200 B is on	PU-200B	-	Display run status on PLC
PU-200 A	Transfer Pump	Units can be controlled in Hand or in Auto	-	-	Pump icon will indicate run status
		If LT-130 measures < 3’, PU-200A off. If LT-130 measures >3’, PU-200A on.	LT-130	Auto – Set points adjustable at panel	Pump icon will indicate run status
		If LT-130 measures >4.5’, PU-200A off. If LT-130<4.5’, PU-200A on.	LT-130	Auto – Set points adjustable at panel	Pump icon will indicate run status
PU-200 B	Transfer Pump	Units can be controlled in Hand or in Auto	-	-	Pump icon will indicate run status
		If LT-230 measures < 3’, PU-200B off. If LT-230 measures >3’, PU-200B on.	LT-130	Auto – Set points adjustable at panel	Pump icon will indicate run status
		If LT-230 measures >4.5’, PU-200B off. If LT-230<4.5’, PU-200B on.	LT-130	Auto – Set points adjustable at panel	Pump icon will indicate run status
PU-300	Discharge Pump	Units can be controlled in Hand or in Auto	-	-	Pump icon will indicate run status
		Pump off at LSL-200	LSL-200	-	Level indicator on panel

		Pump on at LSH-200	LSH-200	-	Level indicator on panel
		High Level Alarm at LSHH-200	LSHH-200	-	High Level Alarm
MX-010 /020/030	Mixer	Units can be controlled on/off manually	-	-	-

3.0 GENERAL STARTUP PROCEDURE

3.1 After Dormancy Pre-start-up Procedures

The following steps shall be taken after extended periods of dormancy, prior to general startup of the WTP.

Task	Check
Perform a visual inspection of the system enclosure for signs of water/snow ingress.	☐
Inspect hose and pipe for signs of leaks, abrasion, or other physical damage.	☐
Inspect Reactor tanks as follows: • Signs of leaks, abrasion, or other physical damage. • Tank connections for signs of strain or stress. • Make sure that valves at the inlet and outlet are opened.	☐
Inspect Blowers as follows: • Signs of abrasion, or other physical damage on all external accessories such as relief valves, gauges and filters. • Make sure that valves at the inlet and outlet are opened.	☐
Inspect Diesel Pumps as follows: • Signs of leaks, abrasion, or other physical damage. • Check for and tighten loose attaching hardware. • Make sure that valves at the inlet and outlet are opened. • Check oil levels and lubricate as necessary.	☐
Inspect Ferric Sulphate pump as follows • Signs of leaks, abrasion, or other physical damage. • Make sure that valves at the inlet and outlet are opened.	☐
Inspect Hydrated Lime pumps as follows • Signs of leaks, abrasion, or other physical damage. • Inspect condition of internal pump hose. • Make sure that valves at the inlet and outlet are opened.	☐
Inspect Polymer pump as follows: • Signs of leaks, abrasion, or other physical damage. • Inspect condition of internal pump hose. • Make sure that valves at the inlet and outlet are opened.	☐
Inspect Level Transmitter as follows: • Monitor debris and ensure the sensor is level and mounted perpendicular to water level. • Check and roughly compare measurement on the PLC with the real on the field.	☐
Inspect pH sensors as follows: • Monitor debris and deposition of scaling on the transmitter. Perform a cleaning of the sensors as necessary.	☐

-

Insect Bag Filter vessel as follows: • Signs of leaks, abrasion, or other physical damage. • Inspect filter bag and replace as necessary	☐
Inspect Inlet Flow Meter as follows: • Signs of leaks, abrasion, or other physical damage. • Inspect flow sensor for scaling. Clean as necessary.	☐
Inspect Geotube Bag as follows: • Ensure inlet connection points are securely attached. • Ensure height of bag does not exceed recommended limits. If so, decommission geotube bag. • Clean geotube surface of sediment and scaling to prevent fouling using a push broom, or gentle pressure washing.	☐

3.2 Commissioning

After pre-start-up procedures are completed, the system can be energized. The following procedure reflects a high level overview of equipment checks to be performed. Detailed instructions can be found in the product specific manuals. Before any mechanical intervention, disconnect the electrical supply.

3.2.1 *Hydrated Lime Pump / Polymer Pump*

Task	Check
Ensure that all protections (cover, cover window, ventilator hood, coupling protection) are in place before operating the pump.	☐
Check the direction of rotation of the pump.	☐
Make sure that valves at the inlet and outlet are opened.	☐
Start the pump by checking its direction of rotation through the cover window.	☐
Check the flow and discharge pressure and adjust rollers if these figures don’t match the pump specifications.	☐

IMPORTANT: Ensure lime pump valves remains open during operation. Should valves be left in the closed position, the process line can over pressurize, leading to a rupture of the chemical hose.

3.2.2 *Blowers*

Task	Check
Ensure impeller rotation is correct.	☐
Check filters and inspect for signs of fouling. Replace if necessary.	☐

Ambient temperature – Check room and discharge air temperatures. Exhaust air should not exceed 135ºC.	☐
Working pressure and vacuum values – Adjust relief valve pressure or vacuum setting, if needed.	☐
Motor current – Check that the supply current matches recommended current rating on product nameplate.	☐
Electrical overload cutout – Check that the current matches the rating on product nameplate.	☐

3.2.3 *Ferric Pump*

Task	Check
Ensure pump is energized.	☐
Make sure that valves at the inlet and outlet are opened.	☐
Start the pump manually, in order to prime and adjust dosing rates.	☐
Prime the pump. See manual for details.	☐
Adjust dosing according to inlet water flow rate. See below.	☐
Check dosing rate with calibration cylinder.	☐

3.2.4 *Motorized Valve*

Task	Check
Ensure valve is energized.	☐
Ensure valve opens/closes reliably in manual mode:	☐

3.2.5 *Diesel Pumps*

Task	Check
Check fuel level and oil levels in the engine, air compressor, pump bearings and seal housing.	☐
Consult engine operations manual before attempting to start the unit.	☐
Allow pump to prime.	☐
Adjust engine speed to desired output.	☐

3.2.6 *pH Sensors*

Task	Check
Ensure sensor is calibrated.	☐
Ensure the pH reading displayed locally at the Walchem panel is transmitted correctly to PLC.	☐

3.2.7 *Geotube*

Task	Check
Ensure surface is clean of sediment and debris.	☐
Ensure all inlet valve are open.	☐
Ensure height of geotube does not exceed manufacturer recommended limit.	☐

4.0 OPERATION

4.1 General Operating Instructions

Operation of the WTP will consist of ensuring major equipment (blowers, dosing pumps, motorized valves, level transmitters) is running correctly, and ensuring influent/effluent monitoring and sampling are conducted on schedule.

The drivers for pH adjustment and TSS treatment are operation of the Ferric Sulfate, Hydrated Lime and Polymer Pump, along with the proper performance of the aeration blowers and diffusers equipment.

The unit will run manually. During short term dormancy, the unit can be operated in a "Sleep Mode" where the system is run in a re-cycle status using two submersible pumps inside TA-130 and TA-230 to recirculate water from the end of each train to the beginning of each train. Chemical injection is disabled during dormancy, however, the lime mixer should remain on to maintain suspension of the hydrated lime slurry. Blowers will also remain on to ensure suspension of solids within the reactor tanks.

Parameters to be measured and recorded daily include temperature, pH (typical values are between 6.5 and 9), and TSS. The system must be monitored regularly to ensure pH does not drop below the low level set point or raise above the level set point.

The pH reading should be recorded daily. The pH should be cross referenced regularly with a hand held device. Should the pH differ from the hand held reading, the operator should clean the pH electrodes using a 2-5% solution of hydrochloric acid.

System data can be recorded in the spreadsheet provided in Appendix B. Regular daily monitoring of parameters such as pH, temperature, TSS, and Geotube height must be recorded to ensure proper operation.

4.2 Operating Procedure

The following section will outline the step-by-step procedures for operating the treatment system.

4.2.1 *Standard Operation*

Inlet

The inlet pond level should be checked and recorded prior to start up. Two pond pumps can be utilized to transfer raw water to the treatment system. Usage will depend on the volume of treatment required. At low pond levels, one pond pump and one process train can be utilized. At high levels, both pumps can be utilized to increase the treatment volume.

All pump discharge valves must be opened. The pumps (PU-100 A/B) shall be placed in “Hand” at the PLC. This will energize the pumps and begin transfer of water to the treatment system. The pumps will only turn on if a high level is measured by LSH-110/210 or LT-130/230.

Operators must ensure the inlet pond level is monitored, as the pumps do not include a low level shut off.

Ferric Pumps (PU-010 A/B)

Water is transferred from the inlet pond to two reactor tanks (TA-110 and TA-210) where ferric sulphate is injected. The dosage rate of the ferric pumps is determined by the inlet quality of the raw water and can range from 0 to 20 mg/l. The dosage rate is to be determined by the operator.

The dosage rate must be set manually at the pump. Once set, the pump can be set to “Auto” at the control panel. The ferric pumps, PU-010 A and PU-010 B, will energize when flow is detected by FIT-100 and FIT-200 respectively.

Before starting the pumps, all discharge valves must be opened.

Lime Pump (PU-020)

After coagulant addition, water flows by gravity to TA-120 and TA-220 where hydrated lime is injected into the process. The dosage rate of the Lime pump is determined by the inlet quality of raw water and the pH required, and can range from 0 to 300 mg/l. The dosage rate is to be determined by the operator.

In manual mode, the speed of the pump can be set at the pump VFD, located on the lime pump stand.

Pump speed will be dependent on the pH measured by pH-120, and the pH set point entered into the panel (adjustable by an operator). At a setpoint of 8.5, the pump will increase speed if pH-120 measures a pH below 8. If pH-120 measures a pH above 9, pump speed will decrease. If pH is measured between 8 to 8.5, the dosage rate will remain the same.

At a pH above 9.5, MV-120 and MV-220 will close.

The lime pump will operate continuously, with chemical consistently recirculated to the lime mixing tank (TA-020). This is done to ensure the lime slurry does not settle and solidify in the piping system. At the end of every shift, clean water must be flushed through the piping in order to prevent fouling. Flushing may be required more frequently depending on operational conditions.

Due to the possibility of fouling, the lime pump system must be monitored for pressure consistently.

Lime Solution Make Up

Hydrated lime solution is made manually, with the solution concentration ranging from 5-10% depending on volume of raw water to be treated. A concentration of 5% is recommended to minimize line fouling caused by the lime slurry. Higher concentrations can be made, but more frequent line flushing will be required.

The lime tank mixer is operated from the panel, and should be operated continuously to prevent the slurry from solidifying.

Polymer Pumps (PU-030 A/B)

The dosage rate of the ferric pumps is determined by the inlet quality and can range from 0 to 3 mg/l.

The dosage rate must be set manually at the pump. Once set, the pump can be set to "Auto" at the control panel. The polymer pumps, PU-020 A and PU-020 B, will energize when the transfer pumps, PU-200 A and PU-200 B are energized.

Before starting the pumps, all discharge valves must be opened.

Polymer Solution Make Up

Polymer solution is made manually, with concentration ranging from 0.1 to 0.25% depending on volume to be treated.

The polymer tank mixer is operated from the panel, and should be kept on at all times to maintain uniformity of the solution.

Blowers

The blowers are operated from the panel, and should be energized at all times when raw water is being processed in the reactor tanks.

Both blowers (BL-100A and BL-100B) can be set in "Auto" at the panel, at which point they will run continuously until the water level in TA-130 and TA-230 is measured to be less than 6". This level is settable at the panel.

Raw Water Bag Filter

The bag filter provides filtration of water required for chemical makeup. The filter bags should be replaced periodically when differential pressure across the filter exceeds approximately 20 psi.

Geotube Bags

Water is transferred from the final reactor tanks (TA-130 and TA-230) by diesel generated trash pumps (PU-200 A and PU-200 B) to the geotube pond. The transfer pumps, PU-200A and PU-200B are operated based on the level measured by the reactor tank level transmitters, LT-130 and LT-230 respectively. These set points are adjustable at the panel.

The height of the geotube bags must be monitored regularly.

4.3 Daily Operator Checklist

The following steps outline day-to-day operational procedures for the WTS.

Standard Operation

Task	Check
Check inlet pond and record water level	☐
Check lime and polymer solutions, make up additional solution as required.	☐
Place PU-100 A (and PU-100 B if necessary) in Hand mode at the control panel.	☐
Set Ferric Sulphate pump (PU-010 A / B) dose rate and place pump in Auto at control panel. Ensure pump energizes when flow is detected by FIT-100 or FIT-200.	☐
Turn on hydrated lime pump (PU-020 A) manually. Adjust dose rate based on flow measured by inlet flow meters.	☐
Monitor hydrated lime pump pressure gauge. If pressure gauge is showing a pressure greater than 15 psi, flush line with water.	☐
Set polymer pump dose rate at panel. Set in “remote” mode. Set pump to auto at panel. Pump will turn on when PU-200A/B energize.	☐
Set Blowers (BL-100 A / BL-100B) to Hand.	☐
Once onion tanks are full, set PU-200A/B to Auto (if using both trains). Ensure downstream valves to geotube bags are open.	☐

Observe reactor tank water levels to ensure inlet and outlet flows are balanced.	☐
Observe and record height of geotube bags. Height must not exceed 6 feet.	☐
Set PU-300 to auto in the panel. Once the water in the pond reaches the operating float switch, the pump will be energized.	☐
Discharge vales must be set manually to allow for discharge to the creek, or recycle back to the inlet pond. Set valves in correct position.	☐

Daily Shutdown

Task	**Check**
Set inlet pump to Off position	
Allow reactor tanks to be pumped down to ¼ volume.	☐
Turn off chemical pumps.	☐
Flush lime line with water	☐
Keep lime mixer (Mix-020) on to ensure hydrated lime slurry remains in liquid form.	☐
If tanks are lowered, blowers can be turned off. If tanks are kept full, energize recirculation pumps.	☐
Check lime and polymer solutions, make up additional solution if required.	☐
Turn transfer pumps (PU-200 A/B) and discharge diesel pump (PU-300) off.	☐

APPENDIX A –DRAWINGS

NOTES:

PU-200A/B- Transfer Pump
PU-300- Discharge Pump
FT-300- Flow Meter
LS- Level Switch
-LSHH 200
-LSH 200
-LSL 200

Process lines
Instrumentation lines

Process based on conceptual desgin by Golder Associates

REVISION TABLE

No.	DESCRIPTION	DATE
0	Original Issue	2018/04/30
1	Record Drawing	2018/07/31

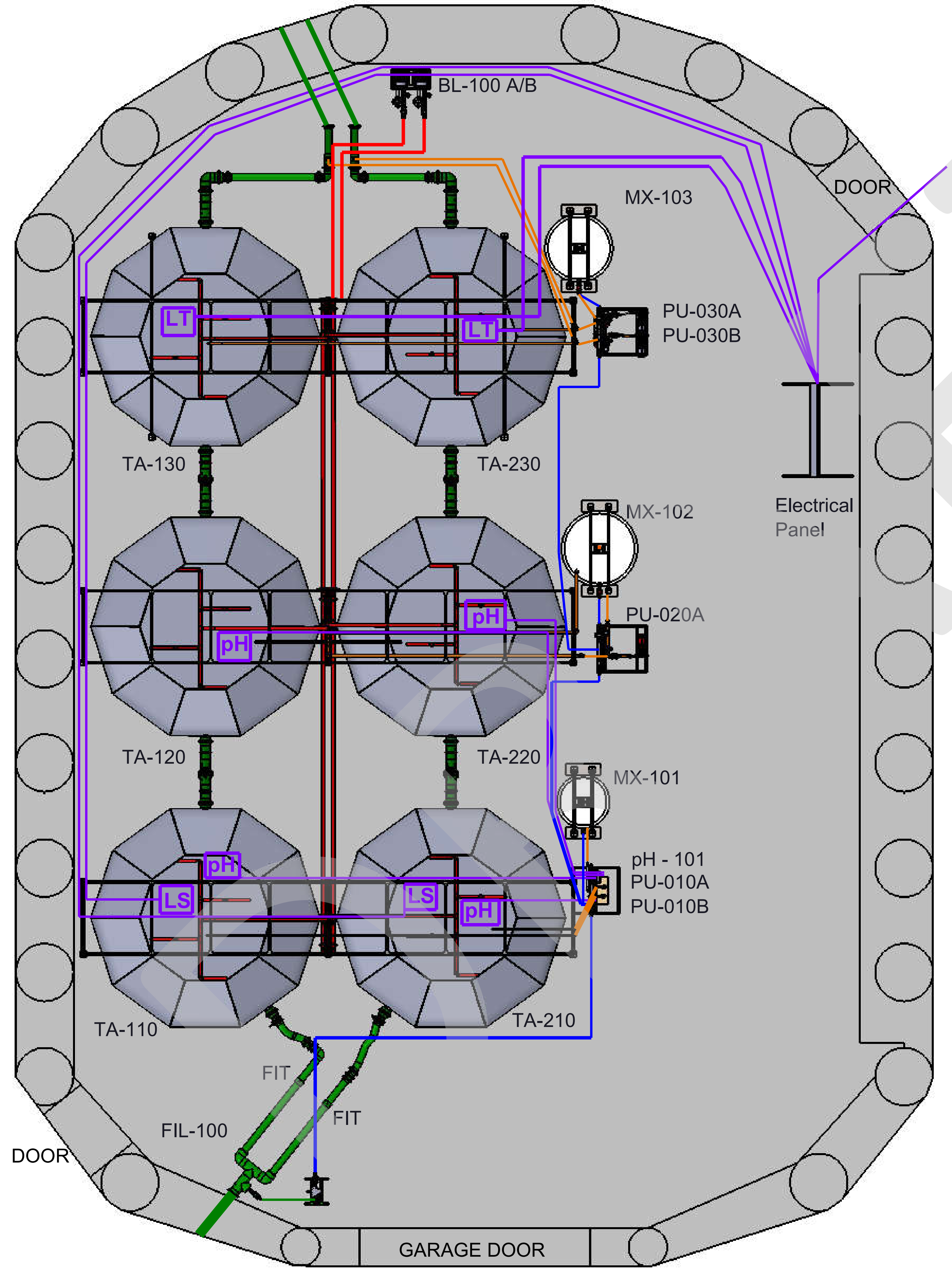
McCUE ENGINEERING CONTRACTORS

CLIENT:

BAFFINLAND IRON MINES CORPORATION

FULL SITE LAYOUT
GENERAL ARRANGEMENT DRAWING
Waste Rock Pile Water Treatment Plant

DATE: July 31, 2018	SCALE: NTS
DATA BY: R.B.	MCCUE JOB NO: 137-0001
DRAWN BY: L.S	FIG: GA-001



LEGEND

BL-100 A/B - Blower
FIL-100 - Bag Filter
MX-101 - Ferric Mixing Station
MX-102 - Lime Mixing Station
MX-103 - Polymer Mixing Station
PU-010 A/B - Ferric Pump
PU-020 - Lime Pump
PU-030 A/B - Polymer Pump
TA-110 - Ferric Process Tank (Train 1)
TA-210 - Ferric Process Tank (Train 2)
TA-120 - Lime Process Tank (Train 1)
TA-220 - Lime Process Tank (Train 2)
TA-130 - Polymer Process Tank (Train 1)
TA-230 - Polymer Process Tank (Train 2)
pH-101 - pH Controller
FIT - Flow Meter
pH - pH Sensor
LS - Level Switch
LT - Level Transmiter

Notes:

- Process Lines
- Water Make-up Lines
- Chemical Lines
- Air Lines
- Instrumentation Line

Process based on conceptual design by Golder Associates

REVISION TABLE

No.	DESCRIPTION	DATE
0	Original Issue	2018/05/01
1	Record Drawing	2018/08/17

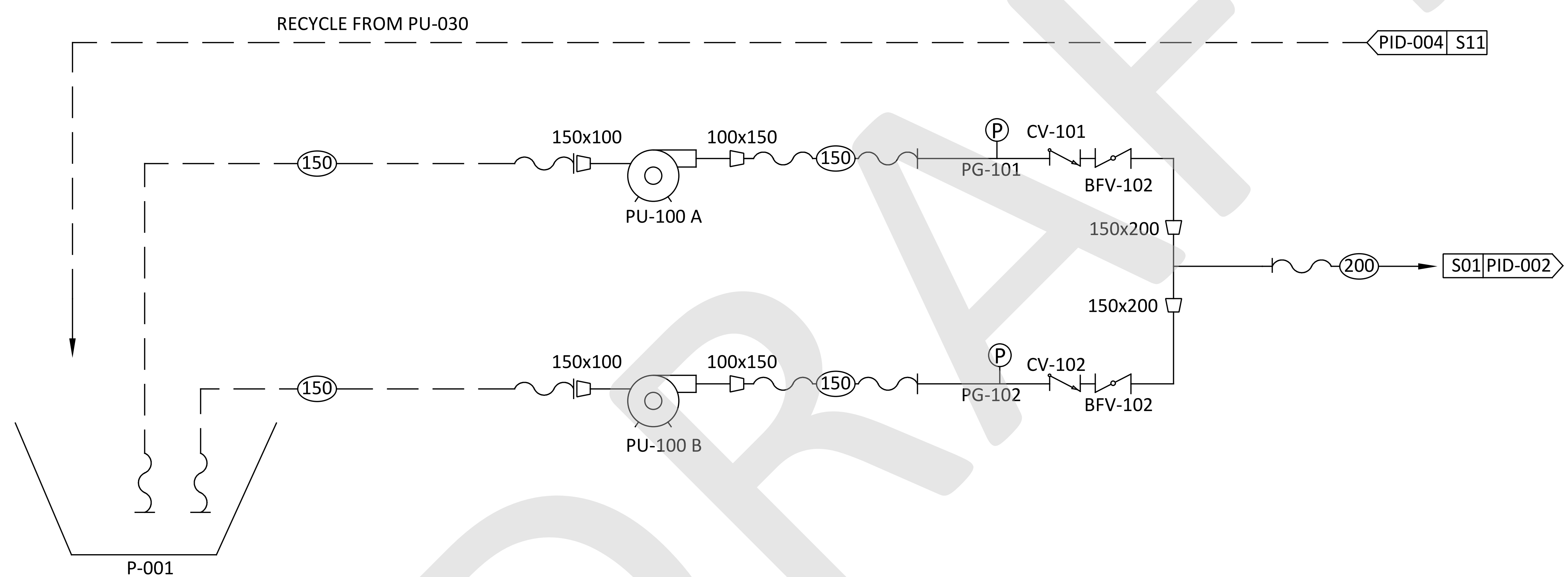
McCUE ENGINEERING CONTRATORS

CLIENT:

BAFFINLAND IRON MINES CORPORATION

BUILDING LAYOUT
GENERAL ARRANGEMENT DRAWING
Waste Rock Pile Water Treatment Plant

DATE: August 17, 2018	SCALE: AS SHOWN
DATA BY: R.B	JOB NO: 137-0001
DRAWN BY: L.S	FIG: GA-002



P-001
Inlet Storage Pond

PU-100 A/B
Pond Transfer Pump
Model: Prime Aire PA4A60-404ST
Power: Diesel Driven
Capacity: 140m³/hr

LEGEND :

- Hose
- Sch. 80 PVC Pipe
- Butterfly Valve
- Check Valve
- Reducer
- Pressure Gauge

Process based on conceptual design by Golder Associates

NO.	REVISION TABLE	DATE
0	Original Issue	April 30, 2018
1	Record Drawing	July 31, 2018

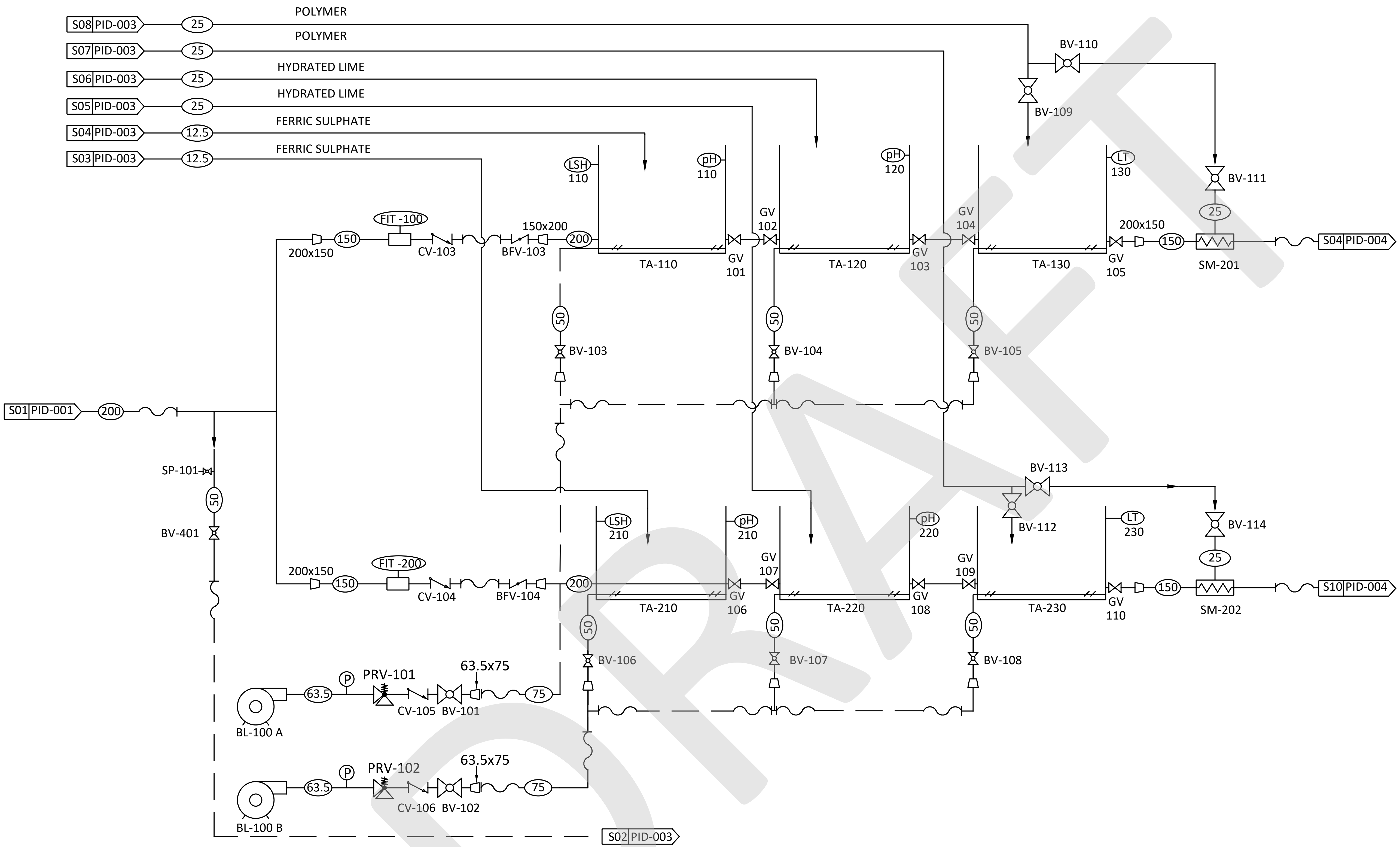
McCUE ENGINEERING CONTRACTORS

CLIENT:

BAFFINLAND IRON MINES CORPORATION

Waste Rock Water Storage Pond
PROCESS & INSTRUMENTATION DIAGRAM
Waste Rock Pile Treatment Plant

DATE: July 31, 2018	SCALE: NTS
DATA BY: R.B.	MCCUE JOB NO: 137-0001
DRAWN BY: M.T.	FIG: PID-0001



BL-100 A/B
Blower
Model: Gast R7100A-3
Power: 208V/3hp/60Hz
Capacity: 500m³/hr @ 1.9m TDH

TA-110/210
Ferric Reaction Tank
Material: Polyurethane
Size: 5.9m W x 1.5 H
Capacity: 24,820 Liters

TA-120/220
Lime Reaction Tank
Material: Polyurethane
Size: 5.9m W x 1.5 H
Capacity: 24,820 Liters

TA-130/230
Polymer Reaction Tank
Material: Polyurethane
Size: 5.9m W x 1.5 H
Capacity: 24,820 Liters

FT-100/200
Influent Flow Meter
Model: GF Signet 3-2551-P1-41

LT-130/230
Level Transmitter
Model: Echosonic 11 LU27

pH-110/120/210/220
pH Meter
Model: Walchem WEL-PHF-NN

LEGEND:

- Hose
- Sch. 80 PVC Pipe
- Butterfly Valve
- Check Valve
- Reducer
- Pressure Gauge
- Static Mixer
- Gate Valve
- Pressure Relief Valve
- Ball Valve
- Sample Port
- Flow Meter
- Level Switch
- pH Sensor
- Level Transmitter

Process based on conceptual design by Golder Associates

NO.	REVISION TABLE	DATE
0	Original Issue	April 30, 2018
1	Record Drawing	July 31, 2018

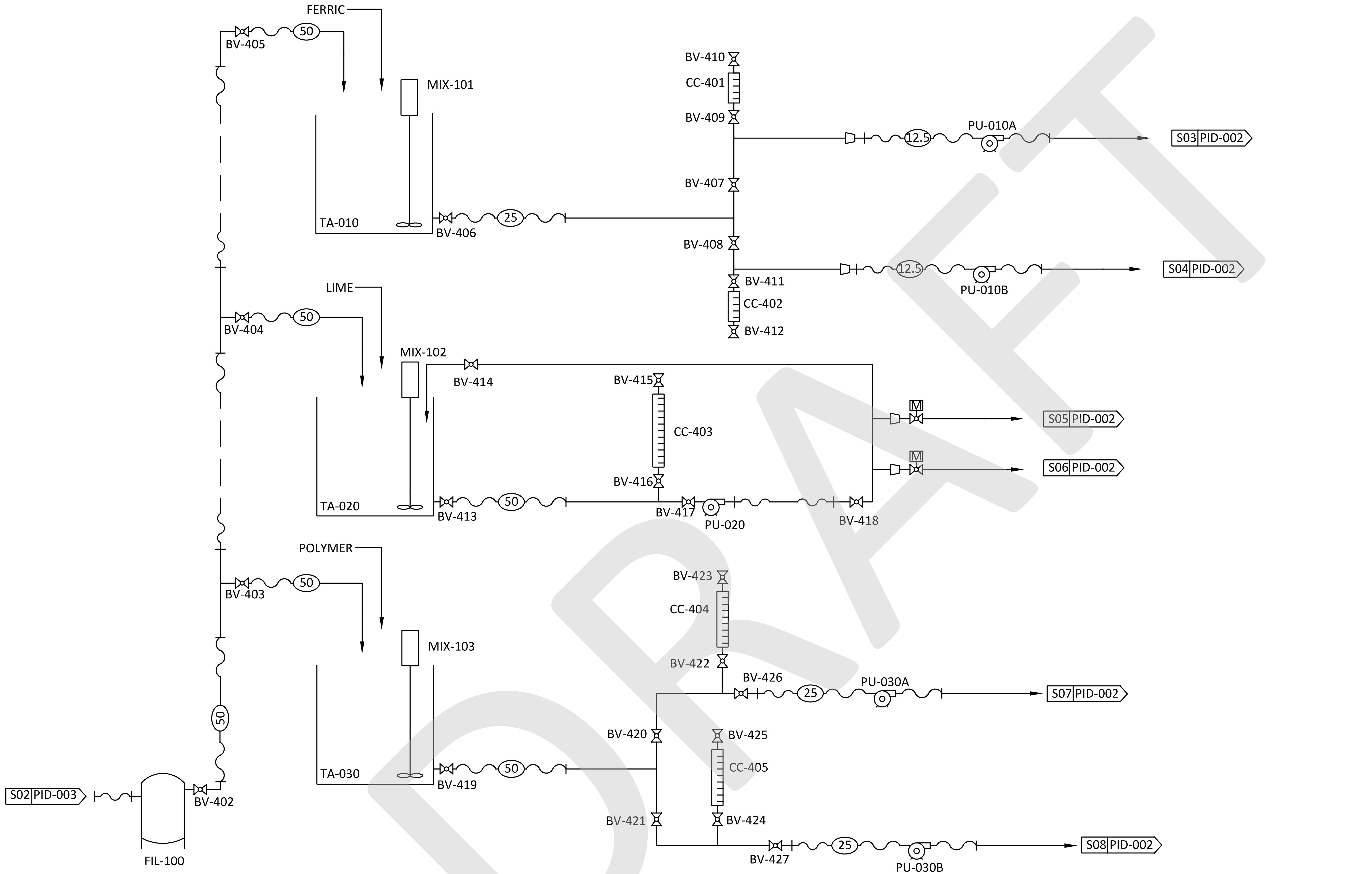
McCUE ENGINEERING CONTRACTORS

CLIENT:

BAFFINLAND IRON MINES CORPORATION

REACTION TANKS
PROCESS & INSTRUMENTATION DIAGRAM
Waste Rock Pile Water Treatment Plant

DATE: July 31, 2018	SCALE: NTS
DATA BY: R.B.	MCCUE JOB NO: 137-0001
DRAWN BY: M.T.	FIG: PID-0002



FIL-100
Bag Filter
Model: FTI 830-2P-150-CS-BS-P13-DP
Bag Size: 5 Micron

PU-010A/B
Ferric Chemical Pump
Model: Welchmen EHE31E1-VC
Power: 115 VAC/1hp/60Hz
Capacity: 21 LPM @ 106m TDH

PU-020
Lime Chemical Pump
Model: Flowmotion FR25-HR30HR
Power: 230V/3hp/60Hz
Capacity: 570 LPM @ 42m TDH

PU-030
Polymer Chemical Pump
Model: Flowmotion FR25-HR30HR
Power: 230V/3hp/60Hz
Capacity: 990 LPM @ 42m TDH

MIX-101
Ferric Mixer
Model: Dynamix DMX-5505K-1
Power: 0.5 HP, 230V/1Ph/60Hz
Shaft: 1" Diameter x 41" Long

MIX-102
Lime Mixer
Model: Dynamix DMX-5505K-2
Power: 0.5 HP, 230V/1Ph/60Hz
Shaft: 1" Diameter x 52" Long

MIX-103
Polymer Mixer
Model: Dynamix DMX-5505K-1
Power: 0.5 HP, 230V/1Ph/60Hz
Shaft: 1" Diameter x 49" Long

TA-010
Ferric Mixing Tank
Material: Polyurethane
Size: Ø 1.2m x 1.3m Height

TA-020
Lime Mixing Tank
Material: Polyurethane
Size: Ø 1.8m x 1.7m Height

TA-030
Polymer Mixing Tank
Material: Polyurethane
Size: Ø 1.6m x 1.6m Height

CC-401/402/403/404/405
Calibration Column

LEGEND:

- Hose
- Sch. 80 PVC Pipe
- Ball Valve
- Reducer
- Motorized Ball Valve

Process based on conceptual design by Golder Associates

NO.	REVISION TABLE	DATE
0	Original Issue	April 30, 2018
1	Record Drawing	July 31, 2018

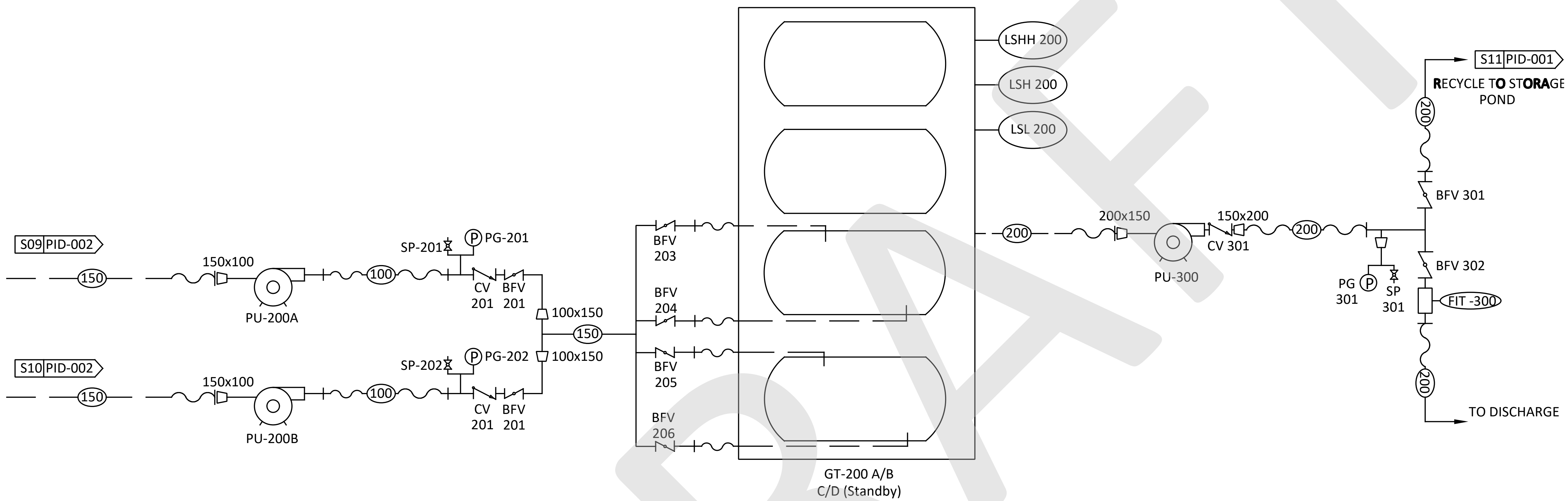
McCUE ENGINEERING CONTRACTORS

CLIENT:

BAFFINLAND IRON MINES CORPORATION

CHEMICAL MAKEUP
PROCESS & INSTRUMENTATION DIAGRAM
Waste Rock Pile Water Treatment Plant

DATE: July 31, 2018	SCALE: NTS
DATA BY: R.B.	MCCUE JOB NO: 137-0001
DRAWN BY: M.T.	FIG: PID-003



PU-200A/B
Transfer Pump
Model: Prime Aire PA4A60-404ST
Power: Diesel Driven
Capacity: 140m³/hr

GT-200 A/B/C/D
Geotube
Model: Tencare GT500
Dimensions: 60' Circumference x 100' Long

PU-300
Discharge Pump
Model: Prime Aire PA4A60-404ST
Power: Diesel Driven
Capacity: 280m³/hr

FT-300
Flow Meter
Model: Toshiba GFG32

LEGEND:

- Hose
- Sch. 80 PVC Pipe
- Butterfly Valve
- Check Valve
- Reducer
- Pressure Gauge
- Sample Port
- Level Switch

Process based on conceptual design by Golder Associates

NO.	REVISION TABLE	DATE
0	Original Issue	April 30, 2018
1	Record Drawing	July 31, 2018

McCUE ENGINEERING CONTRACTORS

CLIENT:

BAFFINLAND IRON MINES CORPORATION

GEOTUBE FIELD
PROCESS & INSTRUMENTATION DIAGRAM
Waste Rock Pile Water Treatment Plant

DATE: July 31, 2018	SCALE: NTS
DATA BY: R.B.	MCCUE JOB NO: 137-0001
DRAWN BY: M.T.	FIG: PID-004

APPENDIX B - MONITORING

McCUE ENGINEERING CONTRACTORS EST. 2000
BROWNFIELDS TO GOLD MINES

Monitoring Spreadsheet

Project Name: BaffinLand Iron Mine
Waste Pile Water Treatment

			Inlet Quality			Train 1						Train 2						Discharge							
Date	Time	OP	Temp ºC	Inlet pH	Inlet TSS mg/L	FIT-100 (L/s)	pH-110	pH-120	Ferric Dosage Stroke/Speed	Lime Dosage Hz	Polymer Dosage Hz	FIT-200 (L/s)	pH-210	pH-220	Ferric Dosage Stroke/Speed	Lime Dosage Hz	Polymer Dosage Hz	FIT-300 (gpm)	FIT-300 Totalizer (gpm)	Geotube Pond pH	Geobag 1 Height (m)	Geobag 2 Height (m)	Discharge pH	Discharge Turbidity NTU	Discharge TSS (mg/L)

<u>Observations</u>

Chemical Availability	Week #1 Date:	Week #2 Date:	Week #3 Date:	Week #4 Date:
Ferric Sulphate				
Hydrated Lime				
Polymer				

Appendix K

Metal and Diamond Mining Effluent Regulations Emergency Response Plan

Baffinland Iron Mines Corporation

METAL AND DIAMOND MINING EFFLUENT REGULATIONS EMERGENCY RESPONSE PLAN

BAF-PH1-830-P16-0047

Rev 2

Prepared By: Connor Devereaux
Department: Environment
Title: Environmental Superintendent
Date: February 27, 2019

Signature:

Approved By: Gerald Rogers
Department: Operations
Title: General Manager
Date: February 27, 2019

Signature: