



WOLVERINE PROJECT

WATER MANAGEMENT AND TREATMENT PLAN

ADVANCED EXPLORATION PHASE

TYPE B WATER LICENCE QZ01-051
CONDITIONS 32, 37, 39, 50, 51, 53, 55, AND 56.

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TABLE OF CONTENTS

LIST OF FIGURES	i
LIST OF TABLES	ii
LIST OF PICTURES	ii
LIST OF APPENDICES	ii
1 Introduction.....	1
2 Background Information.....	1
2.1 Wolverine Project Site Precipitation.....	1
2.1.1 Mean Annual Precipitation	2
2.1.2 Mean Monthly Precipitation	2
2.1.3 Seasonal Precipitation Trends.....	3
2.1.4 Annual and Monthly Precipitation.....	4
2.1.5 Hourly and Daily Rainfall.....	4
2.1.6 Hourly and Daily Snowfall	5
3 Revised Water Quality Model	7
3.1 Discharge Quality Criteria	7
3.2 2005 Mine Water Quality Results.....	7
3.3 2006 Mine Water Quality Results.....	8
3.3.1 Selenium Analyses.....	9
3.4 Waste Rock Sump Water Quality 2006.....	10
4 Water Storage and Treatment Infrastructure.....	11
3.1 Portal Sumps	11
3.2 Water Treatment Sumps	12
3.3 Waste Rock Pad Sump.....	14
5 Water Treatment	15
5.1 Iron Addition.....	15
5.2 Ferric Sulfate Sludge Management.....	17
4.4 Water Treatment Plant	18
5.3 Sediment and Sludge Management.....	19
6 Summary	19
7 References.....	20

LIST OF FIGURES

Figure 1. Hourly and Daily Extreme Precipitation - Wolverine Project Site	5
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LIST OF TABLES

Table 1. Frequency Analysis of Monthly and Annual Precipitation at the Wolverine Project Site – Dry and Wet Years.....	3
Table 2. Frequency Analysis of Winter Snowpack	6
Table 3. B Licence Maximum Authorized Concentration Grab Sample Discharge Quality Criteria	7
Table 4. Mine water collected in Dirty Sump, July to September 2005	8
Table 5. Underground recharge water chemistry for mine water, February to June 2006	8
Table 6. Comparison of Results of Se Analysis on Mine and Portal Water by ICP-MS and Hydride Generation.....	10
Table 7. Summary of Water Chemical Analyses for the Waste Rock Pad Sump, May to July 2006.....	10
Table 8. Average chemical composition of treated mine water for June and July 2006	16
Table 9. ICP-MS vs Hydride results for treated mine water, September 2006.	17

LIST OF PICTURES

Picture 1. Dirty (rectangular) and clean (square) sumps at the portal area, and 4” insulated lines (white) connecting to the underground and water treatment sumps.	11
Picture 2. Portal dirty sump with weighted floating silt curtain installed to enhance settling of solids.	12
Picture 3. Water treatment sumps at the lower laydown area adjacent to the water treatment plant (blue seacan).	13
Picture 4. Pump for treated water discharge is affixed to a floating raft.	13
Picture 5. Waste rock pad sump at lowest corner of the pad (center of top photo) for collection of surface runoff of the stockpile.	14
Picture 6. Two multi-media sand filters and one of the three carbon columns within the WTP.	18

LIST OF APPENDICES

Appendix A: Portal and Water Treatment Sump Design Drawings	
Appendix B: Material Safety Data Sheet: Ferric Sulfate Ferriclear® (Univar)	
Appendix C: Water Treatment Plant: Selenium Filtration System Operation Manual (CEMI and Filterco Water Treatment Ltd.)	

1 Introduction

This report is a revision to the *Water Management and Treatment Plan* submitted November 17, 2005. It has been prepared to satisfy requirements contained within Type “B” Water Licence Approval QZ01-051. The structure and content of this report is based upon details provided in the Environmental Assessment Act Screening Report (Application No. LQ00026), by Yukon Government Energy, Mines and Resources and the Yukon Water Board. Specifically, this report provides information with respect to the following Water Licence Conditions: 32, 37, 39, 50, 51, 53, 55, and 56.

The purpose of this document is to describe the management and treatment of groundwater pumped from underground workings and runoff collected from the waste rock pad. This document also provides plans for sludge produced during water treatment from two processes: iron addition in the water treatment sumps and the activated carbon water treatment plant.

2 Background Information

Regional climate data is available from three Environment Canada stations located within the Liard Basin. Watson Lake is located 175 km south-southeast of the project, at an elevation of 687 m a.s.l. Climate data is available for the period 1938-2005. Tuchtua is located 80 km southeast of the project, at an elevation of 724 m a.s.l. Climate data is available for the period 1971-2004. Hour Lake is located 60 km east-southeast of the project at an elevation of 890 m a.s.l. Climate data is available for the period 1982-2004.

These three stations are sited in valley bottoms and range from 500 m to 900 m lower in elevation than the project site. They are not fully representative of the climate at the project site, which is located in the upland region of the Pelly Mountains. Therefore, interpretation of regional climatic data to characterize conditions in the project area was tempered by the data collected on site. Wherever possible, regional data was corrected for the effects of location and elevation to generate expected conditions at the project.

2.1 *Wolverine Project Site Precipitation*

Baseline data collection began at the project site in 1996 and has continued intermittently to the present. In 1996 and 1997, and again for portions of 2000 and 2001, some automated data was collected at a location near the exploration camp site on Wolverine Lake.

Beginning in October 2004, continuous data has been collected by an automated weather station located adjacent to the airstrip. A new weather station was installed in June 2006 in the Go Creek valley bottom near the airstrip to more accurately the Go-Wolverine valley climatic conditions. The station measures rainfall, air pressure, solar radiation, wind speed and wind direction, air temperature, evaporation and relative humidity. Data from the instruments is recorded by the data logger and is manually downloaded on a regular basis.

The climate at the project site is typical of its location and position. In general, summers are characterized by unstable air, thunderstorms, and frequent rainfall. Winters are cold and dry. Winter conditions begin in October and last through April. Late April and May are the driest months of the year and constitute spring. Summer lasts from June to August and is the wettest season of the year. The short fall period consists of late August through September.

2.1.1 Mean Annual Precipitation

The three regional climate stations have mean annual precipitation totals ranging from 418 mm at Watson Lake, to 514 mm at Hour Lake. Mean annual precipitation increases with elevation (the orographic effect); therefore, the mean annual precipitation at the project site should be higher than at any of the three regional stations.

Precipitation data has been collected at the project site in 2006 (currently being evaluated), summer 2005, and during portions of the summer of 1996 and 1997. The recorded site precipitation for the periods of record has been compared to the recorded precipitation at the regional stations for the same periods. Such a comparison indicates that monthly precipitation recorded at the site varies from 52% to 165% of precipitation recorded at regional stations. There is a weakly positive trend (higher precipitation at the project site than at regional stations) as might be expected because of the orographic effect; however, the data are too limited to provide definitive conclusions.

The Rainfall Atlas of Canada (Bruce 1968) and an Oregon State University reference for Yukon and Alaska¹ both indicate that mean annual precipitation at the project site is expected to be in the range of 500-600 mm. Mean annual precipitation at the project site has therefore been estimated at approximately 550 mm. As noted below, this estimated value is consistent with other observations.

2.1.2 Mean Monthly Precipitation

Precipitation at the project site is higher than at the regional stations in summer, but similar to the regional stations during the winter. When the regional data for summer precipitation is adjusted to account for increase elevation at the project site, the projected net summer precipitation at the site is roughly 25% higher than the regional summer mean, while the net winter precipitation remains similar to the regional winter mean. The results of this seasonal scaling are presented in Table 1. Additionally, the mean annual precipitation found by summing the mean monthly precipitation totals is 548 mm, essentially identical to the 550 mm estimate determined from regional precipitation mapping.

¹ http://www.ocs.oregonstate.edu/pub/maps/Precipitation/Total/States/AK/ak_ppt.gif accessed August 15, 2005

Table 1. Frequency Analysis of Monthly and Annual Precipitation at the Wolverine Project Site – Dry and Wet Years

Return period (years)	1 in 100 yr Dry	1 in 25 yr Dry	1 in 10 Yr Dry	Average Yr	1 in 10 Yr Wet	1 in 25 Yr Wet	1 in 100 Yr Wet	1 in 1000 Yr Wet	1 in 10000 Yr wet
Ratio of annual precipitation to mean annual ²	0.509	0.639	0.74	1.00	1.255	1.344	1.451	1.595	1.75
Month									
Jan	18.3	23.0	26.6	36	45.2	48.4	52.2	57.4	63
Feb	14.3	17.9	20.7	28	35.1	37.6	40.6	44.6	49
Mar	10.7	13.4	15.5	21	26.4	28.2	30.5	33.5	36.8
April	10.2	12.8	14.8	20	25.1	26.9	29	31.9	35
May	24.4	30.7	35.5	48	60.2	64.5	69.6	76.6	84
Jun	35.1	44.1	51.1	69	86.6	92.7	100.1	110.0	120.8
July	41.7	52.4	60.7	82	102.9	110.2	119	130.8	143.5
Aug	31.6	39.6	45.9	62	77.8	83.3	90	98.9	108.5
Sept	29.0	36.4	42.2	57	71.5	76.6	82.7	90.9	99.8
Oct	22.9	28.8	33.3	45	56.5	60.5	65.3	71.8	78.8
Nov	20.4	25.6	29.6	40	50.2	53.8	58	63.8	70
Dec	20.4	25.6	29.6	40	50.2	53.8	58	63.8	70
Annual	278.9	350.1	405.5	548	687.7	736.5	795.1	874.1	959

2.1.3 Seasonal Precipitation Trends

The high summer precipitation and low winter precipitation characterize the continental climate of the southeastern Yukon. High pressure cells and cold temperatures dominate the winter months, leading to extended periods of low precipitation. In summer, thermal instabilities resulting from seasonal heating result in frequent convective storms (thunderstorms).

As is shown in Table 1, mean monthly precipitation is greatest in July and lowest in April. Approximately 320 mm, or 58% of annual precipitation falls during the May-September period as rain or non-accumulating snow. Precipitation that falls between October and April forms the winter snow pack. Note that a conversion factor of 10:1 (1 cm of snow = 1 mm of precipitation), as used by Atmospheric Environment Service, can be applied to estimate the snowfall in centimeters. For instance, the mean monthly precipitation at the project site for March is 21 mm. This is equivalent to 21 cm of snowfall.

² From Gartner Lee Ltd. (2004)

2.1.4 Annual and Monthly Precipitation

Gartner Lee Ltd. (2004) conducted a frequency analysis of the regional climate data in order to determine the variability of mean monthly and mean annual precipitation for a range of return periods. This frequency analysis determined the ratio of annual precipitation to mean annual precipitation that occurs for a given return period. For instance, precipitation in a 1-in-10 year wet year is approximately 25% greater than in a normal year. These ratios have been applied to the mean annual and monthly precipitation figures in Table 1 to provide estimates of monthly and annual precipitation for return periods ranging from a 1-in-100 dry year to a 1-in-10,000 year wet year.

2.1.5 Hourly and Daily Rainfall

Daily rainfall values over the period of record are available from the Watson Lake and Tutchitua regional stations. At Tutchitua, some periods of data are missing, but not enough to significantly affect the analysis. The Environment Canada program Consolidated Frequency Analysis (CFA) was used to conduct a frequency analysis by fitting the data to several statistical distributions. The daily rainfall records were determined by the program to be strongly bimodal; therefore, the Wakeby and nonparametric distributions were chosen to fit to the data as they provide better fits to bimodal distributions than do distributions such as Generalized Extreme Value or triple-lognormal. Both Wakeby and nonparametric distributions gave similar goodness of fits for the two stations. The results from the two were therefore averaged to estimate maximum daily (24-hour) rainfall intensities for various return periods.

Regional one-hour rainfall intensities for a range of return periods were calculated using data from the maps in the Rainfall Atlas of Canada (Bruce, 1968) and the equations given in Alila (2000).

As neither one-hour nor 24-hour rainfall intensity vary significantly with elevation over the regional scale, these calculations should be representative of the expected maximum rainfall for the given durations and return periods at the project site and do not need to be corrected for the location of the project site relative to regional climate stations. Expected one-hour and 24-hour rainfall values are presented in Figure 1.

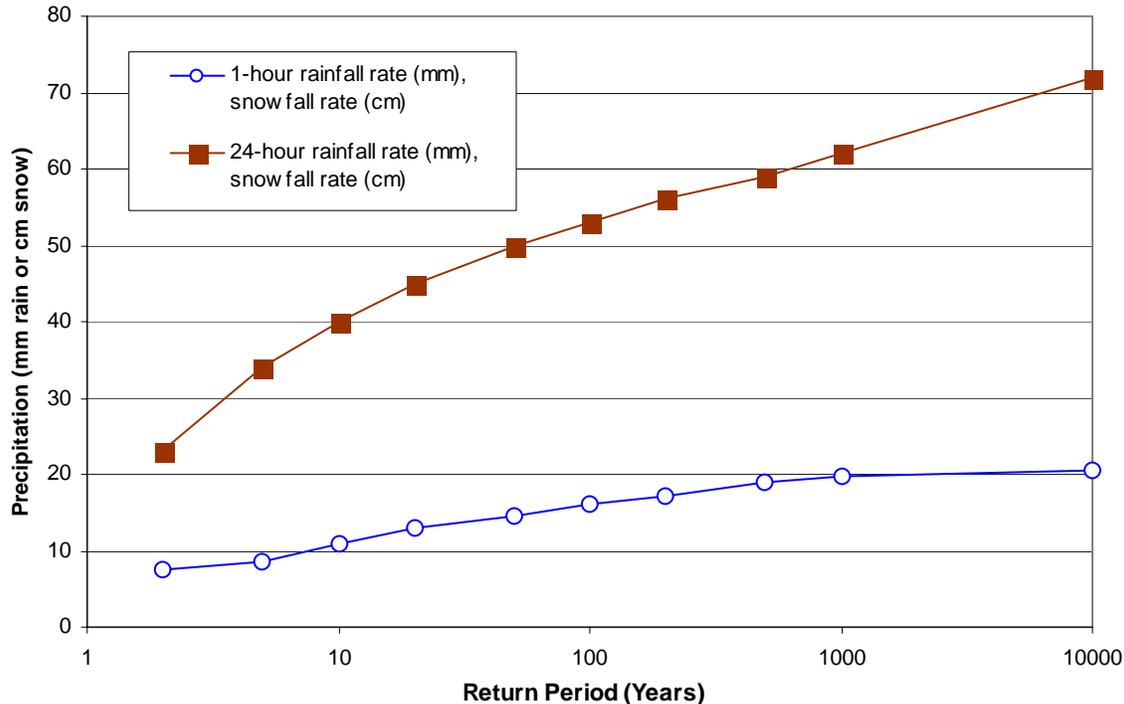


Figure 1. Hourly and Daily Extreme Precipitation - Wolverine Project Site

2.1.6 Hourly and Daily Snowfall

Because there are gaps in the daily data for winter precipitation at the regional stations, the 24-hour snowfall cannot be accurately determined using the frequency analysis method used for rainfall. No on-site data has been collected for daily or hourly snowfall values at the project site. Because net summer precipitation (rainfall) is greater than net winter precipitation, conversion of the 24-hour and daily rainfall values will provide a conservative estimate (overestimate) of extreme snowfall events. However, in the absence of other data, the values given for millimeters of rainfall in Figure 1 can be converted to centimeters to provide a conservative estimate of daily and hourly snowfall for various return periods.

Snowpack accumulates from October through March at the project site. Snow may fall in other months of the year but mean temperatures are high enough to ensure that snowfall will melt rather than accumulate. The peak snowpack in the average year will occur in late March or early April, immediately before spring warming begins.

Yukon Government snow surveys for the Liard Basin³ indicate that mean annual snowpack in the Liard Basin is in the range of 150 to 175 mm snow water equivalent. Using the 5:1 conversion factor for old snow, this would be equivalent to a snowpack depth of 0.75 m to 0.88

³ [http://www.environmentyukon.gov.yk.ca/pdf/water_forecast\(1\).pdf](http://www.environmentyukon.gov.yk.ca/pdf/water_forecast(1).pdf) accessed August 25, 2005

m. However, because little total precipitation occurs in late March and April, the snowpack may continue to age and consolidate through this period with few inputs. The mean annual peak snowpack depth at the project site is likely 1.0 m or greater.

Some snow on the ground melts as a result of heating from below, even in cold climates. Additionally, some snow in the upper snowpack sublimates (evaporates) and returns to the atmosphere as water vapour. For these reasons, the net snow water equivalent of the snowpack throughout the season is lower than the sum of the snowfalls that have occurred. Mean winter precipitation (October-April) totals 230 mm. This indicates that approximately two-thirds to three-quarters of the winter precipitation accumulates, while approximately one-third to one-quarter is lost to melt or sublimation during the winter.

To estimate the expected snow water equivalent under conditions from a 1-in-1,000 year dry year to a 1-in-10,000 year wet year, the regional frequency analysis of annual precipitation (Gartner Lee Ltd. 2004) was applied to snowpack depth and snow water equivalent. The results are given in Table 2. It should be noted that the maximum snow water equivalent would occur later in the year in the case of a wet year, and earlier in the year in the case of a dry year. Cold temperatures and heavy snowfall both contribute to increased snowpack and snow water equivalent. Therefore, it should be expected that the extreme dry year snowpacks are a result of both light precipitation and warm temperatures. In dry years the snowpack will reach maximum snow water equivalent early in the year (e.g., early March) and could melt away as soon as early May. Extreme wet year snowpacks are the result of heavy winter precipitation and cold spring temperatures which delay melt. These deep snowpacks could peak in late May and continue to melt through July and even into August.

Table 2. Frequency Analysis of Winter Snowpack

Return Period	Mean Precipitation Ratio⁴	Maximum snowpack water equivalent (low)	Maximum snowpack water equivalent (high)
(year)		(mm)	(mm)
1000 year dry	0.327	49.1	57.2
100 year dry	0.509	76.4	89.1
25 year dry	0.639	95.9	111.8
10 year dry	0.74	111	129.5
Average year	1.00	150	175
10 year wet	1.255	188.3	219.6
25 year wet	1.344	201.6	235.2
100 year wet	1.451	217.7	253.9
1000 year wet	1.595	239.3	279.1
10000 year wet	1.75	262.5	306.3

⁴ Gartner Lee Ltd. (2004)

3 Revised Water Quality Model

The primary objectives for managing water at the Wolverine Project include the collection of surface runoff and groundwater recharge to prevent the release or discharge of potentially contaminated water into the Wolverine Creek watershed, and to meet or exceed the requirements of Type B Water Licence QZ01-051.

This section describes the results obtained from mine water samples and treated mine water samples collected at the onset of underground development in June 2005, through to September 2006. The information presented below focuses on the constituents of concern, as per the Water Licence. Water quality analytical results from independent labs are provided in appendices contained within previously submitted SNM program reports (YZC 2006a, 2006b, and 2006c).

3.1 Discharge Quality Criteria

Type B Water Licence QZ01-051 discharge quality criteria for Go Creek are summarized in Table 3. In addition to the criteria limits, a discharge must also pass a 96 hour LC₅₀ fish bioassay test as per Environment Canada Method EPS 1/RM/13.

Table 3. B Licence Maximum Authorized Concentration Grab Sample Discharge Quality Criteria

Parameter	Limit
Arsenic	0.10 mg/l
Cadmium	0.02 mg/l
Copper	0.20 mg/l
Lead	0.20 mg/l
Nickel	0.50 mg/l
Zinc	0.50 mg/l
TSS	15 mg/l
Ammonia	2.5 mg/l
Selenium	0.015 mg/l

3.2 2005 Mine Water Quality Results

During test mining in 2005, water (a mix of groundwater, drill water, explosives residue, and runoff from the mine ramp) collecting in the underground was pumped to surface into a 308 m³ dirty sump. The analytical results for July to September 2005 are provided in Table 4. Apart from ammonia and total suspended solids concentrations, the mine water was typically below the discharge criteria with the exception of one sample in July 2005 for selenium.

Table 4. Mine water collected in Dirty Sump, July to September 2005

Dirty Water Sump Water Quality (mg/L)	13-Jul-05	At Inlet 18-Jul-05	At Outlet 18-Jul-05	22-Jul-05	15-Aug-05	08-Sep-05	Discharge Criteria
Total Suspended Solids				25	7	34	15
Ammonia (N)	2.31			3.83	2.51	7.67	2.5
Total Arsenic (As)	<0.20	0.002	0.001	0.002	0.002	0.001	0.10
Total Cadmium (Cd)	<0.010	<0.0001	<0.0001	0.004	<0.0001	< 0.0002	0.02
Total Copper (Cu)	0.014	0.022	0.012	0.006	0.008	0.002	0.2
Total Lead (Pb)	<0.050	0.0008	<0.0005	0.0049	<0.0005	< 0.001	0.2
Total Nickel (Ni)	<0.050	<0.008	<0.008	<0.008	<0.008	0.007	0.5
Total Selenium (Se)	<0.20	0.0122	0.1	0.007	0.0016	0.009	0.015
Total Zinc (Zn)	0.0189	<0.005	<0.005	0.021	<0.005	0.005	0.5

3.3 2006 Mine Water Quality Results

In February 2006, the adit recharged with groundwater to the portal. Without drilling and mining activities underground, all parameters were found to be below discharge limits with the exception of selenium for the period of February to June 2006 (Table 5). All other constituents are typically one to two orders of magnitude lower than the discharge limit. Water samples for untreated and treated mine water passed LC₅₀ rainbow trout lethality tests.

Table 5. Underground recharge water chemistry for mine water, February to June 2006

Water Sample ID	Portal	Portal	TX	PortalSump	B01	B01	TO
Lab Report No.	X2232	X3601	A620637	A621010	A622291	A622807	A623668
Sampling Date	16/02/06	22/03/06	18/05/06	20/05/06	28/05/06	31/05/06	03/06/06
Parameter (mg/L)	ADL						
Total Suspended Solids	15	7.1	8.7	-	-	-	-
Ammonia Nitrogen	2.5	0.967	0.722	-	<4	-	-
Total Arsenic (As)	0.1	0.00191	0.00106	0.002	<0.001	<0.001	0.002
Total Cadmium (Cd)	0.02	0.000746	0.000279	<0.002	<0.002	<0.002	<0.002
Total Copper (Cu)	0.2	0.0027	0.00115	<0.005	<0.005	<0.005	<0.005
Total Lead (Pb)	0.2	0.0227	0.00223	<0.03	<0.03	<0.03	<0.03
Total Nickel (Ni)	0.5	0.0431	0.0366	0.013	0.014	0.02	0.012
Total Selenium (Se)	0.015	0.064	0.0459	0.045	0.032	0.018	0.019
Total Zinc (Zn)	0.5	0.178	0.0832	0.07	0.014	0.039	0.072

Note: ADL = Allowable Discharge limit

As described in detail in Section 5, on site water treatment processes have effectively lowered the concentration of selenium below discharge limits.

3.3.1 Selenium Analyses

Throughout July and August, 2006 poor reproducibility and highly variable Se values were being reported by Maxxam Analytics on mine water and treated water samples. The variable analytical performance resulted in delays in the discharge of treated water and, consequently in slower than anticipated mine dewatering rates.

A program was developed by mine site environmental personnel in conjunction with Lorax Environmental to determine the origins of the poor analytical reproducibility for Se and involved the collection of duplicate and even triplicate samples, subsequently split and sent to Maxxam and ALS laboratories for comparative analysis. In addition, it was suspected that potential problems observed in Se analysis could be related to the analytical technique employed using ICP-MS.

Inductively coupled plasma mass spectrometry (ICP-MS) can accurately measure elemental chemical concentrations as low as 1 part per trillion if there is no other ion at the same mass/charge (m/z) ratio as the elemental ion of interest. Unfortunately, there are molecular ions with the same m/z as each of the Se isotopes (spectral interferences). Spectral interferences are the main limitation of ICP-MS and have been problematic for the elements As, Se and Fe. The source of the problem for Se is that the argon plasma gas, water, acid and the sample matrix itself can combine to introduce a wide range of polyatomic ion species. The resultant interfering species may have the same nominal mass as an analyte ion and thus return a falsely high value for the analyte. For the case of Se, these include argon dimers $^{36}\text{Ar}^{38}\text{Ar}^+$, $^{38}\text{Ar}^{38}\text{Ar}^+$, $^{38}\text{Ar}_2\text{H}^+$, $^{38}\text{Ar}^{40}\text{Ar}^+$, $^{40}\text{Ar}^{40}\text{Ar}^+$ and $^{40}\text{Ar}_2\text{H}_2^+$ at the same m/z as $^{74}\text{Se}^+$, $^{76}\text{Se}^+$, $^{77}\text{Se}^+$, $^{78}\text{Se}^+$, $^{80}\text{Se}^+$ and $^{82}\text{Se}^+$, respectively.

In contrast, analysis for Se can also be accomplished to very low detection limits using hydride generation/atomic adsorption, which does not suffer from potential carrier gas interference. Certain parameters, most notably arsenic and selenium can be accurately quantified by exploiting the fact that both elements can be quantitatively converted to their respective volatile hydrides by sodium borohydride reagent. The hydrides are subsequently measured by atomic absorption spectrophotometry.

Accordingly, it was recommended to analyze the samples by both ICP-MS and hydride generation, with the understanding that the hydride generation technique would provide a reliable benchmark to compare ICP-MS performance. ALS Laboratories was capable of performing hydride generation analysis, whereas Maxxam did not have the capability of analyzing Se by hydride generation.

Results of the comparative analysis between the laboratories and the methods revealed that ICP-MS results could vary by factors upwards of 8 for replicates of the same water quality sample, labeled blindly. By contrast, water samples analyzed by hydride generation were much more consistent (Table 6).

Table 6. Comparison of Results of Se Analysis on Mine and Portal Water by ICP-MS and Hydride Generation

Sample	Se Concentration (ICP-MS) mg/L	Se Concentration (Hydride) mg/L	B License Se Limit (mg/L)
Treated Mine Water (A)	0.0022	0.0032	0.015
Treated Mine Water (B)	0.0171	0.0016	0.015
Treated Mine Water (C)	0.0032	0.0022	0.015
Untreated Portal Water	0.0353	0.0043	0.015

Based on the above, Se is now being analyzed using hydride generation as the primary analytical technique. Although laboratory turn-around times suffer slightly because of this, the results are consistently reliable and defensible.

It is important to note that the data also suggest that untreated portal water contains Se concentrations well below the acceptable discharge limit. It is recommended to continue the practice of pumping from underground, treating in line with Ferric floc, and storage in water retention sumps. However, should portal water quality data consistently show that Se levels are well below 0.015 mg/L, direct discharge to the environment should be considered and evaluated.

3.4 Waste Rock Sump Water Quality 2006

The Waste Rock Sump (WRS) located at the temporary waste rock pad is used to collect surface runoff from the contained waste rock. Water samples from WRS were taken in May, June and July, and selenium levels are above discharge limits for both samples and zinc is above discharge limits for the July 6/06 sample (Table 7). This sump has been monitored for water level, and has not been discharged. As described in Section 4, the water collected in the WRS is transported to the water treatment sumps for treatment prior to discharge.

Table 7. Summary of Water Chemical Analyses for the Waste Rock Pad Sump, May to July 2006

Sampling Date	1/5/2006	10/5/2006	5/6/2006	6/7/2006
Lab Report No.	A617651	A619028	A623969	A630191
Parameters (mg/L)	ADL	WRS	WRS	WRS
Total Suspended Solids	15	36	14	20
Ammonia Nitrogen	2.5	0.41	0.39	-
Total Arsenic (As)	0.1	0.002	0.0007	0.004
Total Cadmium (Cd)	0.02	<0.002	0.00055	0.003
Total Copper (Cu)	0.2	0.015	0.0036	0.026
Total Lead (Pb)	0.2	0.03	0.0064	0.04
Total Nickel (Ni)	0.5	0.009	0.0072	<0.008
Total Selenium (Se)	0.015	0.015	0.0115	0.105
Total Zinc (Zn)	0.5	0.121	0.0422	0.116

4 Water Storage and Treatment Infrastructure

Water management activities for the test mine program consist of dewatering of the underground workings and collection of surface runoff from the temporary waste rock facility. The following sections describe the infrastructure and treatment processes in place to ensure compliance with the Water Licence.

3.1 Portal Sumps

The collection infrastructure used to manage water from the portal area is shown in Picture 1 and drawings provided in Appendix A. There are two sumps, the rectangular dirty sump (PDS) and the square clean sump (PCS) with volumes of 320 m³ and 575 m³, respectively (Appendix A). The sumps were designed to be used in succession to provide initial settling of solids in the water being discharged from the mine. After initial settling of solids in the PDS, the water is pumped to the PCS, and then it is either pumped underground for use with mining activities, or pumped to one of the treatment sumps. A weighted floating silt curtain has been installed within the PDS to enhance settling (Picture 2). If the water from underground is clear, water may be pumped directly to the water treatment sumps and bypass the PCS and PDS.



Picture 1. Dirty (rectangular) and clean (square) sumps at the portal area, and 4" insulated lines (white) connecting to the underground and water treatment sumps.



Picture 2. Portal dirty sump with weighted floating silt curtain installed to enhance settling of solids.

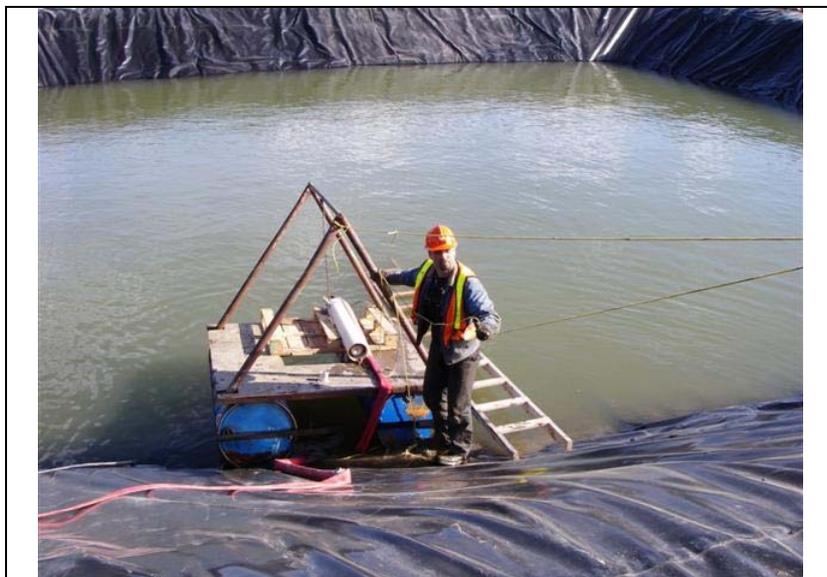
3.2 Water Treatment Sumps

Water is pumped from the PCS or the underground to either the water treatment plant inlet sump (WIS) or the discharge sump (WDS) for treatment. WIS and WDS were initially constructed as inlet and discharge sumps for the water treatment plant (WTP), but they are now used interchangeably for treatment with iron addition (see Section 5). A third small sump was also constructed for backwash water for cleaning of the filters during WTP use, but it has only been used if necessary to store water prior to treatment in WIS or WDS. WIS, WDS and WBS have design volumes of are 2123 m³, 1300 m³, and 359 m³, respectively (Appendix A). They are located adjacent to the WTP as shown in Picture 3.



Picture 3. Water treatment sumps at the lower laydown area adjacent to the water treatment plant (blue seacan).

To ensure that treated water discharged to the environment contains no precipitates and is the same as the analyzed water, the pump is attached to a raft that floats on the top of the water in the sump to prevent it from resting on the bottom (Picture 4). This method of pumping is also used underground to minimize pumping of suspended solids.

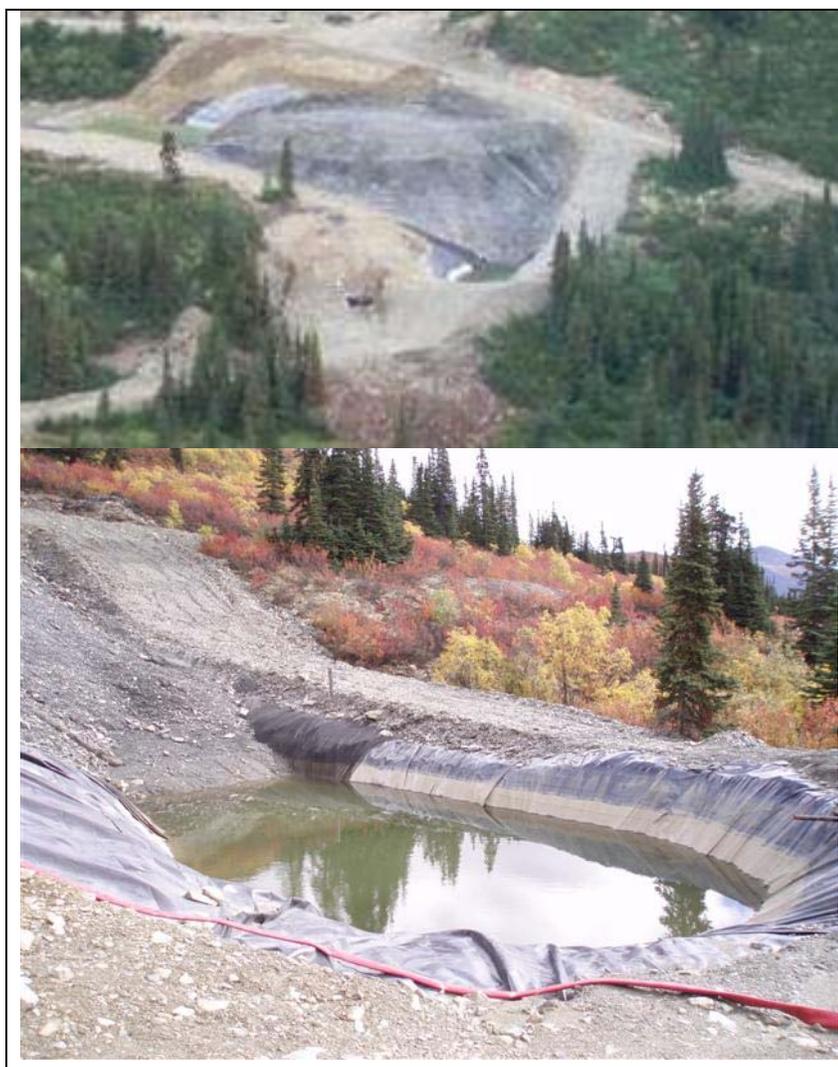


Picture 4. Pump for treated water discharge is affixed to a floating raft.

3.3 Waste Rock Pad Sump

Infrastructure at the temporary waste rock pad is shown in Picture 5. The collection sump located at the southern end of the pad collects surface runoff from the pad. Due to the natural bowl shape of the area and the road berm and ridge on the east and west sides of the pad, respectively, surface runoff is diverted away from the pad. The sump was constructed from local compacted till and lined with Enviro Liner® as described previously in the *Temporary Waste Rock and Ore Storage Facility As-Constructed Report and Drawings* (November 2005). The as-built drawing is provided in Appendix A.

At times, water has also been stored on the lined pad upslope of the stockpile, prior to being trucked to the WIS or WDS for treatment. Storage on the pad is done only as a contingency measure when all other sumps are full; this has occurred when awaiting lab analyses.



Picture 5. Waste rock pad sump at lowest corner of the pad (center of top photo) for collection of surface runoff of the stockpile.

5 Water Treatment

As described in the earlier version of this report (dated November 17, 2005), a conceptual water treatment process was developed in 2004 for the treatment of mine water and waste rock pile seepage and runoff. The water treatment process was designed using theoretical values obtained from the chemistry model, mainly based on data from humidity cells.

Once underground development commenced in 2005 and water was collected in underground sumps, water was discharged to the portal sumps and water samples were analyzed to provide actual chemical characterization of the water in both the sumps (with the effects of mining activity) and the underground (groundwater). Based on this water chemistry, the treatment method proposed used co-precipitation and adsorption to remove excess selenium and other metal contaminants. A water treatment plant was assembled and transported to site on the winter road in early 2006. Details pertaining to this plant are contained in Section 5.2.

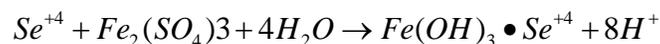
Based on the revised water quality model presented in Section 3.3, and the success realized with the iron addition batch tests, the plant will be used for backup only in the event that the iron addition process becomes ineffective such as with a change in underground water chemistry (such as with the onset of additional mine development activities). The sections below describe the iron addition process for treatment and water treatment plant operation. Sediment and sludge management is also described for each process.

5.1 Iron Addition

In 2005, Canadian Environmental and Metallurgical Inc. (CEMI) conducted tests with ferric sulphate to decrease metal concentrations in the mine water. Ferric sulphate is also known as iron sulphate, ferrifloc or Ferriclear®, and the material safety data sheet is provided in Appendix B.

The testwork involved a 50% ferric sulfate solution, applied in a molar ratio of 100:1 of Fe:Se. The results of the tests showed that this ratio would reduce all metals including selenium to below discharge requirements. Further tests conducted in April 2006 with water from within the adit determined that the molar ratio is less vital to selenium removal than is the maintenance of the pH within the range of 6.7-7.1.

The chemical reaction through which ferric sulfate ($\text{Fe}_2(\text{SO}_4)_3$) precipitates selenium is:



The average pH level in the untreated mine water is close to 8 and it was determined that thorough mixing and aeration were also found to aid in contact and subsequent precipitation of selenium, as well as other metals. The current process used onsite to effectively remove Se is to add ferric sulfate in-line using a metering pump to lower the pH to the within the desired range. An air compressor is used for aeration and to aid in mixing within the sumps. Based on batch tests conducted onsite, the optimum pH for maximizing the adsorption of selenium is between

6.7 and 7.1, and a molar ratio of 550:1 Fe:Se was found to be most effective to lower selenium levels below discharge limits. For example, to treat an 1800 m³ sump volume, approximately 160 L of ferric sulfate (50 wt% solution) is required.

Samples of the treated water are submitted for analysis prior to discharge. The resultant average treated water results for the parameters with discharge criteria are provided below in Table 8 for samples analyzed in June and July. Data for other parameters have been provided in earlier submissions to the Yukon Water Board under the Surveillance Network Monitoring program.

Table 8. Average chemical composition of treated mine water for June and July 2006

Sump Name		PCS	WDS	WIS	WDS	WIS*	WIS*
Lab Report No.		A625299	A625784	A629169	A630191	A631055	A631788
Sample Date		9/06/06	16/06/06	03/07/06	07/07/06	14/07/06	19/07/06
Discharge Date		16/06/06	22/06/06	07/07/06	13/07/06	N/A	20/07/06
Discharge Volume m ³		472	1081	1773	1081	0	1773
Parameters (mg/L)	ADL						
Total Arsenic (As)	0.1	0.0002	0.0006	0.0002	0.0004	0.0002	0.0004
Total Cadmium (Cd)	0.02	0.00015	0.00008	<0.00001	0.00026	0.00018	0.00017
Total Copper (Cu)	0.2	0.0007	0.0006	0.0002	0.0013	0.0018	0.0016
Total Lead (Pb)	0.2	0.00032	0.00024	0.00004	0.00029	0.00076	0.00096
Total Nickel (Ni)	0.5	0.0234	0.0121	0.0056	0.0237	0.0172	0.0165
Total Selenium (Se)	0.015	0.0032	0.0065	0.0022	0.0046	0.0183	0.0045
Total Zinc (Zn)	0.5	0.031	0.0107	0.0014	0.0318	0.0214	0.0163
TSS	15	<4	6	<4	10	6	
Ammonia	2.5	0.413	0.054	<0.005	0.388	0.242	

Note: * WIS (report no. 6431055) did not meet discharge criteria for total selenium due to insufficient exposure time with the flocculent. With additional settling time, all total metals were within discharge limits (as per report no. A631788) Data in provided in previously submitted SNM Program reports.

Based on the detailed description of the lab methodology for Se provided to Section 3.3.1, Se has been tested using hydride generation in the latter part of August and September. A comparison of results from ICP-MS and hydride generation are provided in Table 9 for September 2006. Mine samples are untreated water collected from the adit and WIS and WDS are treated mine water samples collected from a sump.

Table 9. ICP-MS vs Hydride results for treated mine water, September 2006.

Date Sampled	Type	Mass Spec	Hydride
5-Sep-2006	Mine	0.0047	0.004
6-Sep-2006	WIS	0.0062	0.0014
10-Sep-2006	Mine	0.012	0.00451
10-Sep-2006	WIS	0.00426	0.00084
11-Sep-2006	WDS	0.00523	0.00312
8-Sep-2006	Mine	0.016	0.00459
12-Sep-2006	WIS	0.00512	0.00283
12-Sep-2006	Mine	0.0094	0.00625
14-Sep-2006	WDS	0.00632	0.00534
14-Sep-2006	WIS	0.00333	0.0033

5.2 Ferric Sulfate Sludge Management

With the addition of ferric sulfate flocculant to mine water, the ferric salts coagulate the suspended and dissolved contaminants in the mine water resulting in a hydrolyzed liquid/solid sludge. The consistency of the sludge depends upon the physical properties of suspended solids and the chemically bound water and is estimated to be 8 – 30% water.

Chemical characterization of the sludge is paramount when it comes to minimizing potential environmental impacts. Based on the small amount of sludge produced over the 2006 treatment period, YZC has not chemically characterized the sludge to determine the mobility of leachable metal. Removal of the thin layer of sludge on the bottom of WIS and WDS could result in damage to the liner and as such, YZC will commence with extraction tests when an adequate amount of sludge builds up in the sumps and is removed.

Extraction tests have been designated by the USEPA to determine if a waste is classified as hazardous. The toxicity characteristic leach procedure is (TCLP) can be used to determine if a waste is toxic and classified as hazardous. It is important to note that coagulant sludges have never been reported to fail TCLP tests (Cornwell, 1999). Even finding trace amounts of metals in the extract from a TCLP test is uncommon for salt sludges. Lysimeter tests can also be used to characterize release of metals from a sludge and it has been shown that none of the primary drinking water maximum contaminant levels for metals were exceeded in any leachate samples from a ferric sludge (Cornwell, 1999).

Based on this information and the small volume of sludge produced over the past treatment period, YZC proposes to store removed sludges in a sealable drum, and decant excess supernatant back into the sumps. The sludges will be stored onsite until extraction tests are complete. At this time, and since the volume of sludge from iron addition is likely to be a small volume, YZC proposes to stabilize the sludge through the addition of cement (likely 5-10% by volume) and place it underground when the mine is backfilled.

Any sediment from the PDS or WRS will be slurried periodically and transported to the waste rock pad for disposal. As seen in Picture 2, the water quality has been clear for the majority of

the dewatering program and there is no need to remove sediment from the PDS prior to the onset of winter.

4.4 Water Treatment Plant

A water treatment plant (WTP) with its own pumping and power capabilities is onsite to be used as an alternate process for treating underground mine and waste rock sump water. After consideration of numerous alternatives, including high density sludge, lime neutralization, reverse osmosis, activated silica gel, biological treatment and activated carbon, activated carbon was chosen as the treatment method of choice.

Test results from Canadian Environmental and Metallurgical Inc using dirty sump water samples collected in 2005 showed that activated carbon removed heavy metals to discharge requirements. Additional testwork was conducted in early 2006 to determine retention time and media loading limits within the WTP. The flow schematic for the WTP is provided in Appendix C. Once the WTP is operational and actual sample results are available, revised documentation pertaining to the WTP will be provided to the YWB.

The water treatment plant (WTP) is set up with two parallel multi-media filters to remove sediment, and three packed bed activated carbon reactors, which can be run in parallel or series, depending on requirements and effluent concentration. Picture 6 shows a portion of the interior of the WTP.



Picture 6. Two multi-media sand filters and one of the three carbon columns within the WTP.

The WTP intakes water from the WIS and discharges clean water into the WDS. The multi-media filters are periodically backwashed, and the backwash water sent to the WBS. Once the WBS nears capacity, the water will be sent through the WTP for purifying. The flow through the carbon beds is set for a total contact time of 10-15 minutes.

The media used in the initial filters are a series of coarse top layer, medium sized middle layer, and fine bottom layer. As the water travels downward particles of varying sizes are trapped in the respective layers. This treatment is necessary to prevent premature clogging of the carbon adsorption sites.

It is estimated that with initial multi-media treatment, one carbon bed should be able to treat 1000 m³ water before breakthrough, which occurs when contaminants are no longer being adsorbed and influent concentration is equal to effluent concentration. Using the beds in series will prevent breakthrough from occurring in the final bed, during which time the first bed can be exchanged for another clean bed. Once the carbon has been saturated, it is slurried back into the original bags and hung to dry. The water is drained back into the WIS and the filled bags are covered to prevent further exposure to atmospheric moisture. Care must also be taken with storage of the carbon because it is oxygen consuming, and therefore is not to be kept in an enclosed space. In the event of site closure, the spent carbon will be disposed of in the underground mine.

5.3 Sediment and Sludge Management

To date, in the absence of an operating water treatment plant, there has been no sludge generated during the test mining program. However, based on the conceptual water treatment plant input parameters detailed in earlier submissions, the sludge will constitute approximately 91% TSS and 9% metal hydroxides. Therefore, it will be essential to remove the sediments before the effluent is treated through the WTP. Sediment will be disposed of in the waste rock pad.

Recognizing that several thousand liters of sump water would be required to adequately conduct the stability tests in an offsite lab, YZC will continually characterize and monitor inputs to the water treatment plant once it is operational, and collect sludge samples once they are available. The sludge will be subjected to a TCLP procedure to determine whether it is hazardous or not. Based on the TCLP results, a sludge management plan will be developed. In the interim, any sludges produced onsite will be stored in sealed drums. As the volume of sludge from the water treatment plant is likely to be a small volume, YZC proposes to stabilize the sludge through the addition of cement (likely 5-10% by volume) and place it underground when the mine is backfilled.

6 Summary

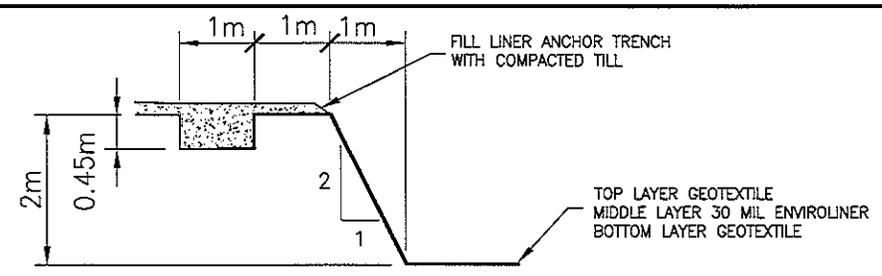
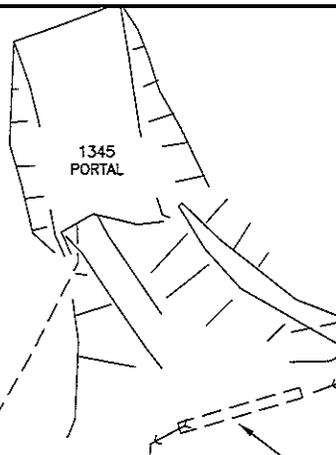
Based on effective water treatment to date in 2006, Yukon Zinc does not anticipate that there will be any need to change the current management and treatment processes currently being employed. All results will be summarized in the annual report required by the Yukon Water Board, and Surveillance Network Monitoring reports containing updates on water chemistry and processes will continue to be submitted on a regular basis.

7 References

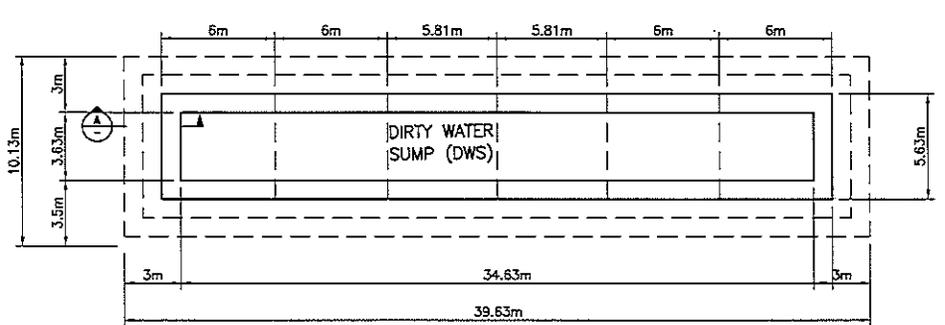
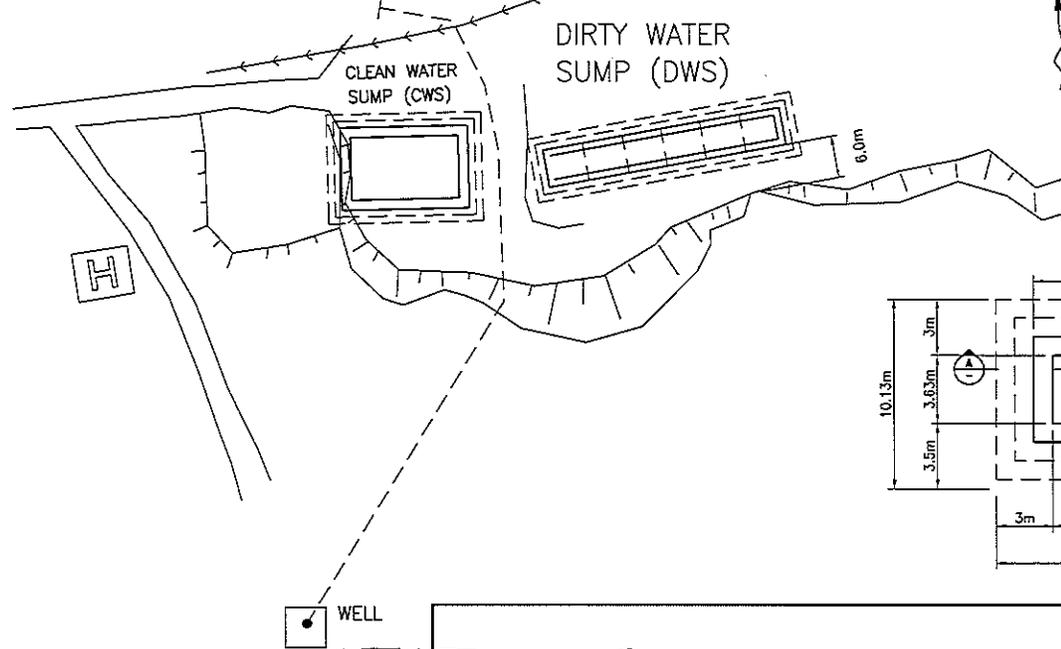
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- Gartner Lee Limited. 2004. Wolverine Project Description Report. Prepared for: Expatriate Resources Ltd. Reference No. GLL 40-755.
- YZC, 2006a. Surveillance Network Monitoring Report, October 2005 to January 2006. Submitted to the Yukon Water Board, February 7, 2006.
- YZC, 2006b Surveillance Network Monitoring Report, February to March, 2006. Submitted to the Yukon Water Board, April 11, 2006.
- YZC, 2006c. Surveillance Network Monitoring Report, April to July, 2006. Submitted to the Yukon Water Board, August 24, 2006.

Appendix A

Portal and Water Treatment Sump Design Drawings

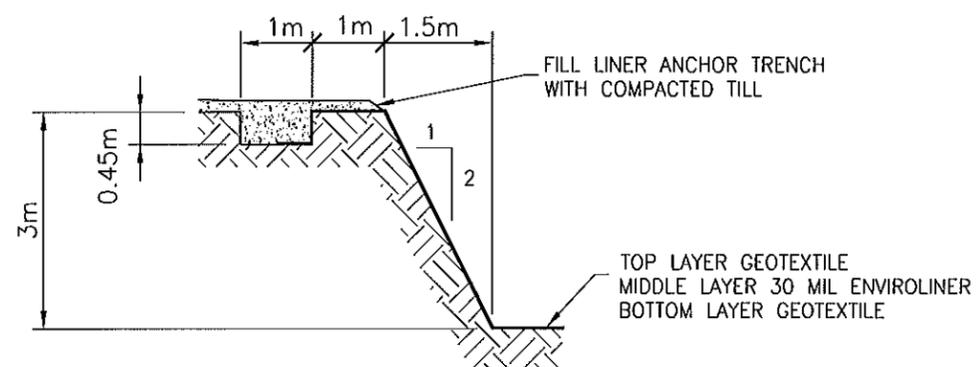
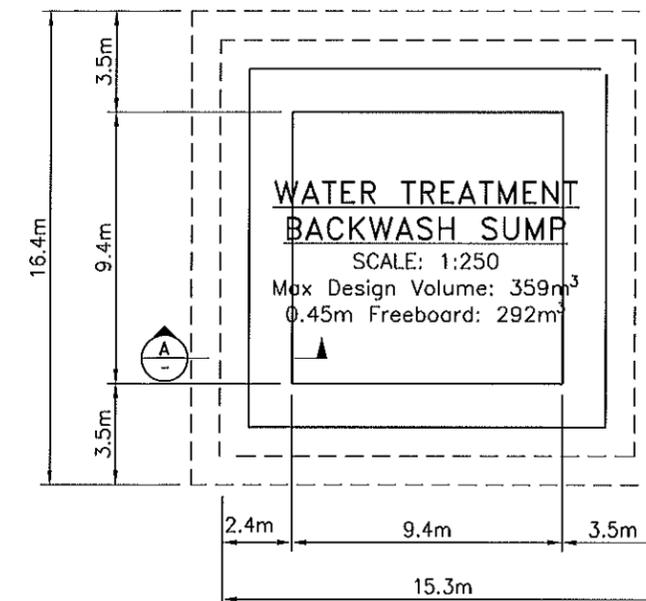
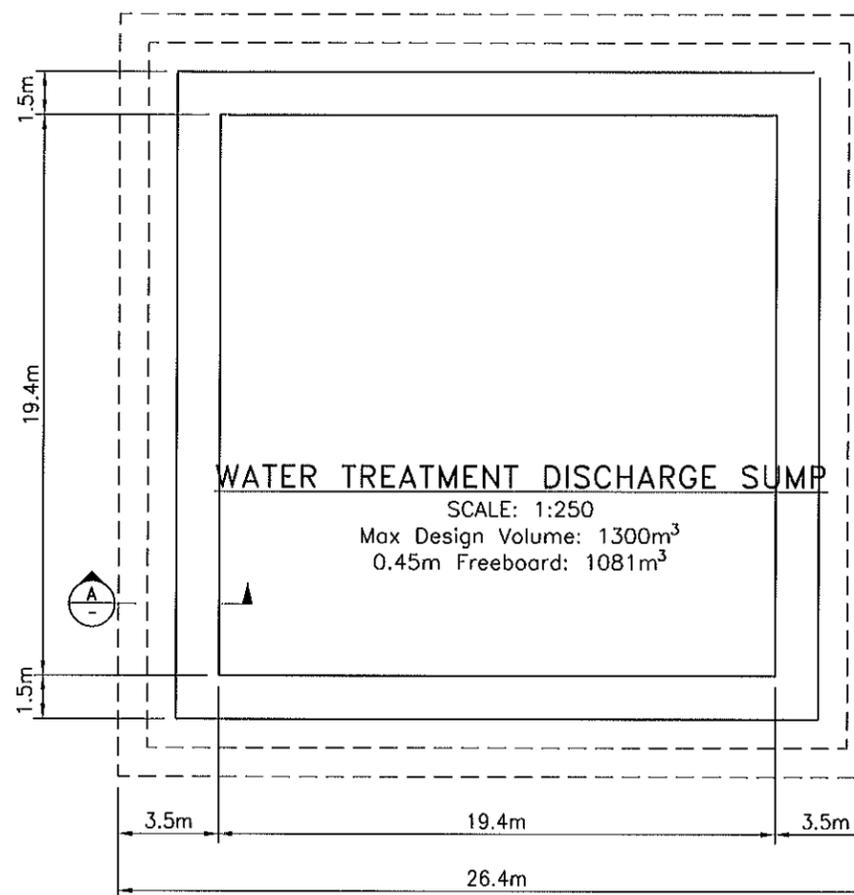
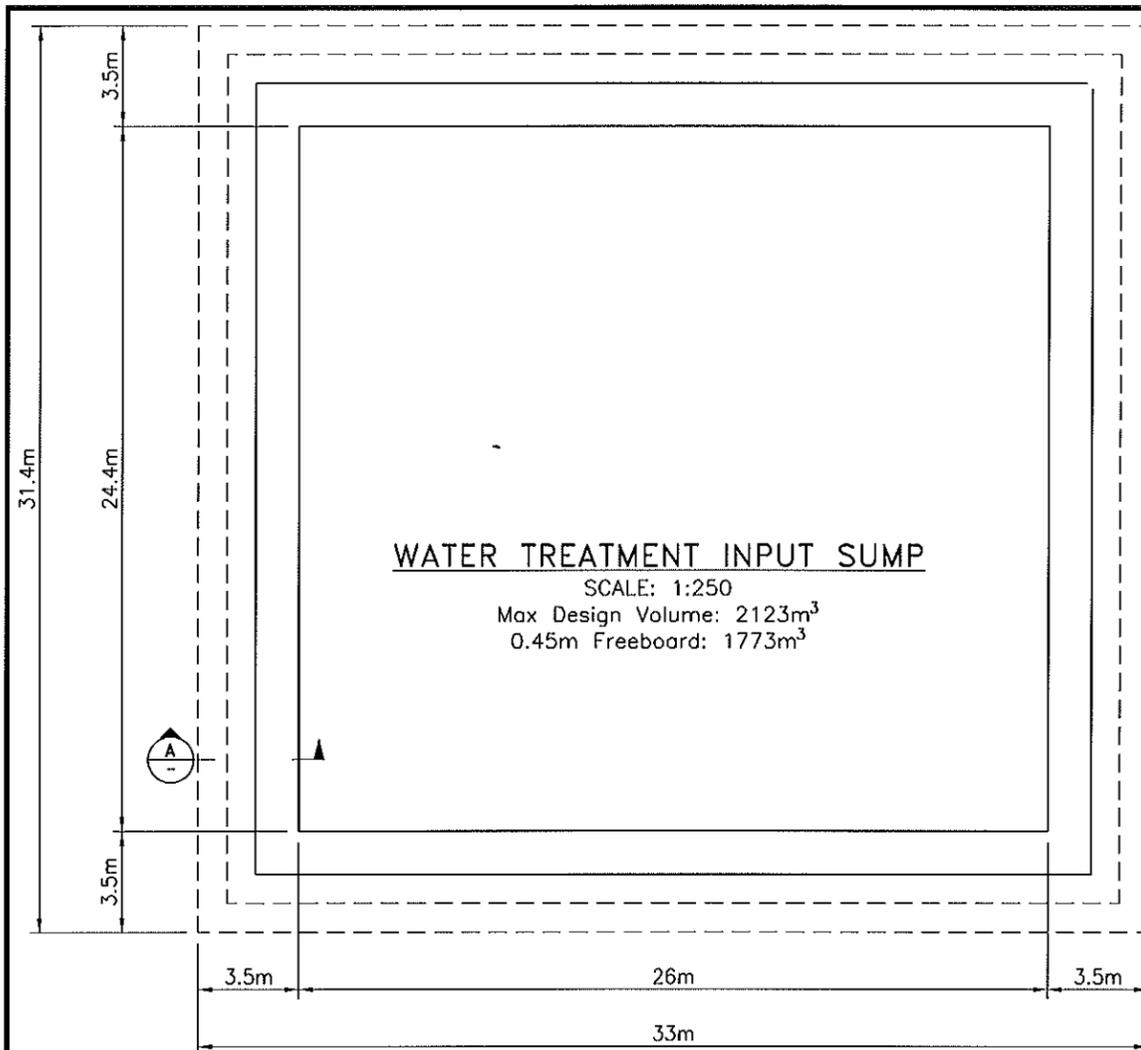


SECTION A
TYPICAL LINER TRENCH

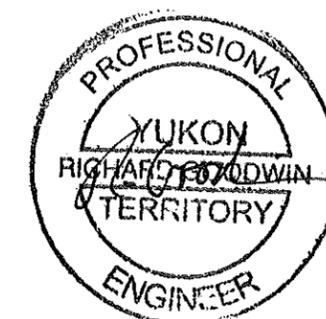


Yukon Zinc
CORPORATION

DWG. CHECK		WOLVERINE PROJECT	
DESIGNED BY		STATUS OF PORTAL	
DRAWN BY		NEW DIRTY WATER SUMP	
DATE		NEW CLEAN SUMP	
SCALE:		DRAWING NO.	REV.
PROJECT NO.	1614		



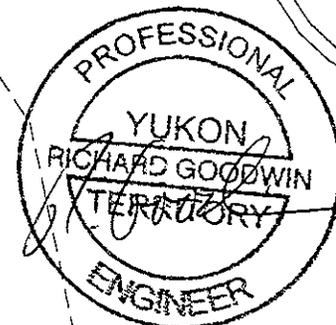
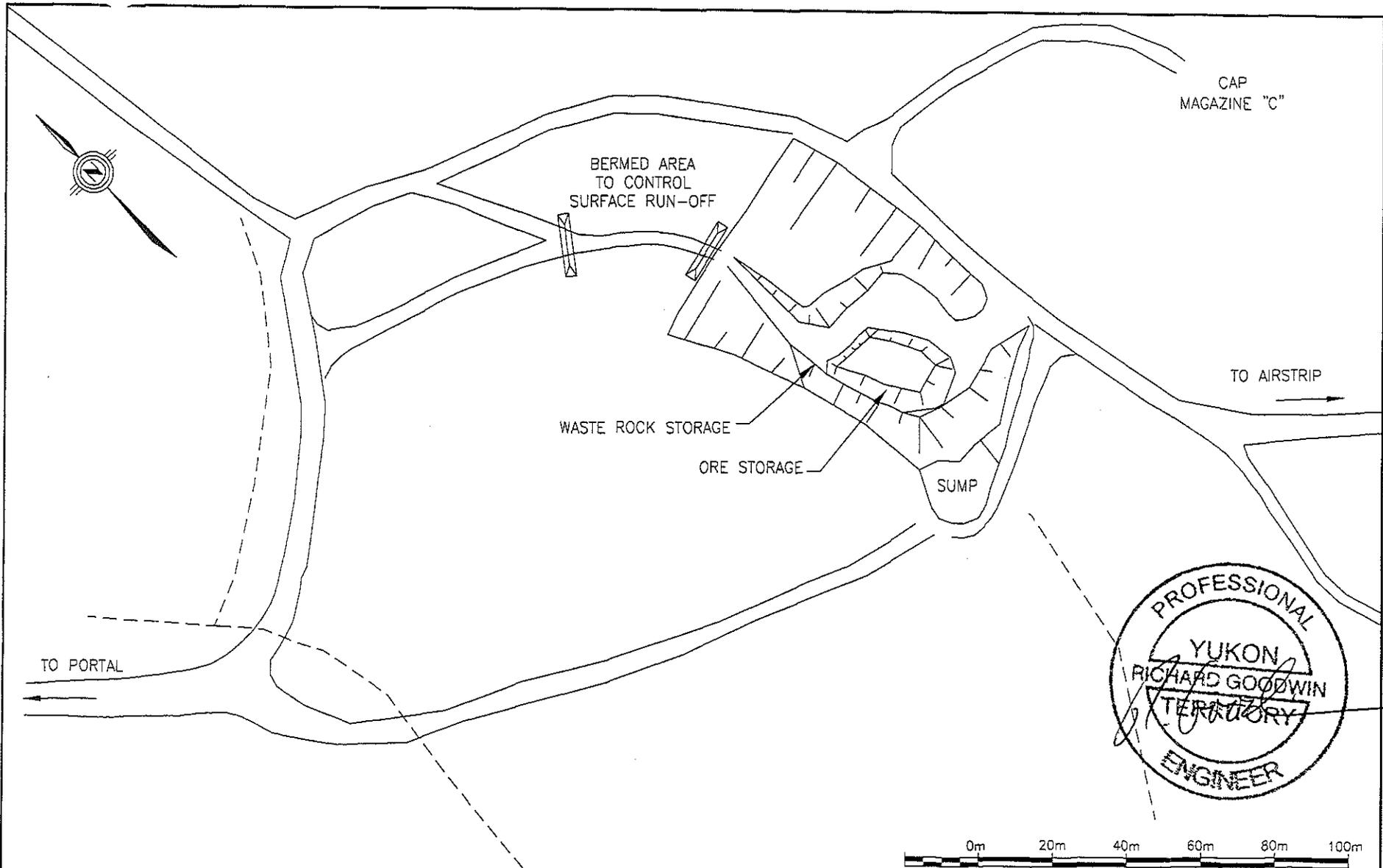
SECTION A
TYPICAL LINER TRENCH
SCALE: 1:100



REV.	REVISION DESCRIPTION	DATE	BY	APP'D

Yukon Zinc
CORPORATION

DESIGNED BY		WOLVERINE PROJECT	
DWG. CHECK		LOWER PORTAL	
DRAWN BY	RMO	WATER TREATMENT SUMPS	
SCALE: 1:250			
PROJECT NO.	1614	DRAWING NO.	1614-C-X
		REV.	B



Yukon Zinc
CORPORATION

DWG. CHECK		WOLVERINE MINE PROJECT	
DESIGNED BY		STATUS OF WASTE ROCK PAD	
DRAWN BY		END OF TEST MINE	
DATE		DRAWING NO.	REV.
SCALE:			
PROJECT NO.	1614		

Appendix B

Material Safety Data Sheet: Ferric Sulfate Ferriclear® (Univar)



Material Safety Data Sheet

LA3674

Ferric Sulfate Ferriclear®

1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

Product Id: LA3674

Product Name: Ferric Sulfate Ferriclear®

Synonyms: Iron (III) Sulfate

Chemical Family: Inorganic salt

Application: Water treatment (potable and waste water). Odor removal.

Distributed By:

Univar Canada Ltd.
9800 Van Horne Way
Richmond, BC
V6X 1W5

Prepared By: The Safety, Health and Environment Department of Univar Canada Ltd.

Preparation date of MSDS: 16 February 2006

Telephone number of preparer: 1-866-686-4827

24-Hour Emergency Telephone Number (CANUTEC): (613) 996-6666

® indicates trademark registered by Eaglebrook, Inc.

2. COMPOSITION/INFORMATION ON INGREDIENTS

Ingredients	Percentage (W/W)	LD50s and LC50s Route & Species:
Ferric sulfate 10028-22-5	40-70	Oral LD50 (Rat) 500 mg/kg
Sulphuric Acid 7664-93-9	<0.1	Oral LD50 (Rat) 2140 mg/kg Inhalation LC50 (Rat) 347 ppm

Note: No additional remark.

3. HAZARDS IDENTIFICATION

Potential Acute Health Effects:

Eye Contact: Causes moderate eye irritation.

Skin Contact: Causes moderate skin irritation.

Inhalation: May irritate mouth, nose, and throat. Inhalation of mist will irritate mucous membranes.

Ingestion: May be harmful if swallowed.

LA3674

Ferric Sulfate Ferriclear®

Page 1 of 6

4. FIRST AID MEASURES

Eye Contact: In case of contact, or suspected contact, immediately flush eyes with plenty of water for at least 15 minutes and get medical attention immediately after flushing.

Skin Contact: Flush skin with large amounts of water. If irritation persists, get medical attention. Remove contaminated clothing and launder before reuse.

Inhalation: Remove person to fresh air. If not breathing, give artificial respiration. If breathing is difficult, get immediate medical attention.

Ingestion: Do NOT induce vomiting. Never give anything by mouth to an unconscious or convulsing person. Seek immediate medical attention. If vomiting occurs spontaneously, keep head below hips to prevent aspiration of liquid into the lungs.

Notes to Physician: Treatment based on sound judgment of physician and individual reactions of patient.

5. FIRE FIGHTING MEASURES

Flash Point: None.

Flash Point Method: Not applicable.

Autoignition Temperature: Not Available.

Flammable Limits in Air (%): Not Available.

Extinguishing Media: Use extinguishing media appropriate for surrounding fire.

Special Exposure Hazards: Under fire conditions, toxic, corrosive fumes are emitted. Sulfuric acid could react with metal to produce hydrogen.

Hazardous Decomposition/Combustion Materials (under fire conditions): Oxides of sulfur.

Special Protective Equipment: Wear protective clothing and self-contained breathing apparatus.

NFPA RATINGS FOR THIS PRODUCT ARE: HEALTH 2, FLAMMABILITY 0, INSTABILITY 1

HMIS RATINGS FOR THIS PRODUCT ARE: HEALTH 2, FLAMMABILITY 0, REACTIVITY 1

6. ACCIDENTAL RELEASE MEASURES

Personal Precautionary Measures: Ventilate spill area if possible. Wear appropriate protective equipment.

Environmental Precautionary Measures: Prevent entry into sewers or streams, dike if needed.

Procedure for Clean Up: Stop leak only if safe to do so. Isolate hazard area and restrict access. Neutralize with lime slurry, limestone, or soda ash. Absorb with an inert dry material and place in an appropriate waste disposal container. Flush area with water to remove trace residue.

7. HANDLING AND STORAGE

Handling: Avoid breathing vapors, mist, fume or dust. Avoid contact with eyes, skin and clothing. Handle and open containers with care. Use caution when handling any chemical substance. Keep the containers closed when not in use. Empty containers may contain hazardous product residues.

When cleaning, decontaminating or performing maintenance on tanks, containers, piping systems and accessories, and in any other situations where airborne contaminants and/or dust could be generated, use protective equipment to protect against ingestion or inhalation. Hepa or air supplied respirator, full Tyvek coveralls with head cover, or chemical suits, gloves and boots are suggested.

Storage: Store in a cool, dry, well ventilated area. Do not store in metal containers, because the metal will dissolve and generate hydrogen. Vent rubber lined steel containers to avoid pressure build up if the lining fails. Avoid storage with incompatible materials. Keep containers tightly closed. Store only in dry rubber-lined, plastic, FRP or stainless steel (304, 316). Store between 10°C (50°F) - 30°C (86°F). Product should be used within one (1) year.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Engineering Controls:

Local exhaust ventilation as necessary to maintain exposures to within applicable limits.

Respiratory Protection: If airborne concentrations exceed the Occupational Exposure Limit, use a NIOSH/MSHA approved full facepiece respirator with acid gas cartridges.

Gloves:

Impervious gloves. Neoprene gloves.

Skin Protection: Skin contact should be prevented through the use of suitable protective clothing, gloves and footwear, selected for conditions of use and exposure potential. Consideration must be given both to durability as well as permeation resistance.

Eyes: Chemical goggles; also wear a face shield if splashing hazard exists.

Other Personal Protection Data: Ensure that eyewash stations and safety showers are proximal to the work-station location.

Ingredients	Exposure Limit - ACGIH	Exposure Limit - OSHA	Immediately Dangerous to Life or Health - IDLH
Ferric sulfate	1 mg/m ³	Not available.	Not Available.
Sulphuric Acid	0.2 mg/m ³ TLV-TWA	1 mg/m ³ TWA	15 mg/m ³

9. PHYSICAL AND CHEMICAL PROPERTIES

Physical State: Liquid

Colour: Reddish Brown

Odour: Acidic

pH <1

Specific Gravity: 1.43 - 1.56

Boiling Point: 105-110°C / 220-230°F

Freezing/Melting Point: Not Available.

Vapour Pressure: Not Available.

Vapour Density: Not Available.

% Volatile by Volume: Not Available.

Evaporation Rate: Not Available.

Solubility: Soluble in water.

VOCs: Not Available.

Viscosity: Not Available.

Molecular Weight: Not Available.

10. STABILITY AND REACTIVITY

Chemical Stability: Stable.

Hazardous Polymerization: Will not occur.

Conditions to Avoid: Excessive heat.

Materials to Avoid: Strong acids. Strong bases. Corrosive to some metals. Strongly corrosive to mild steel.

Hazardous Decomposition Products: Thermal decomposition above 600°C will evolve toxic and irritant vapors (sulfur oxides).

Additional Information:

No additional remark.

11. TOXICOLOGICAL INFORMATION

Principle Routes of Exposure

Ingestion: May be harmful if swallowed.

Skin Contact: Causes moderate skin irritation.

Inhalation: May irritate mouth, nose, and throat. Inhalation of mist will irritate mucous membranes.

Eye Contact: Causes moderate eye irritation.

Additional Information:

Acute Test of Product:

Acute Oral LD50: Not Available.

LA3674

Ferric Sulfate Ferriclear®

Page 3 of 6

Acute Dermal LD50: Not Available.
Acute Inhalation LC50: Not Available.

Carcinogenicity:

Ingredients	IARC - Carcinogens	ACGIH - Carcinogens
Ferric sulfate	Not listed.	Not listed.
Sulphuric Acid	Group 1	A2 - Suspected Human Carcinogen (contained in strong inorganic acid mists)

Carcinogenicity Comment: Contains minor amounts of sulfuric acid. Epidemiological studies of workers chronically exposed to sulfuric acid have suggested an increased risk for upper respiratory cancers. The International Agency for Research in Cancer has concluded that occupational exposure to strong inorganic acid mists containing sulphuric acid is carcinogenic to man, however, sulfuric acid itself is not considered a confirmed human carcinogen at this time. The epidemiological studies which provided the basis for the IARC assessment were confounded by exposure to alkyl sulphates (known animal carcinogens), other chemicals, and smoking. Based on the evidence from all human and animal studies, no definitive relationship has been shown between increased risk of respiratory tract cancer and sulfuric acid alone. Sulfuric acid can react with other substances to form mutagenic and possibly carcinogenic products such as alkyl sulfates.

Reproductive Toxicity/ Teratogenicity/ Embryotoxicity/ Mutagenicity: Not Available.

12. ECOLOGICAL INFORMATION

Ecotoxicological Information:

Ingredients	Ecotoxicity - Fish Species Data	Acute Crustaceans Toxicity:	Ecotoxicity - Freshwater Algae Data
Ferric sulfate	Not Available.	Not Available.	Not Available.
Sulphuric Acid	Not Available.	Not Available.	Not Available.

Other Information:

No additional remark.

13. DISPOSAL CONSIDERATIONS

Disposal of Waste Method: Any residues and/or rinse waters from cleaning of tanks, containers, piping systems and accessories may be a hazardous characteristic waste and must be properly disposed in accordance with all federal, state, provincial and local laws.

Contaminated Packaging: Empty containers should be recycled or disposed of through an approved waste management facility.

14. TRANSPORT INFORMATION

DOT (U.S.):

DOT Shipping Name: CORROSIVE LIQUID, ACIDIC, INORGANIC, N.O.S. (FERRIC SULFATE)

DOT Hazardous Class 8

DOT UN Number: UN3264

DOT Packing Group: III

DOT Reportable Quantity (lbs): Not Applicable.

Note: No additional remark.

Marine Pollutant: No.

TDG (Canada):

TDG Proper Shipping Name: CORROSIVE LIQUID, ACIDIC, INORGANIC, N.O.S. (FERRIC SULFATE)

Hazard Class: 8

UN Number: UN3264

Packing Group: III

Note: No additional remark.

Marine Pollutant: No.

LA3674

Ferric Sulfate Ferriclear®

Page 4 of 6

15. REGULATORY INFORMATION

U.S. TSCA Inventory Status: All components of this product are either on the Toxic Substances Control Act (TSCA) Inventory List or exempt.

Canadian DSL Inventory Status: All components of this product are either on the Domestic Substances List (DSL), the Non-Domestic Substances List (NDSL) or exempt.

Note: Not available.

U.S. Regulatory Rules

Ingredients	CERCLA/SARA - Section 302:	SARA (311, 312) Hazard Class:	CERCLA/SARA - Section 313:
Ferric sulfate	Not Listed.	LISTED	Not Listed.
Sulphuric Acid	LISTED	LISTED	LISTED

California Proposition 65: Not Listed.

MA Right to Know List: Listed.

New Jersey Right-to-Know List: Listed.

Pennsylvania Right to Know List: Listed.

WHMIS Hazardous Class:

E CORROSIVE MATERIAL



16. OTHER INFORMATION

Additional Information:

This product has been classified in accordance with the hazard criteria of the Canadian Controlled Products Regulations (CPR) and the MSDS contains all the information required by the CPR.

Disclaimer:

NOTICE TO READER:

Univar, expressly disclaims all express or implied warranties of merchantability and fitness for a particular purpose, with respect to the product or information provided herein, and shall under no circumstances be liable for incidental or consequential damages.

Do not use ingredient information and/or ingredient percentages in this MSDS as a product specification. For product specification information refer to a Product Specification Sheet and/or a Certificate of Analysis. These can be obtained from your local Univar Sales Office.

All information appearing herein is based upon data obtained from the manufacturer and/or recognized technical sources. While the information is believed to be accurate, Univar makes no representations as to its accuracy or sufficiency. Conditions of use are beyond Univar's control and therefore users are responsible to verify this data under their own operating conditions to determine whether the product is suitable for their particular purposes and they assume all risks of their use, handling, and disposal of the product, or from the publication or use of, or reliance upon, information contained herein. This information relates only to the product designated herein, and does not relate to its use in combination with any other material or in any other process.

*****END OF MSDS*****

Appendix C

Water Treatment Plant: Selenium Filtration System Operation Manual (CEMI and Filterco Water Treatment Ltd.)



YUKON ZINC

Selenium Filtration System

OPERATION MANUAL

Contracted to: **Canadian Environmental & Metallurgical Inc.**
Burnaby, B.C

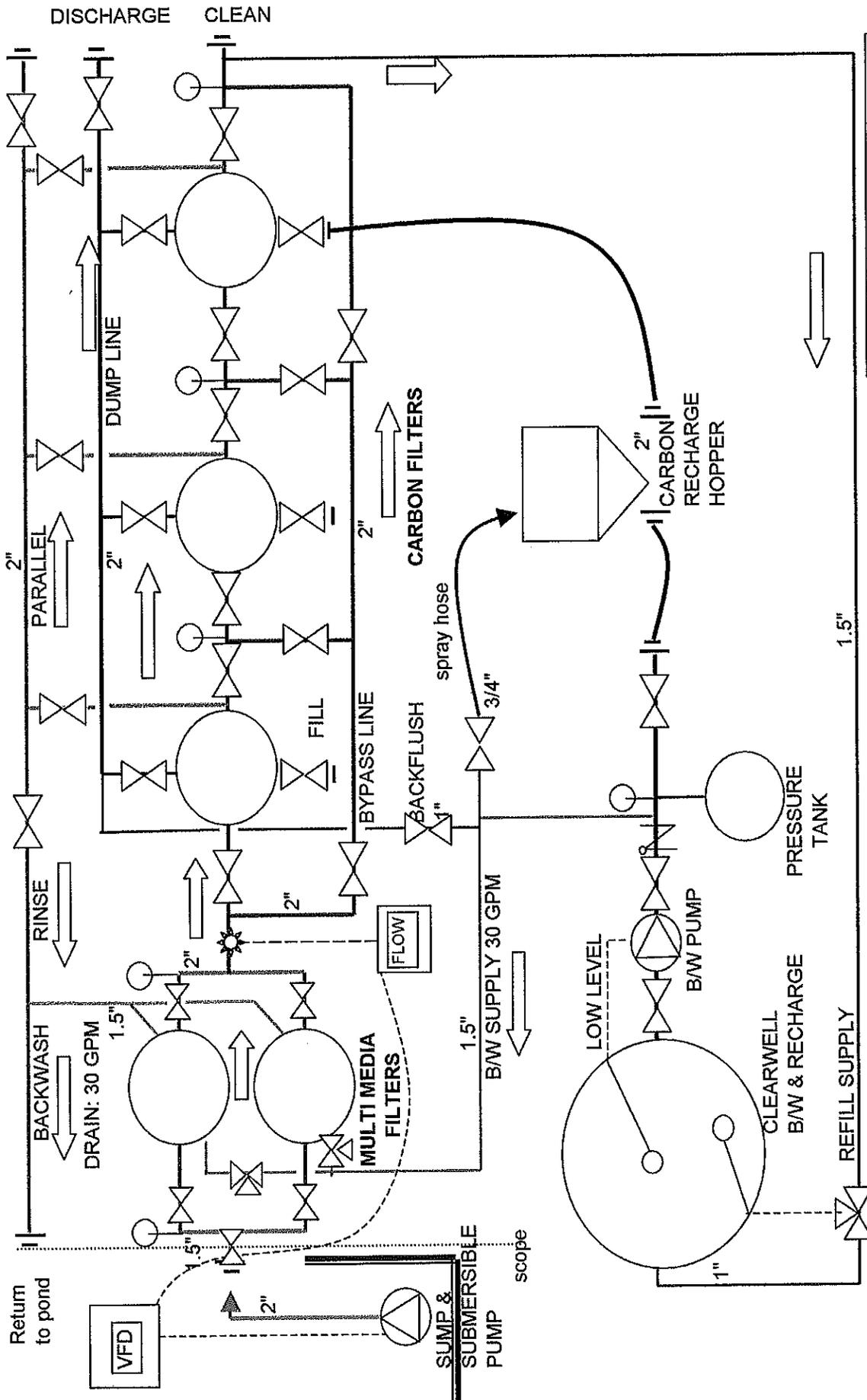
Installed (inside 40' container): March 2006



**Yukon Zinc
Selenium Filtration System**

LIST of EQUIPMENT:

QTY	Unit	PART NO.	DESCRIPTION
1	ea	M-201C-TC-D	Duplex Multi Media: 20" dia c/w:
1	set	19608	Treated water backwash kits: 1"
3	ea	custom	Lined steel 36 x 60" carbon exchange columns: c/w reload ports and manway
1	ea	IP101B	Insertion Flow Meter: 2"
1	ea	FT520	Flow Computer w/ batch function
1	ea	6SE6420-2UC24-OCA1	Complete variable frequency drive:
1	ea	HSJ20	For: 5 HP 208v 3 Ph
1	ea	RM0018P80	incl. Fuse and Line Reactor
1	ea		Pump Starter: backwash pump - HOA & Pilot
1	ea	6TS-75-3	Submersible pump: 60 gpm @ 50 psi (in sleeve)
1	ea	15LTHH3	Backwash pump: 30 gpm @ 35 psi
1	ea		Pressure switch: 20-40 psi
1	ea	T-PSP85	85 gallon Pressure Tank for BW line
1	ea	2083X-PP	Polypropylene injector: 2"
1	ea	custom	60 gal hopper tank w/ 22" lid, etc.
1	ea		Vertical Tank: 48 x 84" 600 gal w/feet
1	lot		2" Camlock fittings & 2" flex hose
2	ea		Shut-off floats for tank & BW Pump
1	ea	457170A	solenoid shut-off: 1.5" (35 Cv) 120v NC



**YUKON ZINC
POND WATER TREATMENT
SYSTEM
FLOW SCHEMATIC - NTS**
March 22, 2006
Julian Noel

1732 West 61st Ave.
Vancouver, BC V6P 2C3
604-677-6777
Fax: 264-9777

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**YUKON ZINC - Containerized Selenium Water Treatment
VALVE SEQUENCE**

March 2006

X = CLOSED

O = OPEN

CARBON

VALVE	1,2 SERIES	2,3 SERIES	1,3 SERIES	1,2,3 PAR	1 BACKFL	1 DUMP	1 RELOAD	1 RINSE
1A	O	O	O	O	O	O	O	O
2A	O	O	O	O	O	O	O	O
2B	O	O	O	O	O	O	O	O
3A	O	O	O	O	O	O	O	O
3B	O	O	O	O	O	O	O	O
4A	O	X	O	O	X	X	X	O
4B	X	O	X	X	X	X	X	X
4C	O	X	O	X	X	X	X	X
4D	X	X	X	O	O	X	O	O
4E	X	X	X	X	X	O	O	X
4F	X	X	X	X	O	O	X	X
5A	O	O	X	O	X	X	X	X
5B	X	X	O	X	X	X	X	X
5C	O	O	X	X	X	X	X	X
5D	X	X	X	O	X	X	X	X
5E	X	X	X	X	X	X	X	X
5F	X	X	X	X	X	X	X	X
6A	X	O	O	O	X	X	X	X
6B	X	X	X	X	X	X	X	X
6C	X	O	O	X	X	X	X	X
6D	X	X	X	O	X	X	X	X
6E	X	X	X	X	X	X	X	X
6F	X	X	X	X	X	X	X	X
6G	X	X	X	X	X	X	X	X
7A	X	X	X	X	O	X	O	O
7B	X	X	X	O	X	X	X	X
7	X	X	X	X	O	X	X	X
8	X	X	X	X	X	X	O	X
9	X	X	X	X	X	O	O	X
10A	O	O	O	O	X	X	X	X
10B	O	O	O	O	X	X	X	X
11	X	X	X	X	X	O	X	X

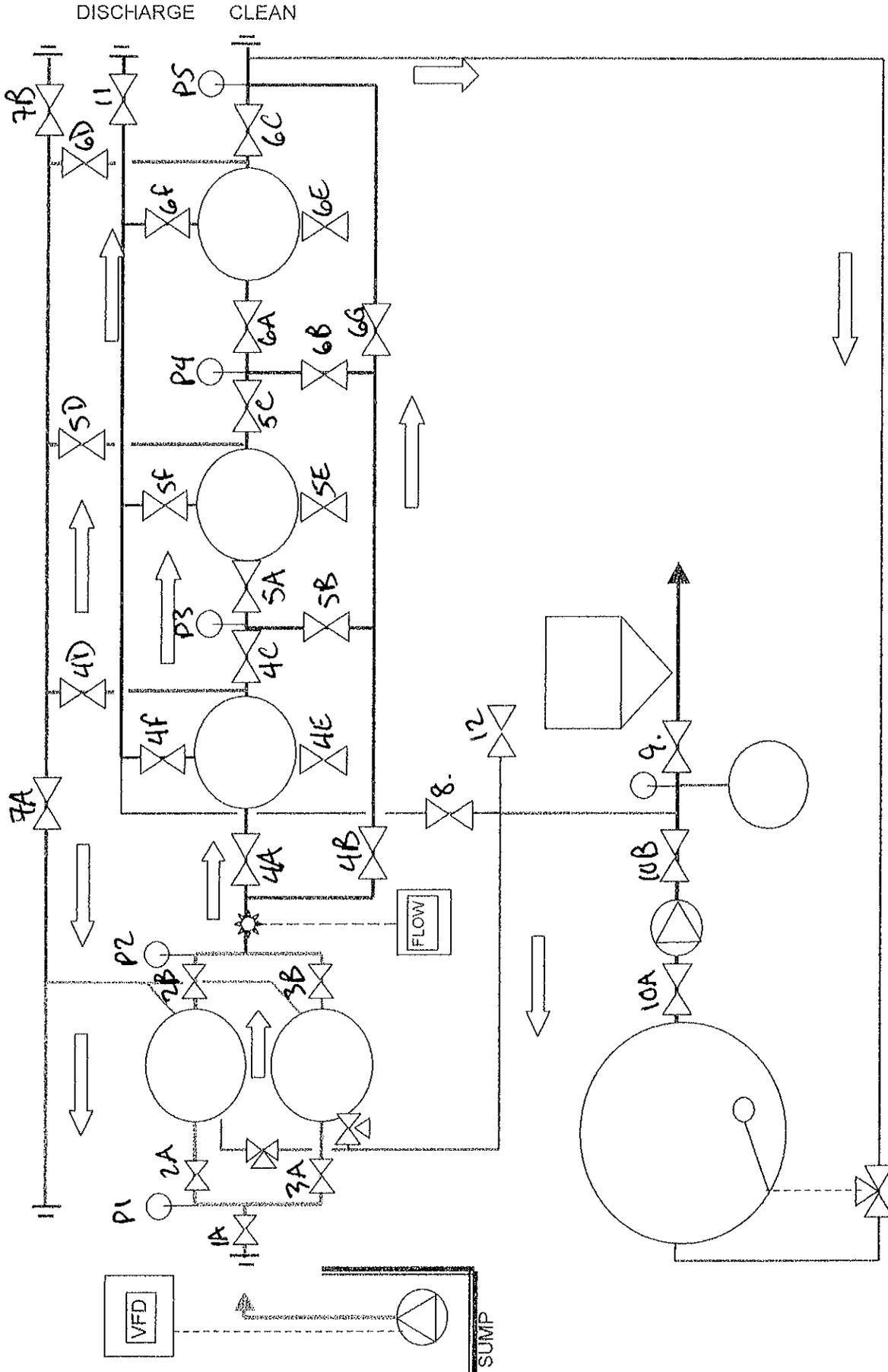
bypass

If no indication then the valve is in another sequence shown of closed (inactive)

Sequence for backflush, reload and rinse is same for all 3 tanks.

Multimedia filters backwash on their own by time clock. Carbon filters should not be backflushed or rinsed while multimedias are backwashing.

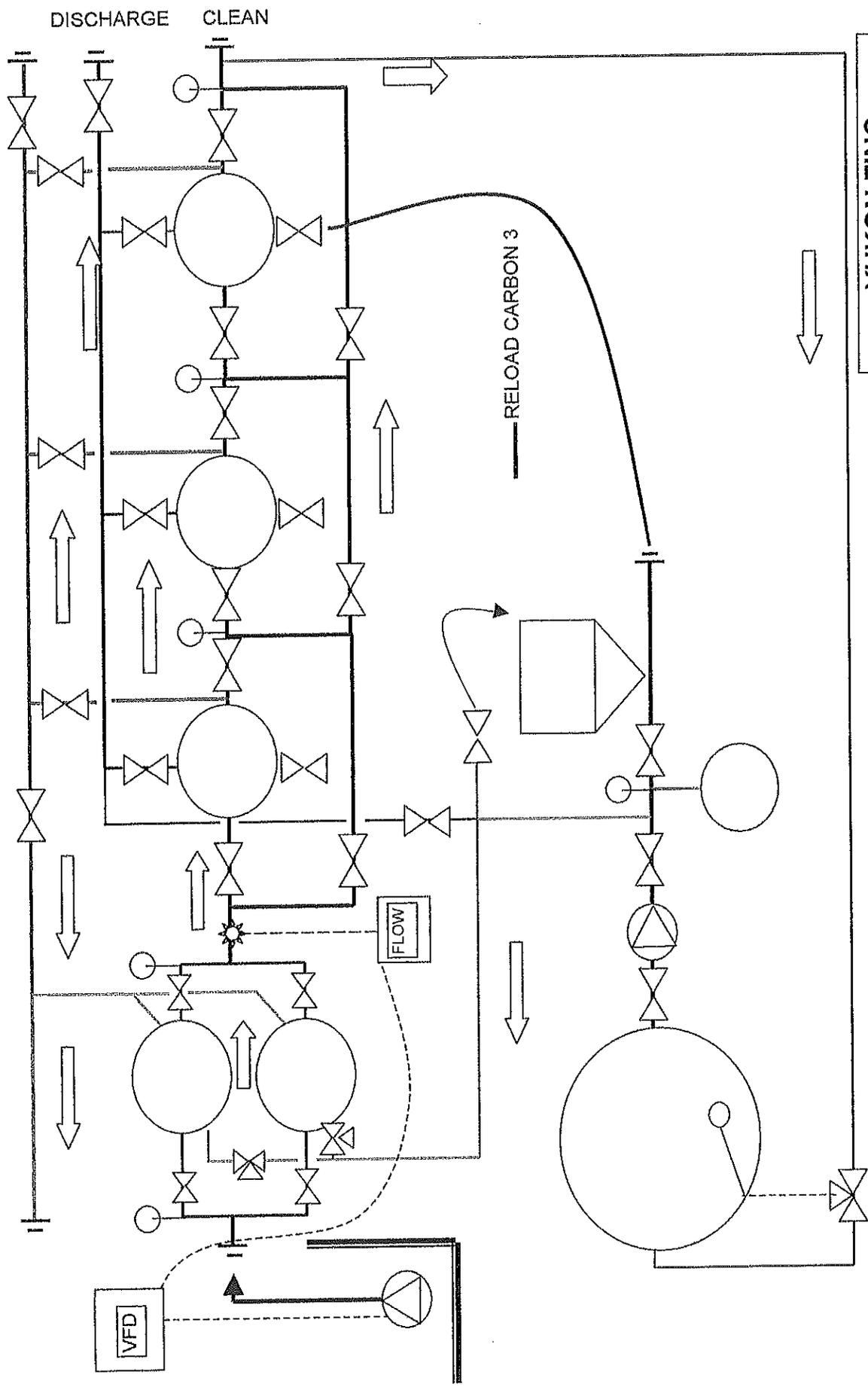
Backflush, Dump, Reload and Rinse valve sequences are the same for carbon filters 2 and 3.



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VALVE LEGEND**
March 22, 2006
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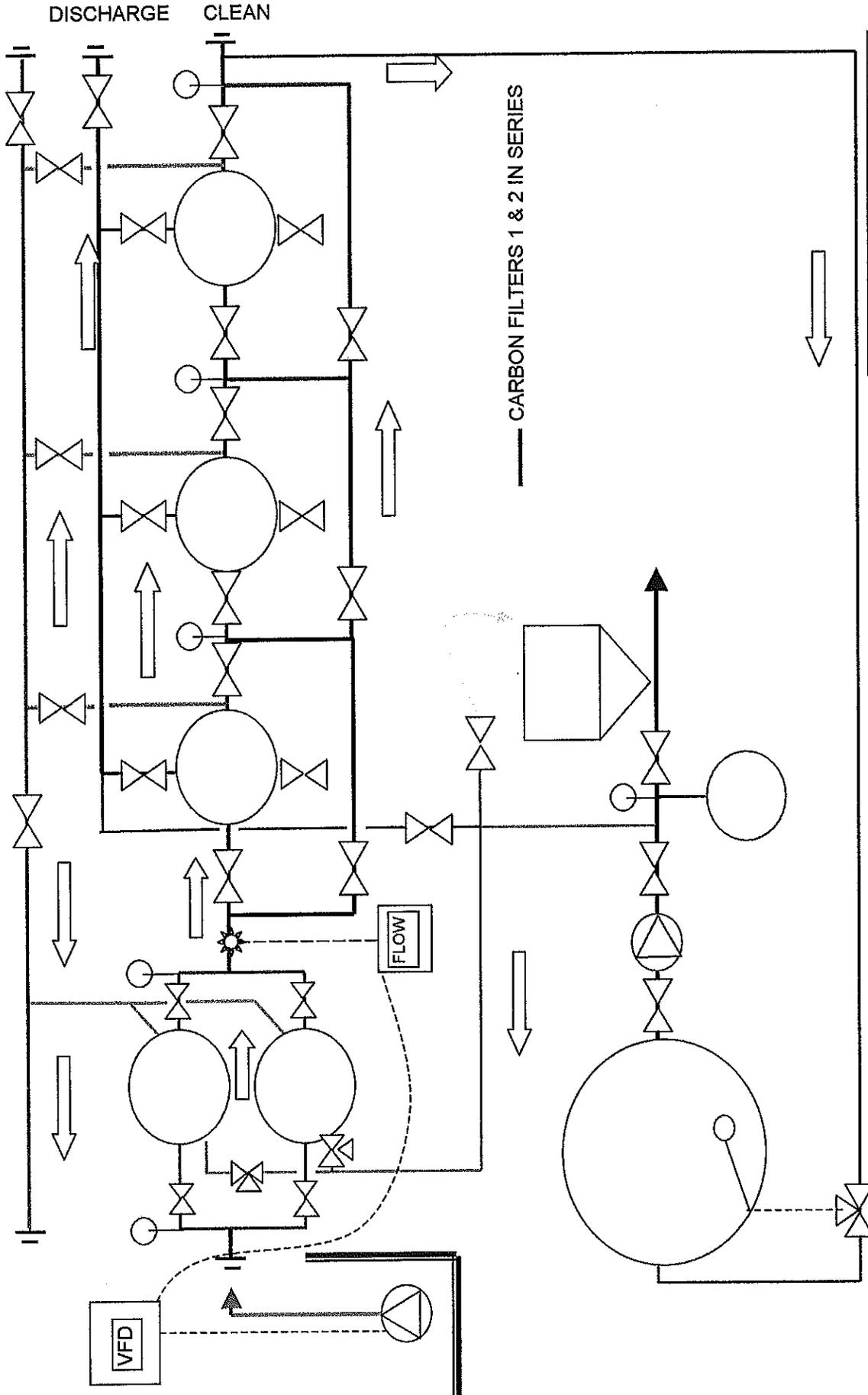
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YUKON ZINC
POND WATER TREATMENT
SYSTEM
FLOW SCHEMATIC - NTS
 March 21 2006
 Julian Noel

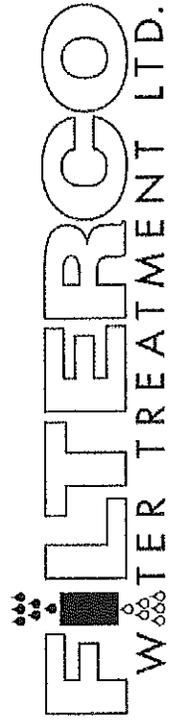
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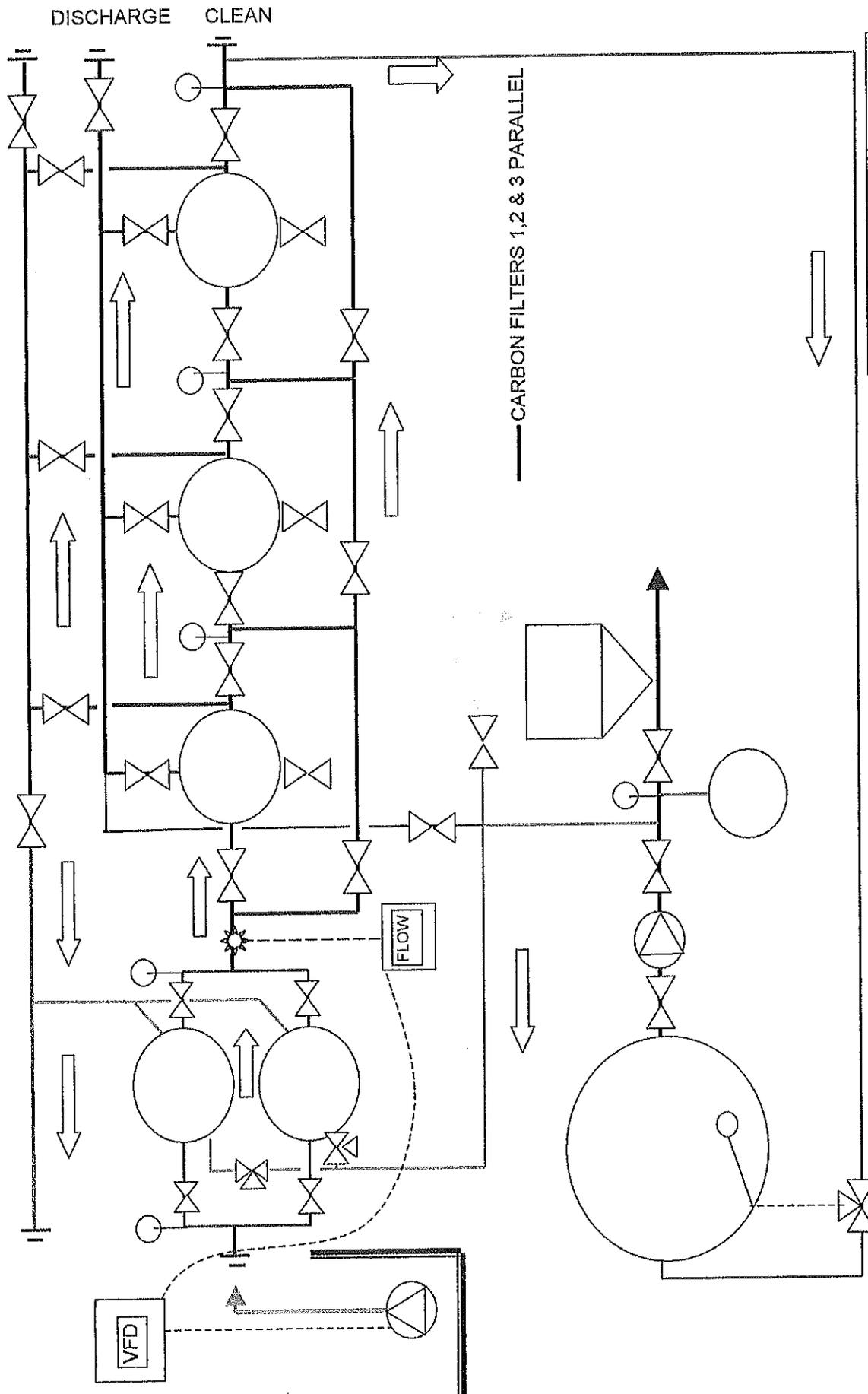
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