Memorandum

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January 31, 2019

TO: Dave Cline, Flambeau Mining Company
Leland Roberts, Flambeau Mining Company

CC: Steve Donohue, Foth Infrastructure & Environment, LLC
Foth Project #: 17F777.19

FR: Sharon Kozicki, Foth Infrastructure & Environment, LLC
Steve Lehrke, Foth Infrastructure & Environment, LLC
Allison Haus, Foth Infrastructure & Environment, LLC

RE: 2018 Annual Summary Memorandum – Reclaimed Flambeau Mine
Flambeau Mining Company

1 Purpose and Need

This 2018 Annual Summary Memorandum documents the work that was completed by Flambeau Mining Company (Flambeau) at the Reclaimed Flambeau Mine Site, Ladysmith, Wisconsin, in 2018, to satisfy the requirements of the Mining Permit (MP). These requirements are summarized in Table 1.

Table 1 – Mine Permit Location Information Key

Condition Number	Location of Information	Condition Requirement
MP, Part 1, Cond. 8	Section 2	*"Submit a report annually to the Department summarizing the activities which took place on the mining site during the year and shall include other additional information specified in this permit and associated plan approvals."*
MP, Part 2, Cond. 4	There were no modifications or deviations to the permit.	*"Include discussion of all modifications received during the previous year and shall include an inventory of all modifications received subsequent to permit issuance. The annual report shall also discuss*

Condition Number	Location of Information	Condition Requirement
		deviations from the approved Mining Plan as a result of final engineering refinements of subsequent plan approvals if these deviations do not require modifications, under Part 2, Conditions 2 and 3."
MP, Part 2, Cond. 6	There were no reportable or recordable incidents in 2018.	*"A summary of incidents subject to various Department reporting requirements shall be included in the annual report required under sec. 144.89, Stats."*
MP, Part 2, Cond 7	There were no exploration activities conducted in 2018.	*"The annual report required under sec. 144.89, Stats, shall include a summary of all exploration drilling activities conducted on the mining site during the previous year."*
MP, Part 4, Cond. 9	Section 2 and Attachment A	*"The annual report required in this permit shall summarize the year's monitoring activities and any observed trends in the monitoring data."*

In the 2018 Request to Modify the Updated Monitoring Plan (November 2018), the annual report format was requested to be changed to a memorandum style. This format change was approved by the Wisconsin Department of Natural Resources (Department) in a letter received on December 7, 2018.

2 2018 Site Monitoring

Environmental monitoring at the Reclaimed Flambeau Mine, during 2018, included assessing the quality of groundwater and backfill pore water. All data obtained during environmental monitoring continues to show that Flambeau remains in compliance with all permit standards and the Flambeau River remains protected.

2.1 Groundwater Sampling and Analysis

Quarterly groundwater monitoring was performed in accordance with descriptions provided in the Updated Monitoring Plan (July 1991), the Quality Assurance Project Plan (February 2015), and the Local Agreement. Results of the 2018 monitoring were submitted to the Department's Mine Reclamation Unit on May 31, 2018, July 27, 2018, September 10, 2018, and December 27, 2018. Those reports are incorporated by reference. A request to reduce the monitoring frequency, and reduce the number of wells and parameters sampled was submitted with the Request to Modify the Updated Monitoring Plan on November 13, 2018. This request is currently under evaluation by the Department.

Figure 1 shows the groundwater potentiometric surface using data obtained during 2018. The map was generated using the shallowest measured water levels, and thus represents shallow groundwater flow in the native formations and in the replaced till and sandstone in the backfilled pit footprint. The potentiometric surface shows a direction of regional shallow groundwater flow toward the Flambeau River. Figure 2 shows the potentiometric surface using the deeper water level for nested wells, where available, and the water levels for the B completion in the backfill monitoring wells. Beyond the pit footprint, the groundwater levels generally mimic the shallow groundwater conditions. Within the pit backfill, the surface reflects a general direction of groundwater flow in the backfilled Type I and Type II stockpile materials along the axis of the pit toward the Flambeau River. Figure 3 shows hydraulic head in the cross section along the axis of the pit. The cross section is interpreted to show predominantly horizontal flow in the backfilled Type I and Type II stockpile materials but with a downward hydraulic gradient at the eastern pit area and an upward hydraulic gradient with convergent groundwater flow near the Flambeau River. These observations are consistent with previous, post-mining years.

2.1.1 Trend Analysis

A detailed analysis of statistical trends occurring in the groundwater and surface water data was performed. Statistical tests evaluated long-term trends occurring during the post-mining period (October 1997 to the present) and short-term trends for the most recent five years. Historical trend graphs of the data are also presented. The complete trend memorandum is included in Attachment A.

The majority of the trends with notable concentration changes occur in the quarterly groundwater indicator monitoring parameters of alkalinity, hardness, manganese, total dissolved solids (TDS), and conductivity. These analytes generally illustrate recent decreasing trends, or in the case of MW-1005, increases through 2017 with decreases in 2018. Iron in the in-pit well of MW-1013 illustrated elevated concentrations during 2018, which were similar to elevated concentrations also observed during 2013. Historical iron concentrations in MW-1013 have exhibited a large degree of variation.

Similar to the above mentioned quarterly parameters in MW-1005, the annual parameters of barium, calcium, chloride, magnesium, and sodium also had increases observed beginning in 2014. In 2018, the increasing trend in these concentrations either slowed, or in the case of sodium, reversed. The increases in these parameters may potentially be due to application of road salt on State Highway 27, which is proximal to the well location. Additional contributing factors may include rising water levels and evaporative concentration effects.

No statistically significant trends were observed in the recent five-year data for the surface water monitoring results.

2.2 Wetland Monitoring

In accordance with Section 3.1.4.3 of the Updated Monitoring Plan, Flambeau monitored water levels in Wetland 1 (Staff Gauge WT-5) in 2018. Water level measurements were collected three times: spring, summer, and fall. Standing water at the staff gauge was

observed during these times. Measurements from Wetland 1 are provided in Attachment A. Figure 1 shows the staff gauge location.

In May 2001, Flambeau submitted a Wetland Area Hydrographic Assessment, prepared by Foth & Van Dyke and Associates, Inc. (FVD), evaluating the wetland water elevations and recommending cessation of monitoring of wetland surface water elevations, with the exception of Wetland 1, in accordance with the Updated Monitoring Plan. Based upon the Wetland Area Hydrographic Assessment, Flambeau requested the Department's approval of cessation of monitoring wetland surface water elevations for Wetlands 5C, 6C, 7, and 10A. During April 2002, the Department concurred with Flambeau's request to decrease the extent of wetland water level monitoring.

A request to end the required monitoring and reporting in Wetland 1 was submitted with the Request to Modify the Updated Monitoring Plan on November 13, 2018. This request is currently under evaluation by the Department.

2.3 Surface Water Sampling and Analysis

Surface water monitoring commenced after completion of the Work Plan Supplement activities on September 23, 2016. Sampling was conducted in accordance with the September 24, 2015 Flambeau Mining Company Surface Water Monitoring Plan (Foth, 2015). Surface water samples were collected at two locations (SW-C9 and SW-C1) as shown on Figure 1. There were two qualifying storm events during the spring and five qualifying storm events during the fall. Surface water was collected from these locations and was sent to Pace Analytical Service, Inc. (Pace) (Green Bay, Wisconsin), a state-certified laboratory. Samples were analyzed for the following parameters:

- Hardness, total
- Copper, total
- Zinc, total
- Total Suspended Solids (TSS), total

Surface water sampling results were provided to the Department on September 10, 2018 and December 27, 2018. The 2018 monitoring concluded the required surface water sampling completed for the 2015 Surface Water Monitoring Plan.

2.4 Protection of the Flambeau River

Potential impact to the Flambeau River was estimated by performing a concentration reduction factor (CRF) calculation in the Request to Modify the Updated Monitoring Plan. This calculation was initially presented in Appendix L of the Mine Permit Application for the Flambeau Project (December 1989), and then updated with current gradient and concentration data for copper, iron, manganese, and sulfate in a memorandum submitted by Flambeau, to the Department, on October 17, 2000, entitled "Backfilled Pit Water Quality Assessment" (October 2000). The 2018 calculation, updated using the current gradient and concentrations, is incorporated by reference. The results of the 2018 calculation were consistent with the 1989 and 2000 CRF calculations, with the CRF being on the order of

0.00000010 and 0.0000010 milligrams per liter (mg/L) for average and low flow conditions, respectively. This CRF results in negligible, unmeasurable, incremental impacts to the Flambeau River that are 3 to 5 orders of magnitude lower than background concentrations in the Flambeau River indicating that the River remains protected. The 2018 Flambeau River analytical results are summarized in Attachment A.

2.5 Subsidence Analysis

Surface subsidence monitoring of the reclaimed mine pit has been completed in accordance with Section 3.1.7 of the Updated Monitoring Plan, which states surface subsidence monitoring will consist of topographically mapping the 32-acre reclaimed mine pit by aerial survey. The initial survey was performed in September 1998 following the completion of reclamation activities in the area of the pit. Subsequent surveys then occurred in the 3rd (2001), 10th (2008), and 20th year (2018). The final survey is scheduled to take place in the 40th year (2038) after reclamation activities in the area of the pit were completed. The Mine Permit Application for the Flambeau Project estimated that settling would be less than 5%, approximately 12 feet. Surface subsidence monitoring was completed in 2001, 2008, and 2018, with each monitoring event being compared to the 1998 aerial mapping topography.

The 2008 subsidence monitoring showed that no subsidence was evident (January 2009). The difference between 2008 and 1998 elevations was an average increase in elevation of 0.6 feet, which is within the accuracy range of the measurement technique. The maximum observed subsidence between 2008 and 1998 elevations was 4.1 feet in isolated areas, which is below the anticipated of 5% (approximately 12 feet).

The 2018 survey and aerial mapping was compared to the 2008 and 1998. The results of the comparison were originally presented in the Request to Modify the Updated Monitoring Plan. The difference between 2018 and 1998 surface elevations was an average increase in elevation of less than 1 foot, which is within the accuracy range of the measurement technique. The difference between 2018 and 2008 surface elevations was an average increase in elevation of less than 1 foot, which is within the accuracy range of the measurement technique.

The maximum observed subsidence between 2018 and 1998 elevations was 3.5 feet in isolated areas, which is below the threshold of 5% (approximately 12 feet). This is similar to what was observed in 2008 and is significantly less than the 5% settlement (or 12 feet) due to compaction control measures taken during backfilling. Based on the results of the 2008 and 2018 surveys, sufficient data has been collected to document subsidence in the backfilled pit. It was requested that the 40th year subsidence evaluation be eliminated in the Request to Modify the Updated Monitoring Plan. This request is currently under evaluation by the Department.

2.6 Aerial Photography (Color and Infrared)

In accordance with Section 3.1.6 of the Updated Monitoring Plan, aerial and color infrared photography was completed in late summer for four consecutive years following completion

of closure and will continue every five years throughout the long-term care and maintenance period to monitor success of revegetation.

In the November 7, 2002 submittal of the 2002 Aerial and Color Infrared Photography, Flambeau requested a reduction of the area of coverage for the photography based upon the substantial rebound of groundwater around the reclaimed mine site. Flambeau proposed that the photography cover the reclaimed mine site and 500 feet beyond the site's perimeter including the area of Wetland 1. In a letter dated July 9, 2003, the Department authorized Flambeau to reduce the breadth of the aerial and color infrared photography as requested.

Year 2005 was the fourth year of the four consecutive years for aerial and color infrared photography since the submittal of the Notice of Completion in 2001. Aerial and color infrared photography was completed on August 3, 2006 for a fifth additional year, and these results were presented in the 2006 Annual Reclamation Report (November 2006).

With the long-term care phase of the Flambeau project beginning with the May 2007 Certificate of Completion, aerial and color infrared photography has been conducted every five years. The first of the long-term care phase aerial and color infrared photography occurred in 2012. The results were presented in the 2012 Annual Report. The second of the long-term care phase aerial and color infrared photography occurred in 2017. The results were presented in the 2017 Annual Report (January 2018). Subsequent aerial and color infrared photography are scheduled in 2022, 2027, 2032, 2037, 2042, and 2047. Based on the results of the previous evaluations, it was requested that the future infrared photography events be eliminated in the Request to Modify the Updated Monitoring Plan. This request is currently under evaluation by the Department.

2.7 Annual Site Inspection

The site was inspected quarterly during the 2018 groundwater monitoring events. The subsidence survey was completed in May 2018, and Applied Ecological Services (AES) visited the site to assess vegetation in the Industrial Outlot (refer to Section 2.3). During these events, there were no areas of erosion or settling observed, vegetative growth appeared normal, and all monitoring devices were functional, with the exception of the staff gauge at WT-5 which appears to have heaved. This monitoring device will be scheduled for abandonment as soon the request to eliminate monitoring at this location, as described in Section 2.2, is approved by the Department.

AES completed a vegetation analysis in accordance with the Flambeau Mining Company Surface Water Monitoring Plan (September 2015) on August 29, 2018. Vegetative coverage was evaluated in the East area, North area, East-West Swale, West area, and Wetland 7. Total estimated coverage was 96% in the East Upland Prairie, 121% in the East Area Bottom, 99% in the North Area Upland Prairie, 104% in the North Area Bottom, >100% in the West Area, and 115% in Wetland 7. The ecological monitoring memorandum is included as Attachment B. This was the third and final industrial outlot vegetation analysis related to the 2015 Monitoring Plan. The AES memorandum is provided in Attachment B.

2.8 Other Activities

The Flambeau River was voluntarily monitored in the spring and fall for copper, iron, manganese, total hardness, zinc, and TSS. These results are summarized in Attachment A. The results indicate that the Flambeau River remains protected.

3 References

Request to Modify the Updated Monitoring Plan	November 2018
2017 Annual Report	January 2018
2016 Annual Report	January 2017
Copper Park Business and Recreation Area Supplement Construction Documentation Report	November 2016
2015 Annual Report	January 2016
2015 Flambeau Mining Company Surface Water Monitoring Plan	September 2015
Copper Park Business and Recreation Area Work Plan Supplement	May 2015
Quality Assurance Project Plan	February 2015
2014 Annual Report	January 2015
2013 Annual Report	January 2014
Copper Park Business and Recreation Area Maintenance and Monitoring Plan	February 2013
2012 Annual Report	January 2013
Copper Park Business and Recreation Area Construction Documentation Report	January 2013
2012 Annual Reclamation Report	November 2012
2011 Annual Report	January 2012
2011 Annual Reclamation Report	November 2011
Copper Park Business and Recreation Area Work Plan	May 2011
2010 Annual Report	January 2011
2010 Annual Reclamation Report	November 2010
2009 Annual Report	February 2010
2009 Annual Reclamation Report	November 2009
2008 Annual Report	January 2009
2008 Annual Reclamation Report	November 2008
2008 Monitoring Results and Copper Park Lane Work Plan	October 2008
2007 Annual Report	January 2008
COC Stipulation Monitoring Work Plan	December 2007
Quality Assurance Project Plan – Stipulation Monitoring Work Plan QAPP for the Flambeau Mine	December 2007
2007 Annual Reclamation Report	November 2007
Stipulation and Order	May 2007

2006 Annual Report	January 2007
Biofilter Management Plan	January 2007
2006 Annual Reclamation Report	November 2006
Construction Documentation Report – Flambeau Industrial Outlot	September 2006
2005 Annual Report	January 2006
2005 Annual Reclamation Report	November 2005
2004 Annual Reclamation Report	November 2004
2001 Annual Reclamation Report	November 2001
2000 Annual Report	January 2001
Revised Mining Permit Quality Assurance/Quality Control Plan	August 1991
Updated Monitoring Plan	July 1991
Mining Permit	January 1991
Operational Phase and Long Term Care Quality Assurance Plan	November 1993
Mine Permit Application	December 1989
Local Agreement	August 1988

4 Submittal Summary

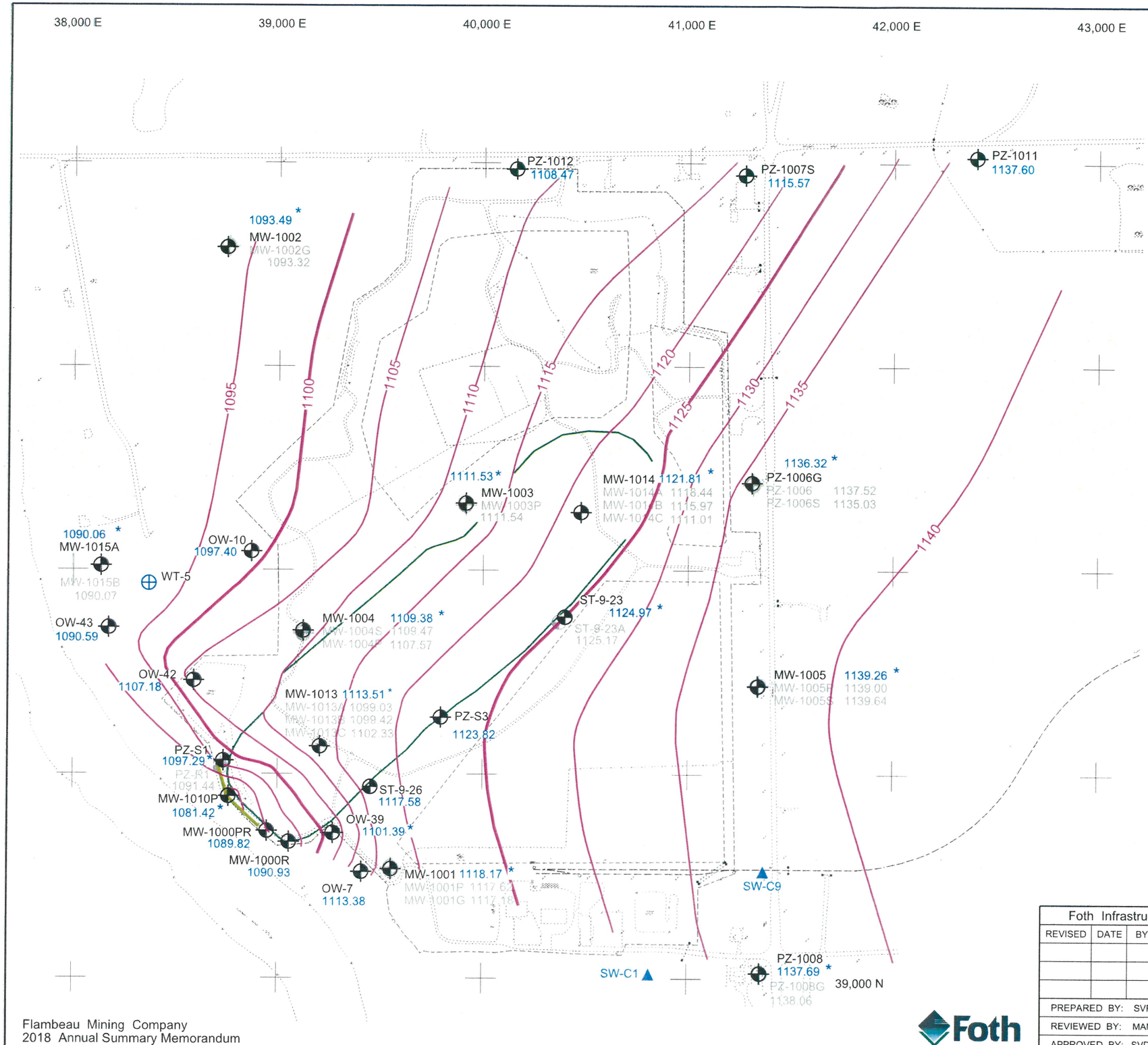
Document	Date	Submittee
2017 Annual Report	January 2018	Dave Siebert[1]
Environmental Groundwater Monitoring (First Quarter 2018)	May 2018	Dave Siebert[1]
Environmental Groundwater Monitoring (Second Quarter 2018)	July 2018	Dave Siebert[1]
Surface Water Analytical Report (Spring 2018)	September 2018	Dave Siebert[1]
Environmental Groundwater Monitoring (Third Quarter 2018)	September 2018	Dave Siebert[1]
Environmental Groundwater Monitoring (Fourth Quarter 2018)	December 2018	Dave Siebert[1]
Fall 2018 Surface Water Analytical Report	December 2018	Dave Siebert[1]
Request to Modify the Updated Monitoring Plan	November 2018	Dave Siebert[1]

[1] Wisconsin Department of Natural Resources
Division of External Services
Bureau of Environmental Analysis & Sustainability

Attachments:

Figure 1	October 2018 Potentiometric Surface, Shallow Groundwater Levels
Figure 2	October 2018 Potentiometric Surface, Wells Screened at Mid-Depths
Figure 3	2018 Mine Pit Cross Section A-A' with In-Pit Groundwater Monitoring Wells
Attachment A	Groundwater Quality & Elevation/Surface Water Quality Trends
Attachment B	AES Industrial Outlot Vegetation Inspection

Figures



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LEGEND

- 1125 — POTENTIOMETRIC SURFACE CONTOUR
- MW-1001G 1117.18 — GROUNDWATER MONITORING WELL AND MEASURED GROUNDWATER ELEVATION (FT MSL) (OCTOBER 23, 2018)
- WT-5 — WETLAND STAFF GAUGE
- SW-C1 — SURFACE WATER SAMPLE LOCATION
- 1193.49 * — ASTERISK DENOTES ELEVATION FROM WELL NEST REPRESENTED BY GROUNDWATER CONTOUR
- SLURRY WALL LOCATION
- APPROXIMATE LIMITS OF FORMER MINE PIT

NOTE:
FOR THE PURPOSE OF THIS POTENTIOMETRIC SURFACE MAP THE SHALLOWEST, NON DRY WELL OF THE NESTED WELL SET WAS USED TO GENERATE THE POTENTIOMETRIC SURFACE.

Flambeau Mining Company
2018 Annual Summary Memorandum

Foth

Foth Infrastructure & Environment, LLC

REVISED	DATE	BY	DESCRIPTION

PREPARED BY: SVF	DATE: JAN. '19		
REVIEWED BY: MAN	DATE: JAN. '19		
APPROVED BY: SVD1	DATE: JAN. '19		

FLAMBEAU MINING COMPANY

FIGURE 1
OCTOBER, 2018
POTENTIOMETRIC SURFACE,
SHALLOW GROUNDWATER LEVELS

Scale: 0 250' 500'
Date: JANUARY 2019
Drafted By: JOW
Project No. 17F777.18

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38,000 E
39,000 E
40,000 E
41,000 E
42,000 E
43,000 E

43,000 N
42,000 N
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39,000 N

PZ-1012
1108.47
PZ-1007S
1115.57
PZ-1011
1137.60
MW-1002
MW-1002G
1093.32
1095
1100
1105
1110
1115
1120
1125
1130
1135
1140
MW-1003
MW-1003P
1111.54
MW-1014
MW-1014A
MW-1014B 1115.97
MW-1014C
PZ-1006G
PZ-1006
PZ-1006S 1135.03
1143.62
PZ-1009G
PZ-1009
MW-1015A
MW-1015B
1090.07
OW-10
1097.40
OW-43
1090.59
MW-1004
MW-1004S
MW-1004P 1107.57
ST-9-23
ST-9-23A
1125.17
OW-42
1107.18
MW-1013
MW-1013A
MW-1013B 1099.42
MW-1013C
PZ-S3
1123.82
MW-1005
MW-1005P 1139.00
MW-1005S
PZ-S1
1097.29*
PZ-R1
1091.44
MW-1010P
1081.42*
ST-9-26
1117.58
OW-39
1101.39*
MW-1000PR
1089.82
MW-1000R
1090.93
OW-7
1113.38
MW-1001
MW-1001P 1117.62
MW-1001G
PZ-1008
PZ-1008G 39,000 N
1138.06

N

LEGEND

- 1120 — POTENTIOMETRIC SURFACE CONTOUR
- MW-1002G 1092.20 — GROUNDWATER MONITORING WELL AND MEASURED GROUNDWATER ELEVATION (FT MSL) (OCTOBER 23, 2018)
- SLURRY WALL LOCATION
- APPROXIMATE LIMITS OF FORMER MINE PIT

NOTE:

1. "B-WELLS" IN THE BACKFILLED PIT AND DEEPER WELLS IN AREAS WITH WELL NESTS OUTSIDE OF THE BACKFILLED PIT WERE USED.

Flambeau Mining Company
2018 Annual Summary Memorandum

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Foth Infrastructure & Environment, LLC			
REVISED	DATE	BY	DESCRIPTION
PREPARED BY: SVF		DATE:	JAN. '19
REVIEWED BY: MAN		DATE:	JAN. '19
APPROVED BY: SVD1		DATE:	JAN. '19

FLAMBEAU MINING COMPANY

FIGURE 2

OCTOBER, 2018 POTENTIOMETRIC SURFACE
WELLS SCREENED AT MID-DEPTHS

Scale: 0 250' 500'
Date: JANUARY 2019
Drafted By: JOW
Project No. 17F777.18

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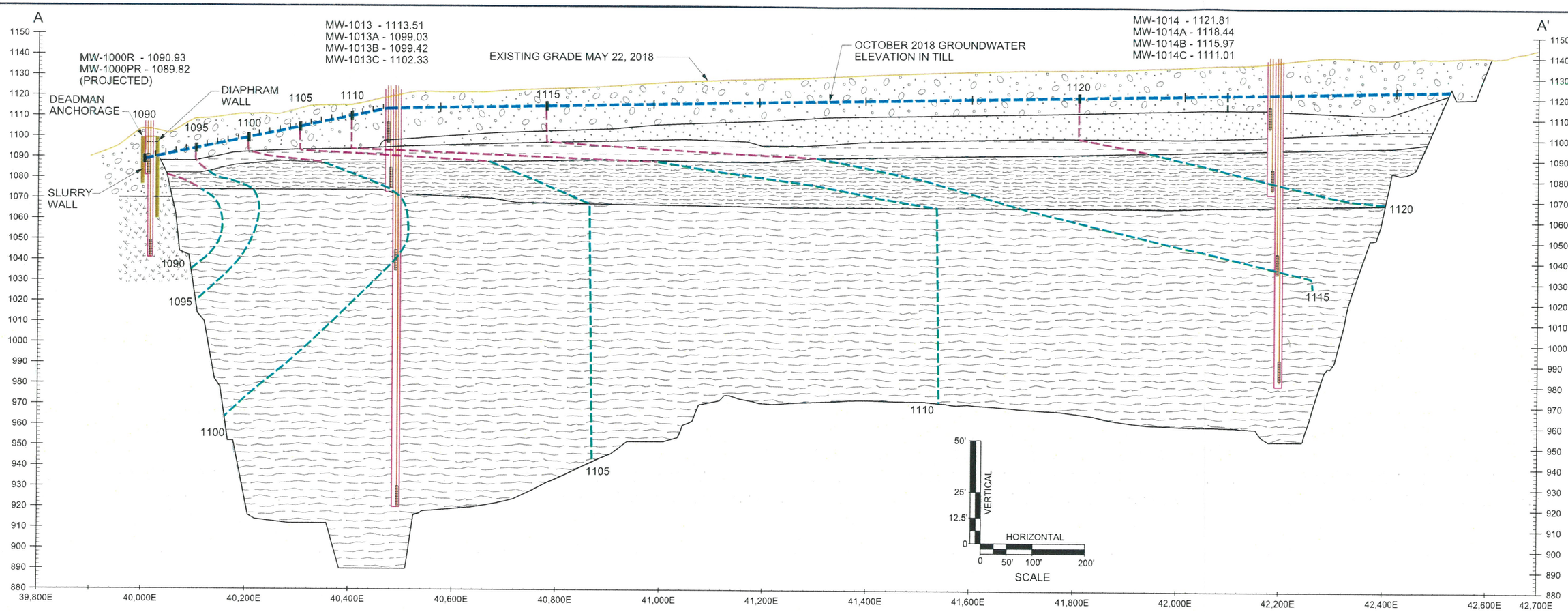

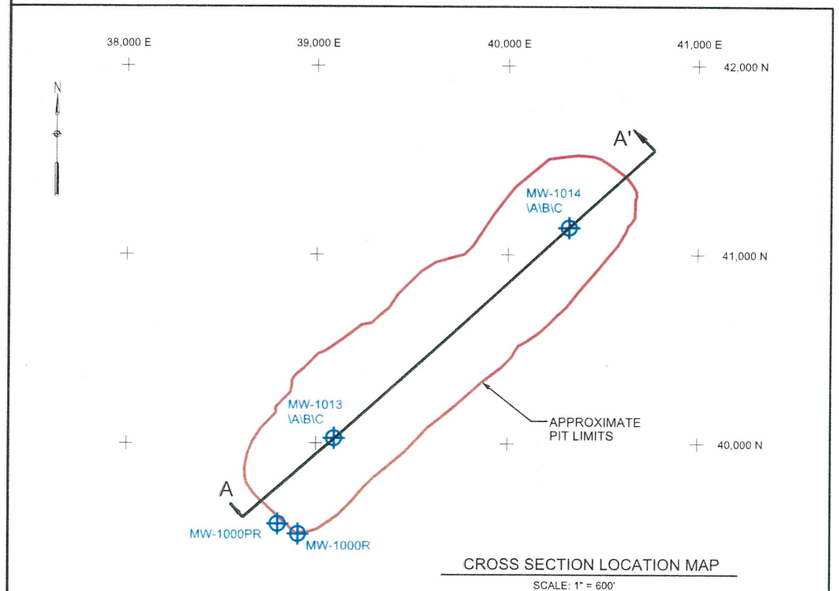

Flambeau Mining Company
2018 Annual Summary Memorandum

MINE PIT COORDINATES
SECTION A - A'

LEGEND

- TILL
- SANDSTONE
- SAPROLITE
- TYPE I MATERIAL
- TYPE II MATERIAL
- PRECAMBRIAN
- WATER TABLE
- GROUNDWATER EQUIPOTENTIAL LINE IN TYPE I AND II BACKFILL
- GROUNDWATER EQUIPOTENTIAL LINE IN SHALLOW FLOW SYSTEM

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REVISED	DATE	BY	DESCRIPTION

PREPARED BY: SVF	DATE: JAN. '19		
REVIEWED BY: MAN	DATE: JAN. '19		
APPROVED BY: SVD1	DATE: JAN. '19		

FLAMBEAU MINING COMPANY

FIGURE 3
2018 MINE PIT CROSS SECTION A - A'
WITH IN-PIT GROUNDWATER
MONITORING WELLS

Scale:	SEE BAR SCALE	Date:	JANUARY 2019
Drafted By:	JOW	Project No.	17F777.18

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Attachment A

Groundwater Quality & Elevation/Surface Water Quality Trends

Foth

Memorandum

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FR: Stephen Lehrke, Ph.D., Foth Infrastructure & Environment, LLC
Allison Haus, Ph.D., Foth Infrastructure & Environment, LLC

RE: 2018 Annual Report Groundwater and Surface Water Trends

1 Background

Groundwater and surface water sample results collected during the 2018 monitoring programs were added to the analytical monitoring historical database. These results were statistically tested and graphically displayed to determine whether any significant increasing or decreasing trends are occurring in the groundwater or surface water chemistry. This is done to satisfy the requirements of Part 4, Condition 9 of the Mine Permit, to summarize the monitoring activities and any observed trends. The 2018 surface water samples from the Flambeau River were collected voluntarily by Flambeau Mining Company (Flambeau).

Groundwater quality results, trend graphs, and statistical test results are included as attachments: Attachment 1 presents the quarterly monitoring parameters and Attachment 2 presents the annual monitoring parameters. Surface water quality results, trend graphs, and statistical test results are included as Attachment 3. Hydrographs are included as Attachment 4.

Intervention boundary wells included in the trend analyses are MW-1000PR, MW-1002, MW-1002G, MW-1004P, MW-1004S, MW-1005, MW-1005P, MW-1005S, and MW-1010P. The in-pit wells included in the trend analyses are MW-1013, MW-1013A, MW-1013B, MW-1013C, MW-1014, MW-1014A, MW-1014B, and MW-1014C. Wells MW-1015A and MW-1015B (also included in the analyses) were constructed in January 2001 approximately 1,000 feet northwest of the backfilled pit and adjacent to the compliance boundary.

2 Statistical Methods

Groundwater and surface water trends over time were assessed using the non-parametric Mann-Kendall test. This test indicates general increasing or decreasing trends over the time

periods evaluated. Two data sets (utilizing two distinct start dates) were assessed: "short-term" trends encompass the results of 2014 through 2018, i.e., the last five years, and "long-term" trends encompass the results from October 1997, when the post-mining period began, through the end of 2018.

Annual monitoring, and long-term trend analyses, began in July 1999 for barium, cadmium, calcium, chloride, chromium, lead, magnesium, mercury, potassium, selenium, silver, sodium, and zinc. Monitoring and long-term trend analyses began in February 1999 for the in-pit wells (i.e., MW-1013B, MW-1013C, MW-1014A, MW-1014B, and MW-1014C), and in April 2001 for wells MW-1015A and MW-1015B. Trend analyses for wells MW-1013, MW-1013A, and MW-1014 began in October 2005, and for MW-1000R and MW-1004 in October 2010, when groundwater levels recovered sufficiently to collect samples.

The statistical results of the non-parametric Mann-Kendall test are used in conjunction with the graphs in Attachments 1, 2, and 3, to evaluate trend conditions within the context of the broader site hydrology. It should be noted that a statistically increasing or decreasing trend as determined through the Mann-Kendall test does not necessarily indicate a substantial increase or decrease in actual parameter concentrations. There are situations where variation in the data is small, allowing slight but consecutive increasing or decreasing concentration changes to be detected as a statistically significant trend. Although these minor trends may occur, they should not be construed as an indication of a broader impact on water quality.

In some cases, the Mann-Kendall trend test results of Attachments 1, 2, and 3, may indicate a statistical trend in the "long-term" data (i.e., results from October 1997), while "short-term" data do not illustrate trend. In these situations, higher or lower concentration data may have been observed in the past, and more recent concentration data has stabilized. The trend result discussion given below will focus on cases that exhibit trends only in the more recent "short-term" data of 2014 through 2018.

The procedure for the Mann-Kendall test is given in Gilbert (1987)[1] and USEPA (2009)[2]. The Type I error for each test was set to 0.01 (two-tailed), with the exception of the 5-year trend tests for the annual parameters. To counteract the decrease in power due to small sample sizes in those cases, the type I error (two-tailed) was set to 0.05 to increase the statistical power (power of detecting existing trends). All non-detected values were replaced with a common value below the lowest detected value.

In the trend test results of Attachments 1, 2, and 3, a "+" indicates a statistically increasing trend and a "-" indicates a statistically decreasing trend. If neither a "+" or "-" is given, no statistically significant trend is present.

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[1]Gilbert, R.O., 1987. *Statistical Methods for Environmental Pollution Monitoring*, Van Nostrand Reinhold, New York.

[2]USEPA, 2009. Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities – Unified Guidance. EPA 530-R-09-007. Office of Resource Conservation and Recovery, Program Implementation and Information Division, Washington, D.C.

3 Trend Results

The majority of trends, increasing, and/or decreasing, were exhibited in the groundwater results for the quarterly parameters. Statistical trend results at each well are summarized below. Historical trend graphs from Attachment 1 (quarterly parameters), Attachment 2 (annual parameters), Attachment 3 (surface water), and Attachment 4 (hydrographs) aid in interpretation. The results are organized by well nest and location.

As previously noted, the Mann-Kendall test may at times indicate that a statistical trend exists due to slight but consecutive concentration changes (either increasing or decreasing). The discussion below is limited to trends existing in the recent five-year dataset that show at least a modest change in relative concentration level.

3.1 Quarterly Parameters (Attachment 1)

3.1.1 Intervention Boundary Wells

- **MW-1000R/MW-1000PR/MW-1010P (Figures B-1a to B-1d):** These three wells are located near the immediate southwest boundary and hydraulically downgradient of the reclaimed mine pit.

  Changes in Reported Trends from Previous Annual Report:
  None to report.

  Continuing Trends from Previous Annual Report:
  Manganese, total dissolved solids (TDS), and conductivity continue to illustrate decreasing trends in MW-1000R, along with a decreasing trend of conductivity in MW-1000PR. The decreasing trends of TDS and conductivity are also occurring in the long-term data.

- **MW-1002/MW-1002G (Figures B-2a to B-2d):** This well nest is located approximately 1,800 feet to the northwest and hydraulically side-gradient to the former mine pit.

  Changes in Reported Trends from Previous Annual Report:
  None to report.

  Continuing Trends from Previous Annual Report:
  Alkalinity, hardness, and TDS in MW-1002G have a small increasing trend. Concentrations remain within historic variation, except alkalinity at MW-1002G, which is slightly above historic range.

- **MW-1004/MW-1004S/MW-1004P (Figures B-3a to B-3d):** This well nest is located near the immediate northwest boundary, and is hydraulically downgradient of the former mine pit.

Changes in Reported Trends from Previous Annual Report:
None to report.

Continuing Trends from Previous Annual Report:
MW-1004S has had small decreasing trends of hardness, sulfate, TDS and conductivity since the beginning of 2015.

- **MW-1005/MW-1005S/MW-1005P (Figures B-4a to B-4d):** This well nest is located approximately 1,000 feet to the southeast and hydraulically upgradient of the former mine pit.

  Changes in Reported Trends from Previous Annual Report:
  While the statistically increasing trends of hardness, manganese, TDS, and conductivity are still being reported in the Mann-Kendall results for MW-1005 (similar to the past Annual Report), the 2018 results have shown modest reversals, illustrating decreased concentrations through the year. Concentration increases observed through 2017 were previously attributed to application of road salt on State Highway 27, which is proximal to the well location..

  Continuing Trends from Previous Annual Report:
  None to report.

- **MW-1015A/MW-1015B (Figures B-5a to B-5d):** This well nest is located approximately 1,000 feet to the west and hydraulically downgradient of the former mine pit.

  Changes in Reported Trends from Previous Annual Report:
  None to report.

  Continuing Trends from Previous Annual Report:
  None to report.

3.1.2 In-Pit Wells

- **MW-1013/MW-1013A/MW-1013B/MW-1013C (Figures B-6a to B-6d):** This well nest is located within the former mine pit on the southwest side.

  Changes in Reported Trends from Previous Annual Report:
  A small decreasing trend of manganese is occurring in MW-1013B.

  Iron at MW-1013 has historically exhibited a large degree of variation. Between 2006 and 2009, seasonal effects were apparent, with iron being highest during the first and fourth quarter sampling events. While the seasonal effect seemed to diminish following 2009, iron concentrations in this well were elevated in 2013 and again in 2018.

Continuing Trends from Previous Annual Report:
None to report.

- **MW-1014/MW-1014A/MW-1014B/MW-1014C (Figures B-7a to B-7d):** This well nest is located within the former mine pit on the northeast side.

  Changes in Reported Trends from Previous Annual Report:
  Arsenic at MW-1014C shows a small increasing trend since 2003. Concentrations remain below those observed in this well prior to 2003.

  Continuing Trends from Previous Annual Report:
  None to report.

3.2 Annual Parameters (Attachment 2)

Similar to previous trend analyses, the annual groundwater parameters of barium, cadmium, calcium, chloride, chromium, lead, magnesium, mercury, potassium, selenium, silver, sodium, and zinc illustrate few statistically significant trends. Of those trends that are noted, most reflect relatively small consecutive concentration changes. The following summary is limited to those trends which show at least a modest change in recent concentrations.

Changes in Reported Trends from Previous Annual Report:

- Calcium, magnesium, and sodium in MW-1000R illustrate decreasing trends after elevated levels were observed in 2014.

Continuing Trends from Previous Annual Report:

- Calcium, chloride, magnesium, and sodium increased slightly in 2011 at MW-1002 and MW-1002G, and have remained generally constant since then.

- Barium, calcium, chloride, magnesium, and sodium also had small increases in concentrations during 2011 in MW-1005, which remained consistent through 2015. Concentrations of barium, calcium, chloride and magnesium parameters, however, rose again from 2016 through 2018. The increase in these parameters is potentially due to application of road salt on State Highway 27, which is proximal to the well location. Additional contributing factors may include rising water levels and evaporative concentration effects.

Historical trend charts for the annual parameters are illustrated on Figures B-8a through B-14e of Attachment 2.

3.3 Surface Water (Attachment 3)

Flambeau voluntarily continued surface water sampling of the Flambeau River in 2018. Sampling parameters currently include copper, hardness, iron, manganese, zinc, and total suspended solids. Concentrations were stable and no statistical trends, neither increasing nor decreasing, were noted in the recent five-year surface water results.

3.4 Hydrographs (Attachment 4)

As observed in the hydrographs (Figures B-16a through B-16p), water levels have stabilized in all wells that showed significant drawdown during the production period from1993 to 1997.

Groundwater elevations increased steadily from 1999 through 2002 for the in-pit wells MW-1013A, MW-1013B, MW-1013C, MW-1014, MW-1014A, MW-1014B, and MW-1014C, and stabilized after 2003. At MW-1013, groundwater elevation rose through 2004 and stabilized during 2005.

Generally higher groundwater elevations are noted for all wells during 2010 and 2011, reflecting the increased precipitation observed in those years. Elevations dropped in 2012, and rebounded during the summer of 2013. An increase in water levels was observed from 2014 through 2017 for both the intervention boundary and the in-pit wells, followed by a decrease in elevation in 2018.

4 WT-5 Water Levels

Data collected from the Wetland 1 (WT-5) water level staff gauge is tabulated and presented in Attachment 5. The location was observed to be wet with approximately 1 inch of standing water during quarters 2, 3, and 4. The staff gauge reading is below the 0 mark.

5 Conclusions

A detailed analysis of statistical trends occurring in the groundwater and surface water data was performed. Statistical tests evaluated long-term trends occurring during the post-mining period (October 1997 to the present) and short-term trends for the most recent five years. Historical trend graphs of the data are also presented.

A general discussion of the trend results for each well nest is provided in Section 3 above. The majority of the trends with notable concentration changes occur in the quarterly groundwater indicator monitoring parameters of alkalinity, hardness, manganese, TDS and conductivity. These analytes generally illustrate recent decreasing trends, or in the case of MW-1005, increases through 2017 with decreases in 2018. The in-pit well MW-1013 illustrated elevated iron concentrations in 2018, similar to elevated concentrations observed in 2013. Historically, iron concentrations at MW-1013 have exhibited a large degree of variation.

Similar to the above-mentioned quarterly parameters at MW-1005, the annual parameters of barium, calcium, chloride, magnesium, and sodium also increased, beginning in 2014. In

2018, the increasing trend in these concentrations either slowed, or in the case of sodium, reversed. The increases in these parameters may be due to application of road salt on State Highway 27, which is proximal to the well location. Additional contributing factors may include rising water levels and evaporative concentration effects.

No statistically significant trends were observed in the recent five-year data for the surface water monitoring results.

Attachment 1

Groundwater - Quarterly Parameters

Statistical Results
Trend Graphs
2018 Data

Trend Analysis Results - Groundwater (Quarterly Parameters)
Year Ending 2018

	Alkalinity	Arsenic	Copper	Hardness	Iron	Manganese	Sulfate	TDS	Field pH (su)	Cond (umhos /cm)	Redox (mV)	Grd Water El (Feet)
MW-1000PR												
Trend Results for Most Recent 5 Years												
Sample Size	20	20	20	20	20	20	20	20	20	20	19	20
Mann-Kendall S	-51	56	-17	-58	-12	-59	-24	-74	50	-99	3	18
p-Level	0.105	0.074	0.608	0.064	0.724	0.059	0.460	0.016	0.112	0.001	0.946	0.586
Trend										-		
Trend Results for All Data Since Oct. 1997												
Sample Size	85	66	85	85	85	85	85	85	85	85	69	85
Mann-Kendall S	1742	863	-823	-2484	-495	-2170	-2695	-2411	1001	-2626	-750	1031
p-Level	0.000	0.000	0.002	0.000	0.061	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Trend	+	+	-	-		-	-	-	+	-	-	+
MW-1000R												
Trend Results for Most Recent 5 Years												
Sample Size	20	20	20	20	20	20	20	20	20	20	19	20
Mann-Kendall S	-39	3	-70	-78	-22	-88	-75	-86	47	-90	9	25
p-Level	0.221	0.949	0.024	0.012	0.5	0.004	0.015	0.004	0.137	0.004	0.782	0.441
Trend						-		-		-		
Trend Results for All Data Since Oct. 1997												
Sample Size	33	33	33	33	33	33	33	33	33	33	32	84
Mann-Kendall S	-219	43	-176	-226	-99	-143	-56	-225	-39	-240	-116	1130
p-Level	0	0.518	0.006	0	0.13	0.027	0.398	0	0.559	0	0.062	0.000
Trend	-		-	-				-		-		+
MW-1010P												
Trend Results for Most Recent 5 Years												
Sample Size	20	20	20	20	20	20	20	20	20	20	19	20
Mann-Kendall S	49	-10	50	47	-7	51	70	52	-30	-4	-19	2
p-Level	0.120	0.774	0.112	0.137	0.847	0.105	0.024	0.098	0.352	0.924	0.534	0.974
Trend												
Trend Results for All Data Since Oct. 1997												
Sample Size	85	66	85	85	85	85	85	85	85	85	70	85
Mann-Kendall S	892	820	-787	2487	-1091	-554	2679	890	626	2242	826	710
p-Level	0.000	0.000	0.000	0.000	0.000	0.036	0.000	0.001	0.018	0.000	0.000	0.007
Trend	+	+	-	+	-		+	+		+	+	+
MW-1002												
Trend Results for Most Recent 5 Years												
Sample Size	20	20	20	20	20	20	20	20	20	20	19	20
Mann-Kendall S	24	-9	31	-32	-2	1	-91	11	20	-57	-25	-11
p-Level	0.460	0.798	0.335	0.318	0.974	0.987	0.003	0.749	0.542	0.069	0.406	0.749
Trend							-					
Trend Results for All Data Since Oct. 1997												
Sample Size	85	63	85	85	85	85	85	85	85	85	20	85
Mann-Kendall S	1146	-10	115	1066	-474	-226	-1272	-165	-471	854	-44	700
p-Level	0.000	0.899	0.567	0.000	0.025	0.198	0.000	0.533	0.074	0.001	0.164	0.008
Trend	+			+			-			+		+
MW-1002G												
Trend Results for Most Recent 5 Years												
Sample Size	20	20	20	20	20	20	20	20	20	20	19	20
Mann-Kendall S	158	0	3	122	14	-20	115	83	10	40	-21	-12
p-Level	0.000	1.000	0.949	0.000	0.678	0.542	0.000	0.007	0.774	0.208	0.490	0.724
Trend	+			+			+	+				
Trend Results for All Data Since Oct. 1997												
Sample Size	85	63	85	85	85	85	85	85	85	85	20	85
Mann-Kendall S	1166	-93	232	2137	-196	216	-894	875	-688	1779	-40	661
p-Level	0.000	0.071	0.100	0.000	0.327	0.218	0.001	0.001	0.009	0.000	0.208	0.012
Trend	+			+			-	+	-	+		

Trend Analysis Results - Groundwater (Quarterly Parameters)
Year Ending 2018

	Alkalinity	Arsenic	Copper	Hardness	Iron	Manganese	Sulfate	TDS	Field pH (su)	Cond (umhos /cm)	Redox (mV)	Grd Water El (Feet)
MW-1004												
Trend Results for Most Recent 5 Years												
Sample Size	20	20	20	20	20	20	20	20	20	20	19	20
Mann-Kendall S	15	21	-54	27	-30	-22	18	37	16	5	-21	-20
p-Level	0.654	0.521	0.086	0.404	0.352	0.5	0.586	0.247	0.63	0.898	0.49	0.542
Trend												
Trend Results for All Data Since Oct. 1997												
Sample Size	32	32	32	32	32	32	32	32	32	32	31	72
Mann-Kendall S	-119	26	186	-67	-26	7	-12	97	-55	-75	-186	534
p-Level	0.056	0.688	0.002	0.287	0.688	0.923	0.86	0.12	0.385	0.232	0.002	0.010
Trend			+								-	+
MW-1004S												
Trend Results for Most Recent 5 Years												
Sample Size	20	20	20	20	20	20	20	20	20	20	19	20
Mann-Kendall S	-30	-5	47	-100	3	63	-84	-103	43	-93	-25	-18
p-Level	0.352	0.898	0.137	0.000	0.949	0.043	0.006	0.000	0.175	0.002	0.406	0.586
Trend				-			-	-		-		
Trend Results for All Data Since Oct. 1997												
Sample Size	85	65	85	85	85	85	85	85	85	85	70	85
Mann-Kendall S	363	-15	896	707	-592	-9	1635	-471	61	363	-564	1161
p-Level	0.169	0.827	0.000	0.007	0.002	0.971	0.000	0.073	0.820	0.169	0.004	0.000
Trend			+	+	-		+				-	+
MW-1004P												
Trend Results for Most Recent 5 Years												
Sample Size	20	20	20	20	20	20	20	20	20	20	19	20
Mann-Kendall S	31	51	17	59	18	13	38	36	-29	-1	39	-29
p-Level	0.335	0.105	0.608	0.059	0.586	0.701	0.234	0.260	0.369	0.987	0.186	0.369
Trend												
Trend Results for All Data Since Oct. 1997												
Sample Size	86	66	86	86	86	86	86	86	86	86	66	86
Mann-Kendall S	758	486	-723	1084	1967	1878	179	-212	382	1106	-672	1320
p-Level	0.001	0.001	0.000	0.000	0.000	0.000	0.451	0.429	0.155	0.000	0.000	0.000
Trend	+	+	-	+	+	+				+	-	+
MW-1005												
Trend Results for Most Recent 5 Years												
Sample Size	20	20	20	20	20	20	20	20	20	20	19	20
Mann-Kendall S	88	-13	-46	142	75	123	124	95	-21	102	16	37
p-Level	0.004	0.701	0.146	0.000	0.015	0.000	0.000	0.002	0.521	0.000	0.604	0.247
Trend	+			+		+	+	+		+		
Trend Results for All Data Since Oct. 1997												
Sample Size	85	63	85	85	85	85	85	85	85	85	20	84
Mann-Kendall S	-1145	-317	830	1377	-98	494	963	1348	-858	1463	-3	1042
p-Level	0.000	0.058	0.000	0.000	0.712	0.061	0.000	0.000	0.001	0.000	0.949	0.000
Trend	-		+	+			+	+	-	+		+
MW-1005S												
Trend Results for Most Recent 5 Years												
Sample Size	20	20	20	20	20	20	20	20	20	20	19	20
Mann-Kendall S	-134	-31	-3	-90	-91	-96	78	-58	-13	-142	21	38
p-Level	0.000	0.335	0.949	0.004	0.003	0.002	0.012	0.064	0.701	0.000	0.490	0.234
Trend	-			-	-	-				-		
Trend Results for All Data Since Oct. 1997												
Sample Size	85	63	85	85	85	85	85	85	85	85	20	85
Mann-Kendall S	444	-68	-1	638	-19	434	-603	-573	225	479	4	1091
p-Level	0.079	0.690	1.000	0.012	0.945	0.093	0.009	0.029	0.394	0.070	0.924	0.000
Trend							-					+

Trend Analysis Results - Groundwater (Quarterly Parameters)
Year Ending 2018

	Alkalinity	Arsenic	Copper	Hardness	Iron	Manganese	Sulfate	TDS	Field pH (su)	Cond (umhos /cm)	Redox (mV)	Grd Water El (Feet)
MW-1005P												
Trend Results for Most Recent 5 Years												
Sample Size	20	20	20	20	20	20	20	20	20	20	19	20
Mann-Kendall S	60	7	-21	76	49	-6	-4	37	43	-16	53	34
p-Level	0.054	0.847	0.521	0.014	0.120	0.872	0.924	0.247	0.175	0.630	0.068	0.288
Trend												
Trend Results for All Data Since Oct. 1997												
Sample Size	85	63	85	85	85	85	85	85	85	85	72	85
Mann-Kendall S	303	128	9	721	1838	719	-330	-218	-48	1034	108	854
p-Level	0.234	0.253	0.960	0.005	0.000	0.006	0.053	0.408	0.858	0.000	0.603	0.001
Trend				+	+	+				+		+
MW-1015A												
Trend Results for Most Recent 5 Years												
Sample Size	20	20	20	20	20	20	20	20	20	20	19	20
Mann-Kendall S	85	0	-3	67	-20	84	-20	60	-52	0	-29	17
p-Level	0.005	1.000	0.949	0.031	0.542	0.006	0.542	0.054	0.098	1.000	0.332	0.608
Trend	+					+						
Trend Results for All Data Since Oct. 1997												
Sample Size	79	72	79	79	80	80	79	79	80	80	56	80
Mann-Kendall S	823	-131	265	791	15	-1160	-58	-145	200	1562	-150	410
p-Level	0.000	0.067	0.063	0.001	0.922	0.000	0.809	0.540	0.408	0.000	0.292	0.089
Trend	+			+		-				+		
MW-1015B												
Trend Results for Most Recent 5 Years												
Sample Size	20	20	20	20	20	20	20	20	20	20	19	20
Mann-Kendall S	8	-21	15	21	11	-66	13	-8	-46	10	46	11
p-Level	0.822	0.521	0.654	0.521	0.749	0.034	0.701	0.822	0.146	0.774	0.116	0.749
Trend												
Trend Results for All Data Since Oct. 1997												
Sample Size	79	72	79	79	80	80	79	79	80	80	57	80
Mann-Kendall S	-38	128	121	1219	35	-989	188	41	527	1477	884	464
p-Level	0.853	0.256	0.124	0.000	0.888	0.000	0.150	0.865	0.029	0.000	0.000	0.054
Trend				+		-				+	+	
MW-1013												
Trend Results for Most Recent 5 Years												
Sample Size	20	20	20	20	20	20	20	20	20	20	19	20
Mann-Kendall S	-68	59	-51	-43	53	44	-113	-22	37	-75	-67	12
p-Level	0.028	0.059	0.105	0.175	0.092	0.164	0.000	0.500	0.247	0.015	0.020	0.724
Trend							-					
Trend Results for All Data Since Oct. 1997												
Sample Size	53	53	53	53	53	53	53	53	53	53	53	80
Mann-Kendall S	212	-61	331	-188	-15	701	-1086	13	-190	-418	-370	2200
p-Level	0.104	0.626	0.010	0.150	0.914	0.000	0.000	0.926	0.146	0.001	0.005	0.000
Trend			+			+	-			-	-	+
MW-1013A												
Trend Results for Most Recent 5 Years												
Sample Size	20	20	20	20	20	20	20	20	20	20	19	20
Mann-Kendall S	84	20	-40	-29	-59	-6	-23	-16	26	-37	-7	28
p-Level	0.006	0.542	0.208	0.369	0.059	0.872	0.480	0.630	0.422	0.247	0.836	0.386
Trend	+											
Trend Results for All Data Since Oct. 1997												
Sample Size	53	53	53	53	53	53	53	53	53	53	52	80
Mann-Kendall S	274	5	102	-111	311	508	-231	129	-147	-109	-377	1604
p-Level	0.035	0.968	0.373	0.397	0.014	0.000	0.076	0.325	0.262	0.407	0.003	0.000
Trend						+					-	+

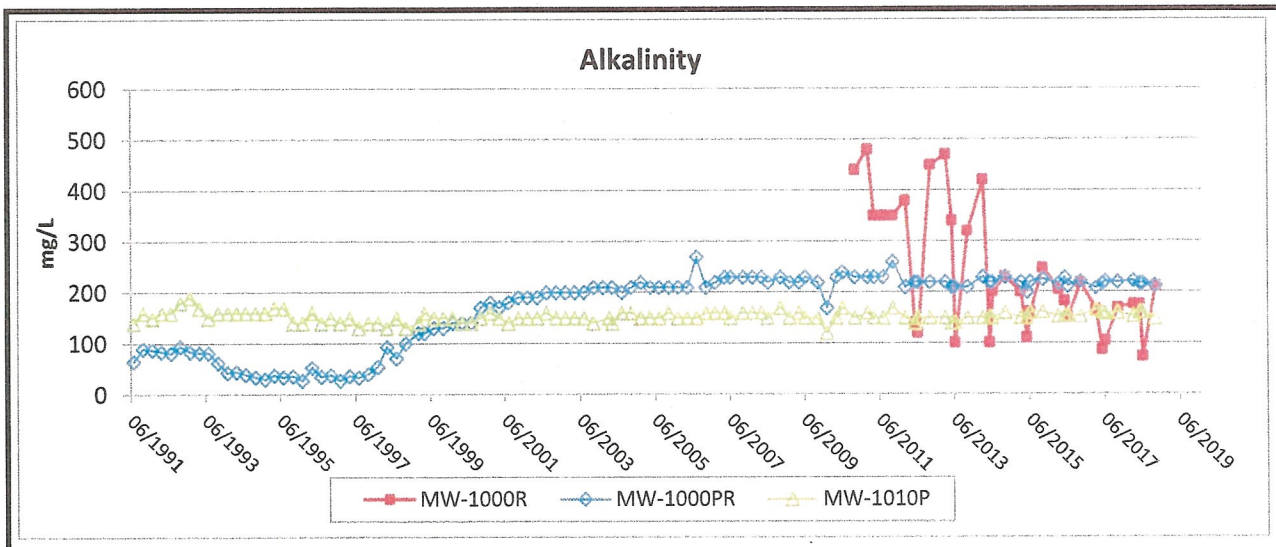
Trend Analysis Results - Groundwater (Quarterly Parameters)
Year Ending 2018

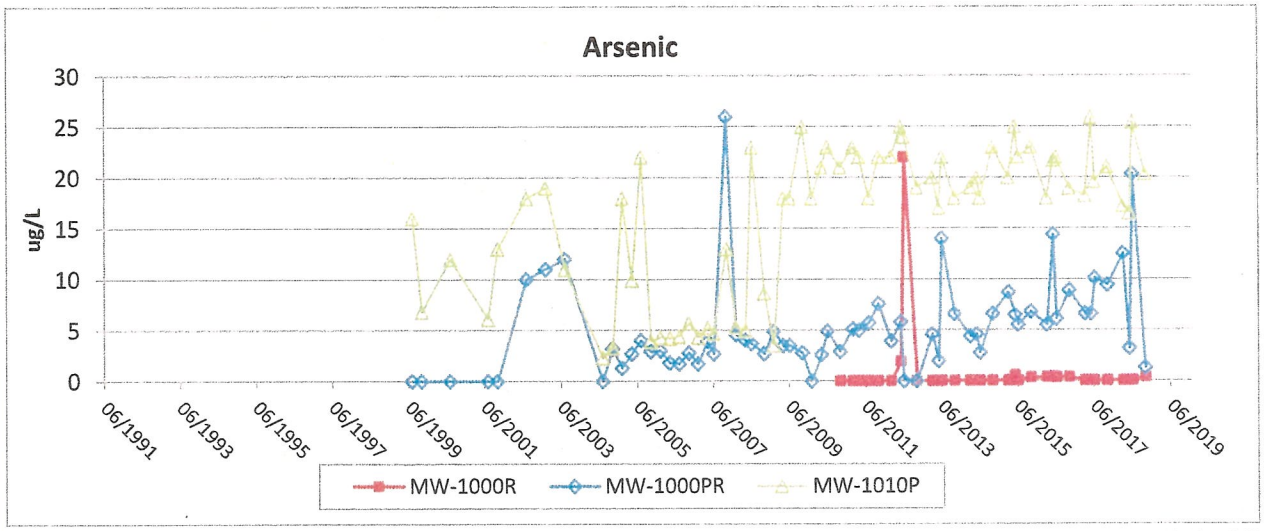
	Alkalinity	Arsenic	Copper	Hardness	Iron	Manganese	Sulfate	TDS	Field pH (su)	Cond (umhos /cm)	Redox (mV)	Grd Water El (Feet)
MW-1013B												
Trend Results for Most Recent 5 Years												
Sample Size	20	20	20	20	20	20	20	20	20	20	19	20
Mann-Kendall S	15	83	-67	3	-69	-86	127	-25	46	-35	-41	15
p-Level	0.654	0.007	0.031	0.949	0.026	0.004	0.000	0.441	0.146	0.274	0.164	0.654
Trend		+				-	+					
Trend Results for All Data Since Oct. 1997												
Sample Size	80	68	80	80	80	80	80	80	80	80	72	80
Mann-Kendall S	-490	-112	1844	-563	-448	-369	729	-834	-279	-858	-274	1637
p-Level	0.042	0.527	0.000	0.015	0.044	0.126	0.002	0.000	0.246	0.000	0.184	0.000
Trend			+				+	-		-		+
MW-1013C												
Trend Results for Most Recent 5 Years												
Sample Size	20	20	20	20	20	20	20	20	20	20	19	20
Mann-Kendall S	-34	15	21	-45	14	-24	67	-80	10	-45	-7	40
p-Level	0.288	0.654	0.521	0.155	0.678	0.460	0.031	0.010	0.774	0.155	0.836	0.208
Trend								-				
Trend Results for All Data Since Oct. 1997												
Sample Size	80	68	80	80	80	80	80	80	80	79	72	80
Mann-Kendall S	69	1098	81	-1217	2684	600	-402	-1542	105	-1248	290	1636
p-Level	0.777	0.000	0.661	0.000	0.000	0.012	0.085	0.000	0.665	0.000	0.160	0.000
Trend		+		-	+			-		-		+
MW-1014												
Trend Results for Most Recent 5 Years												
Sample Size	20	20	20	20	20	20	20	20	20	20	19	20
Mann-Kendall S	32	20	-107	91	-20	4	119	95	29	52	-25	54
p-Level	0.318	0.542	0.000	0.003	0.542	0.924	0.000	0.002	0.369	0.098	0.406	0.086
Trend			-	+			+	+				
Trend Results for All Data Since Oct. 1997												
Sample Size	53	53	53	53	53	53	53	53	53	53	53	77
Mann-Kendall S	83	-1	-114	-77	34	361	-625	-4	-288	-248	-513	1640
p-Level	0.521	1.000	0.384	0.558	0.683	0.006	0.000	0.982	0.027	0.058	0.000	0.000
Trend						+	-				-	+
MW-1014A												
Trend Results for Most Recent 5 Years												
Sample Size	20	20	20	20	20	20	20	20	20	20	19	20
Mann-Kendall S	21	99	10	39	-39	34	54	19	54	-22	14	64
p-Level	0.521	0.001	0.774	0.221	0.221	0.288	0.086	0.564	0.086	0.500	0.653	0.040
Trend		+										
Trend Results for All Data Since Oct. 1997												
Sample Size	75	65	75	75	75	75	75	75	75	75	72	80
Mann-Kendall S	590	94	931	-213	-893	-1812	-49	-493	-390	-843	-294	1843
p-Level	0.007	0.563	0.000	0.297	0.000	0.000	0.825	0.019	0.074	0.000	0.154	0.000
Trend	+		+		-	-				-		+
MW-1014B												
Trend Results for Most Recent 5 Years												
Sample Size	20	20	20	20	20	20	20	20	20	20	19	20
Mann-Kendall S	14	108	-57	-2	-10	-53	86	20	62	-58	-69	40
p-Level	0.678	0.000	0.069	0.974	0.774	0.092	0.004	0.542	0.046	0.064	0.016	0.208
Trend		+					+					
Trend Results for All Data Since Oct. 1997												
Sample Size	80	68	80	80	80	80	80	80	81	81	72	81
Mann-Kendall S	-538	-106	-873	-1362	-34	-2447	-682	-1474	216	-1644	-1283	1701
p-Level	0.025	0.564	0.000	0.000	0.818	0.000	0.004	0.000	0.379	0.000	0.000	0.000
Trend			-	-		-	-	-		-	-	+

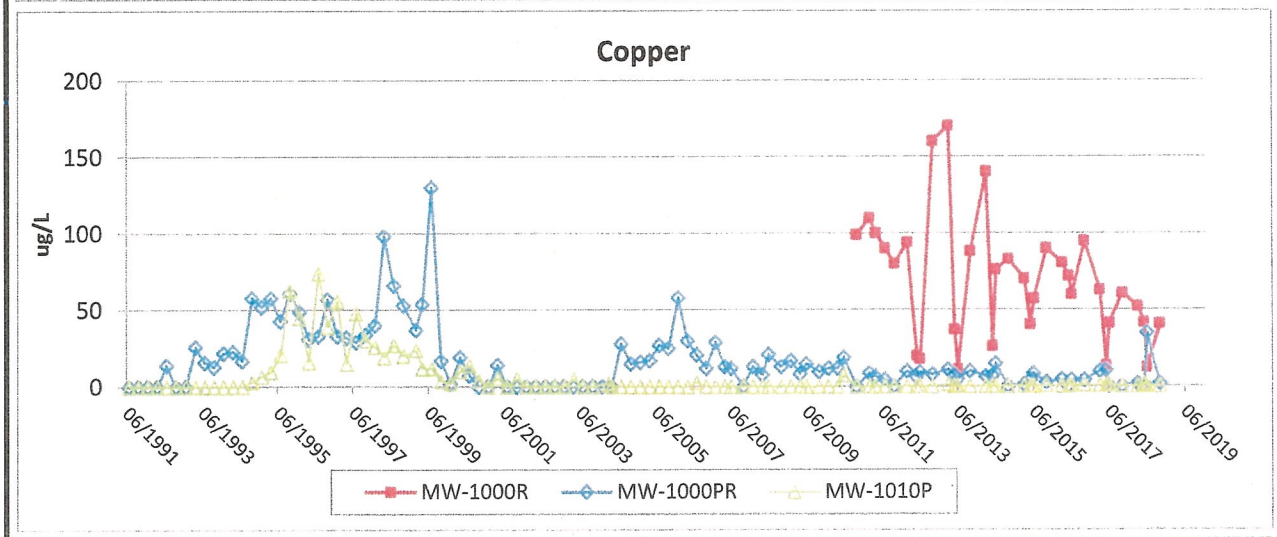
Trend Analysis Results - Groundwater (Quarterly Parameters)
Year Ending 2018

	Alkalinity	Arsenic	Copper	Hardness	Iron	Manganese	Sulfate	TDS	Field pH (su)	Cond (umhos /cm)	Redox (mV)	Grd Water El (Feet)
MW-1014C												
Trend Results for Most Recent 5 Years												
Sample Size	20	20	20	20	20	20	20	20	20	20	19	20
Mann-Kendall S	28	100	-26	81	-67	-10	128	32	56	-32	79	38
p-Level	0.386	0.000	0.422	0.009	0.031	0.774	0.000	0.318	0.074	0.318	0.006	0.234
Trend		+		+			+				+	
Trend Results for All Data Since Oct. 1997												
Sample Size	80	68	80	80	80	80	80	80	80	80	72	80
Mann-Kendall S	-2033	1333	244	-2033	-2464	-2242	-2089	-1974	742	-2357	308	1585
p-Level	0.000	0.000	0.147	0.000	0.000	0.000	0.000	0.000	0.002	0.000	0.135	0.000
Trend	-	+		-	-	-	-	-	+	-		+

Notes: Overall increasing trend denoted by "+".
Overall decreasing trend denoted by "-"
All trend tests performed at a Type I (two-tailed) error rate of 0.01.







Note: Fourth quarter 2010 was the first time MW-1000R had sufficient water recovery for sampling.

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Figure B-1a

Groundwater Trend Graphs - Quarterly Results

MW-1000R/MW-1000PR/MW-1010P

Scale: NA	Date: January 2019	
Prepared By: SGL	Checked By: SVF	Project: 17F777.18

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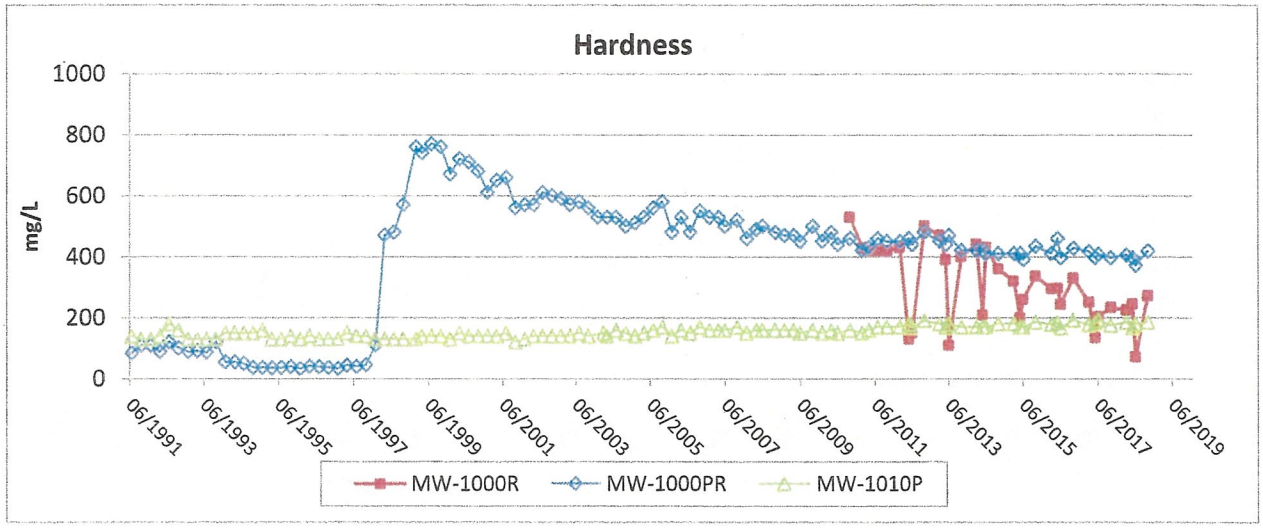
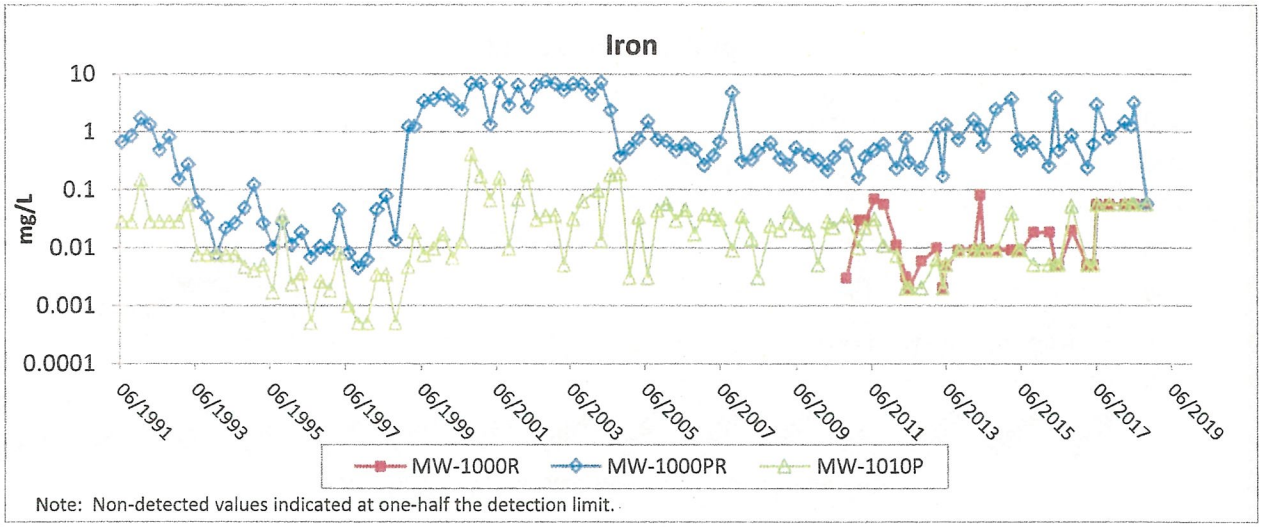
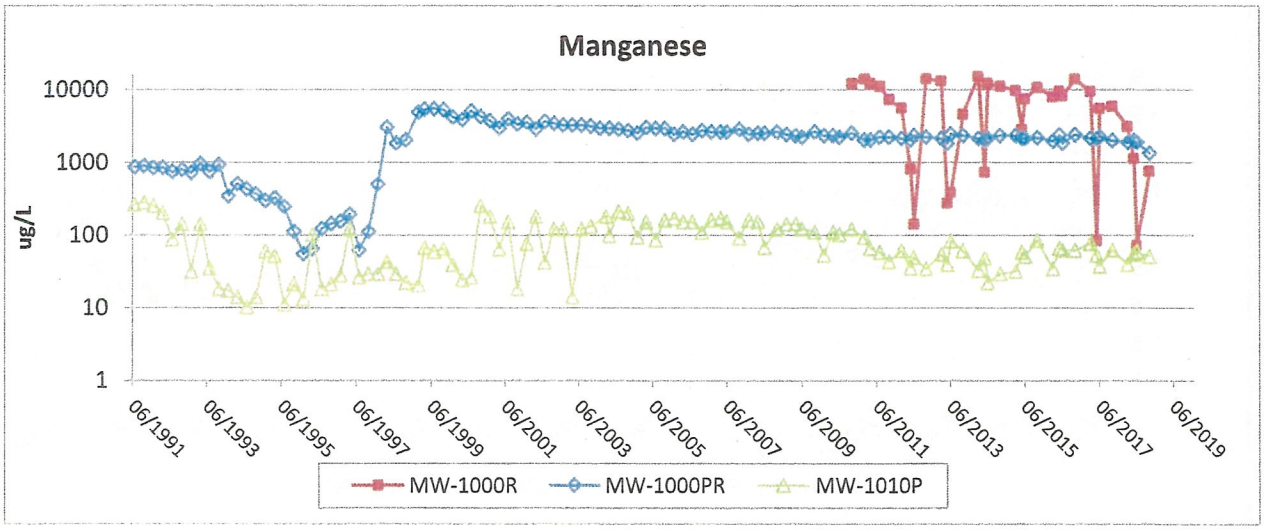




Note: Non-detected values indicated at one-half the detection limit.



Note: Iron trend graphs are displayed on a logarithmic scale so the trend patterns of MW-1000R, MW-1000PR and MW-1010P are visible at different concentration scales.

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Figure B-1b

Groundwater Trend Graphs - Quarterly Results

MW-1000R/MW-1000PR/MW-1010P

Scale: NA	Date: January 2019
Prepared By: SGL	Checked By: SVF	Project: 17F777.18

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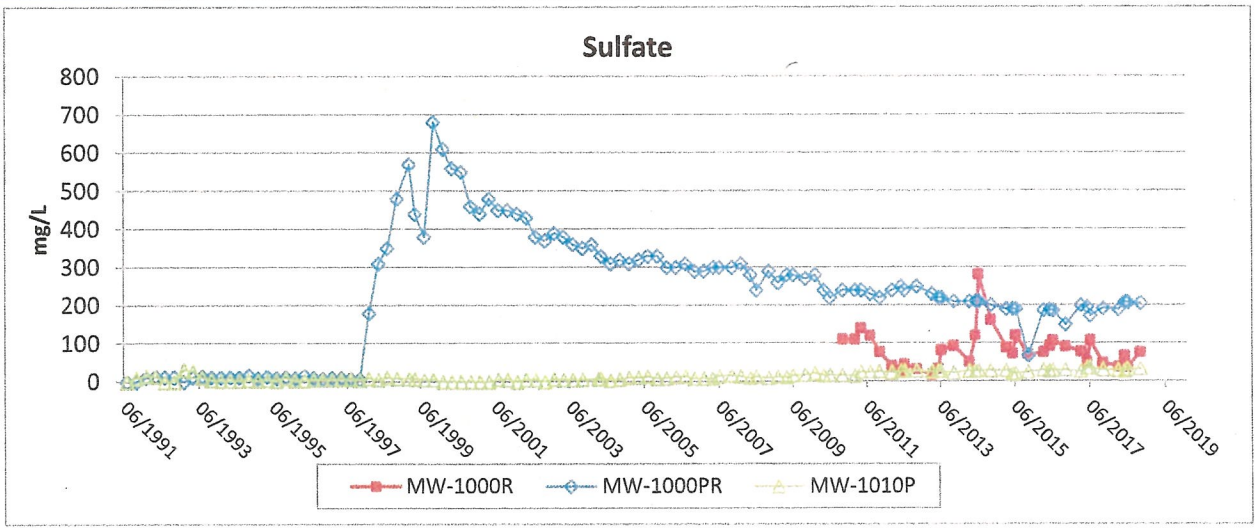

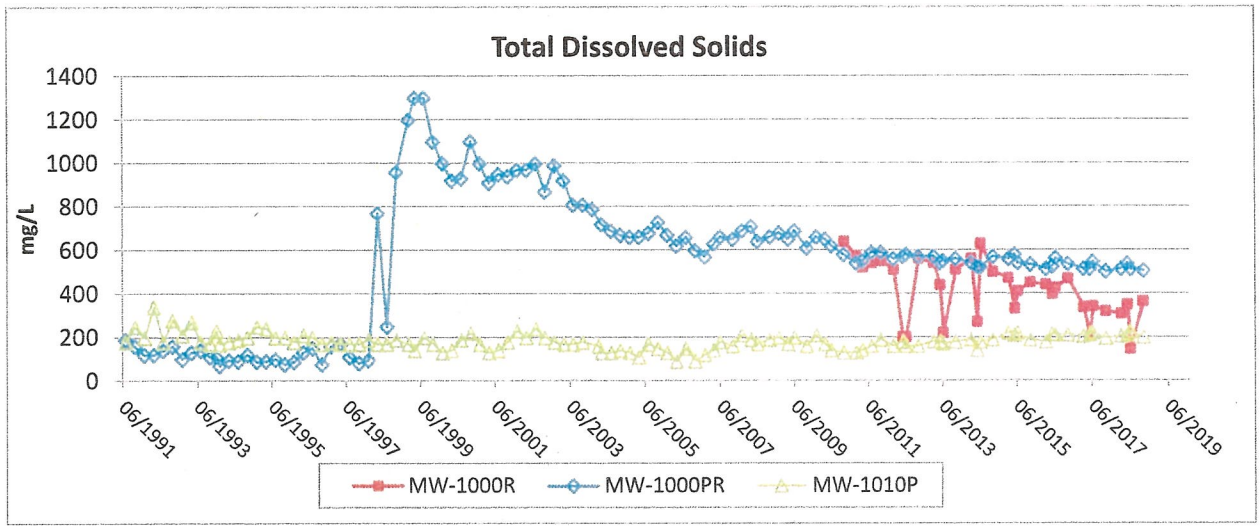

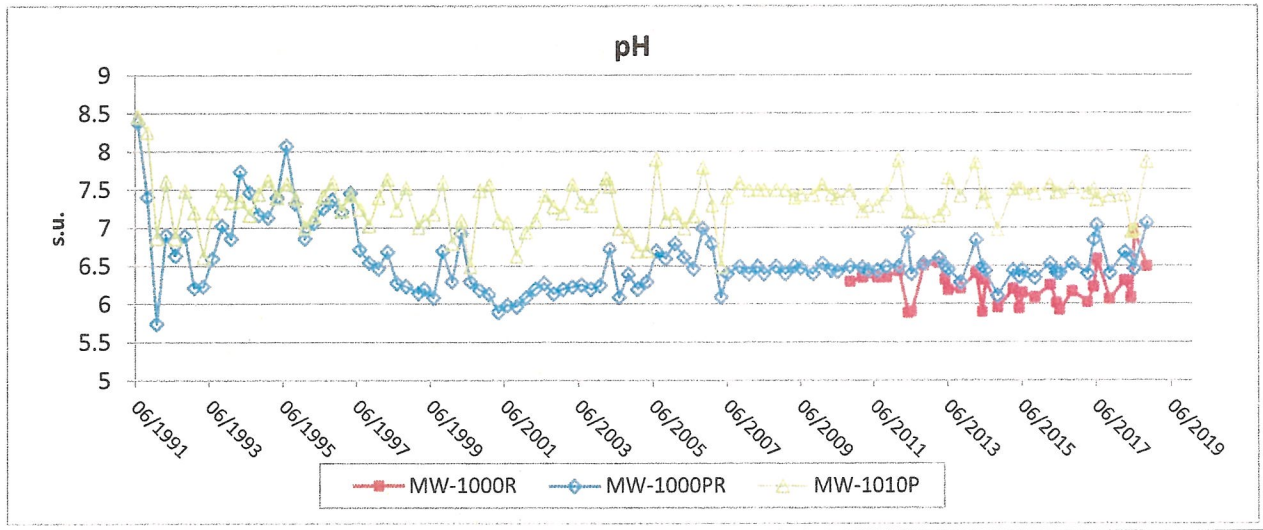

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Figure B-1c

Groundwater Trend Graphs - Quarterly Results

MW-1000R/MW-1000PR/MW-1010P

Scale: NA	Date: January 2019	
Prepared By: SGL	Checked By: SVF	Project: 17F777.18

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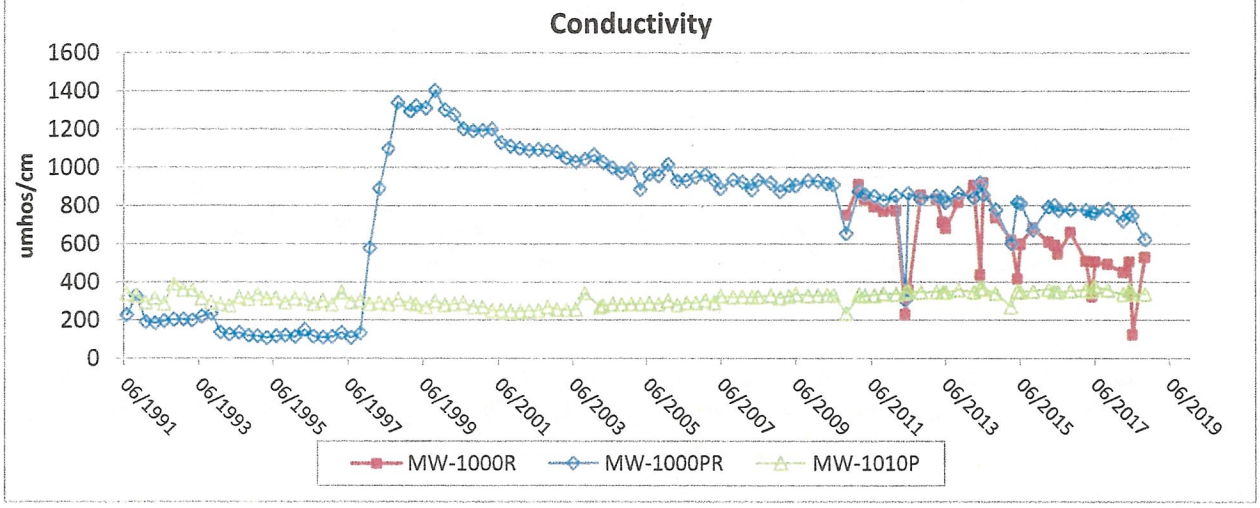

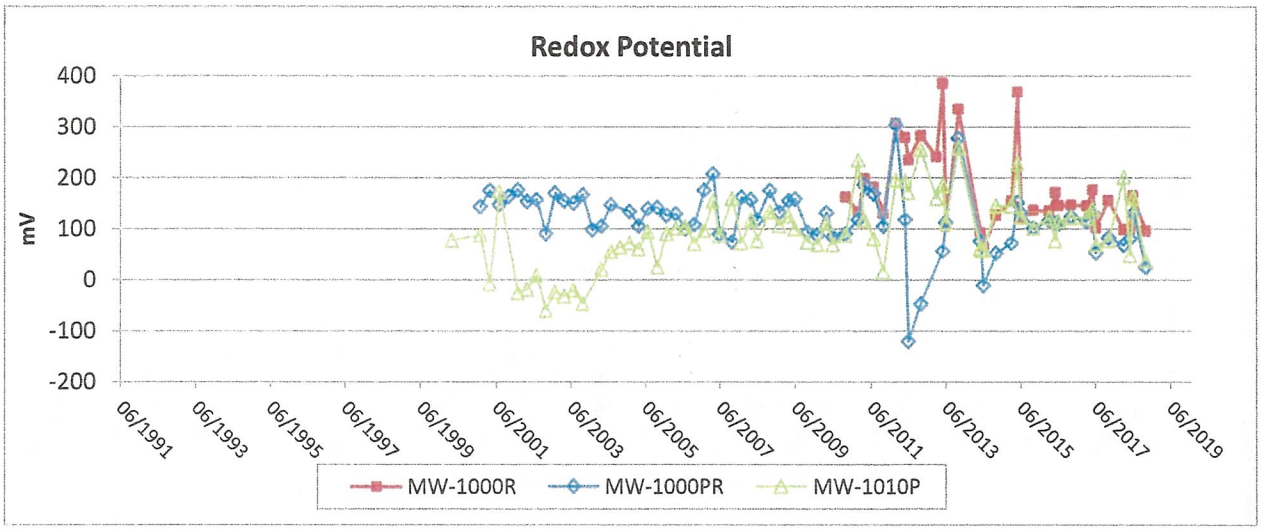

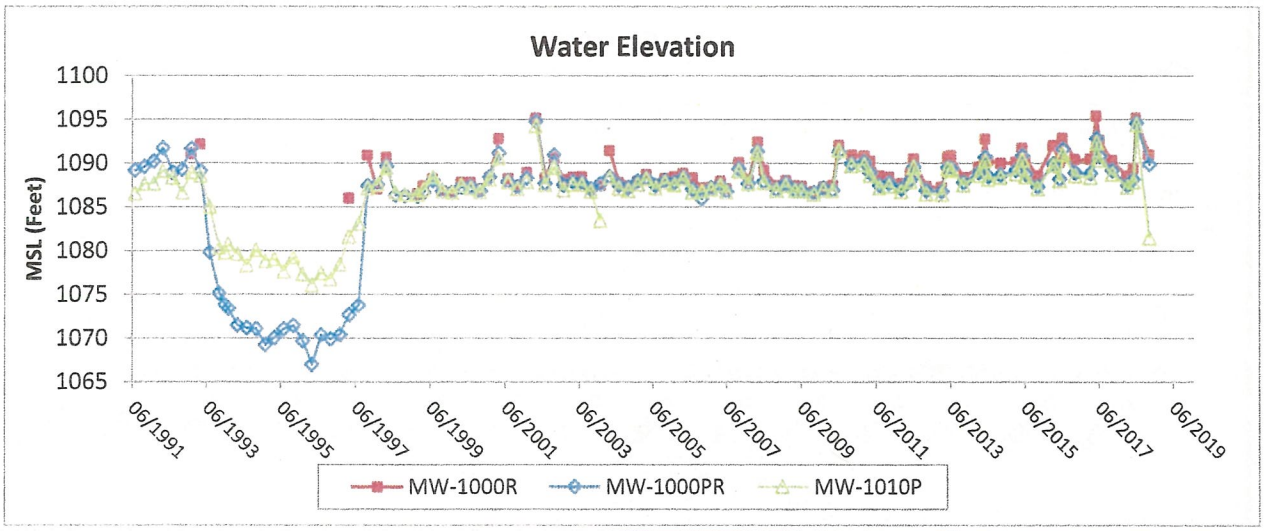

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Figure B-1d

Groundwater Trend Graphs - Quarterly Results

MW-1000R/MW-1000PR/MW-1010P

Scale: NA	Date: January 2019
Prepared By: SGL	Checked By: SVF	Project: 17F777.18

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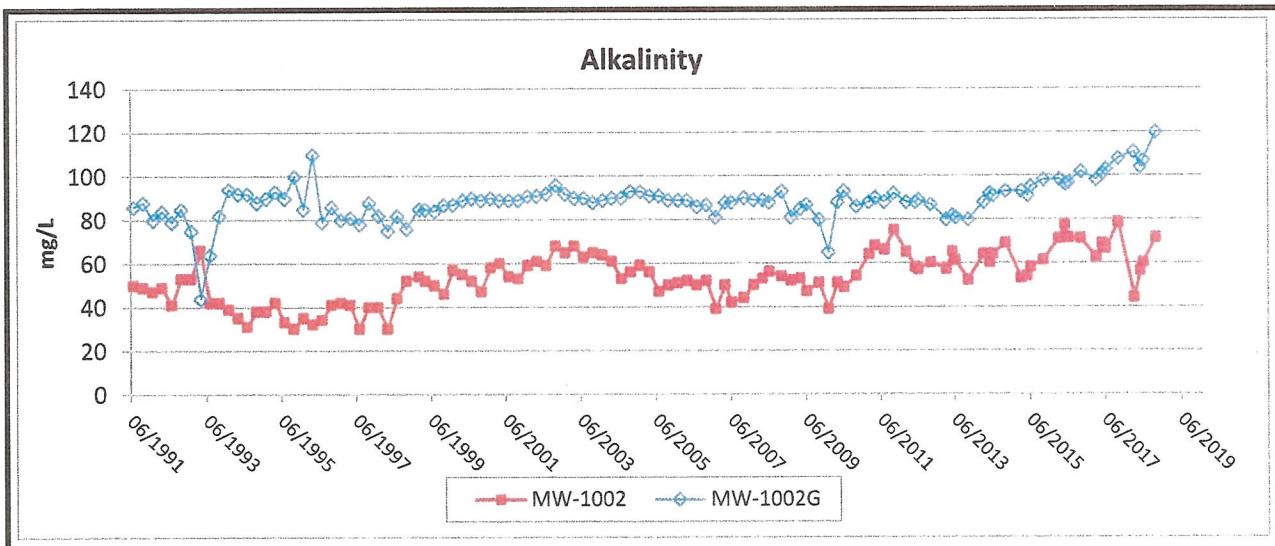

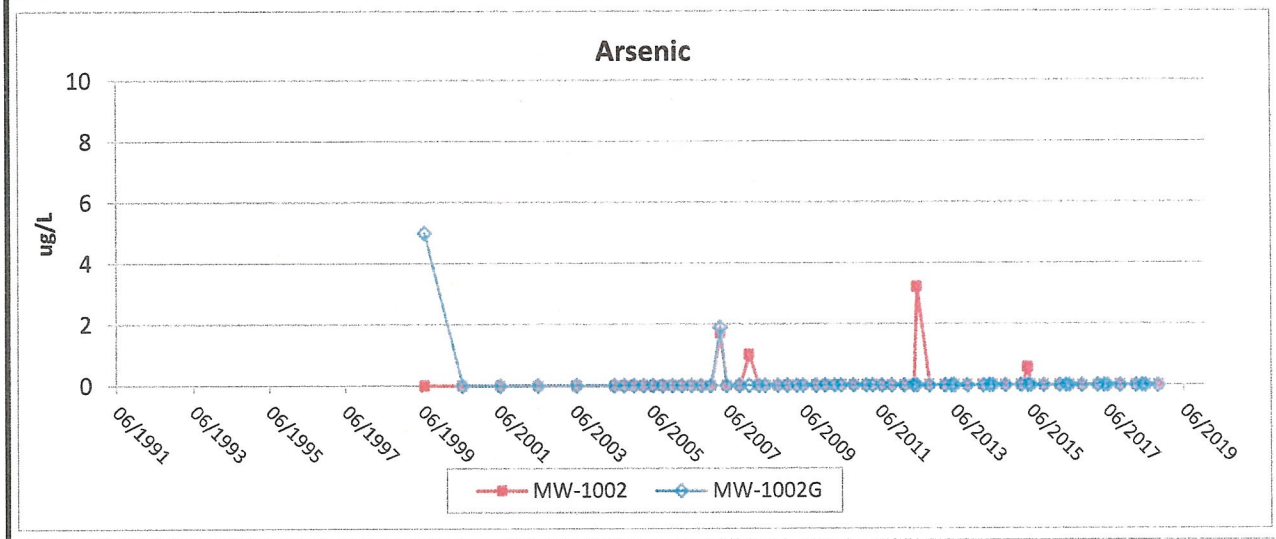

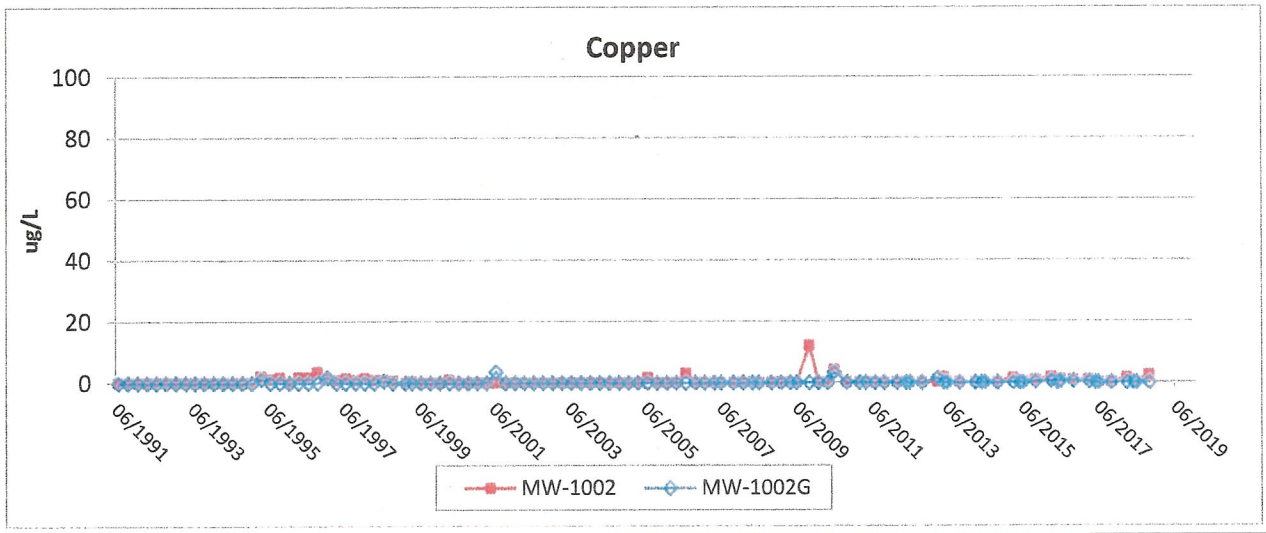

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Figure B-2a

Groundwater Trend Graphs - Quarterly Results

MW-1002/MW-1002G

Scale: NA	Date: January 2019	
Prepared By: SGL	Checked By: SVF	Project: 17F777.18

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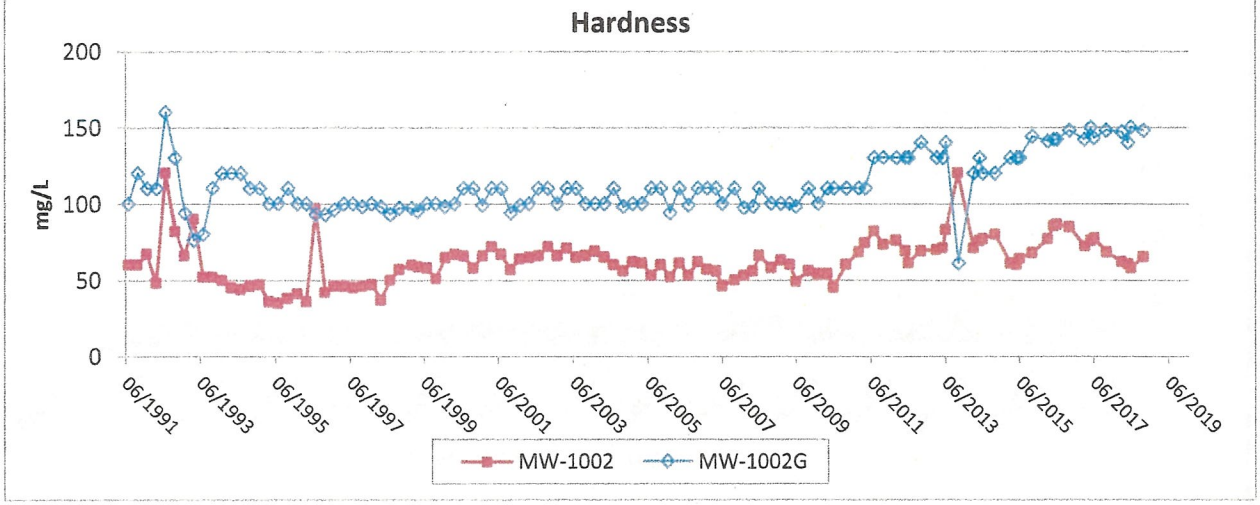

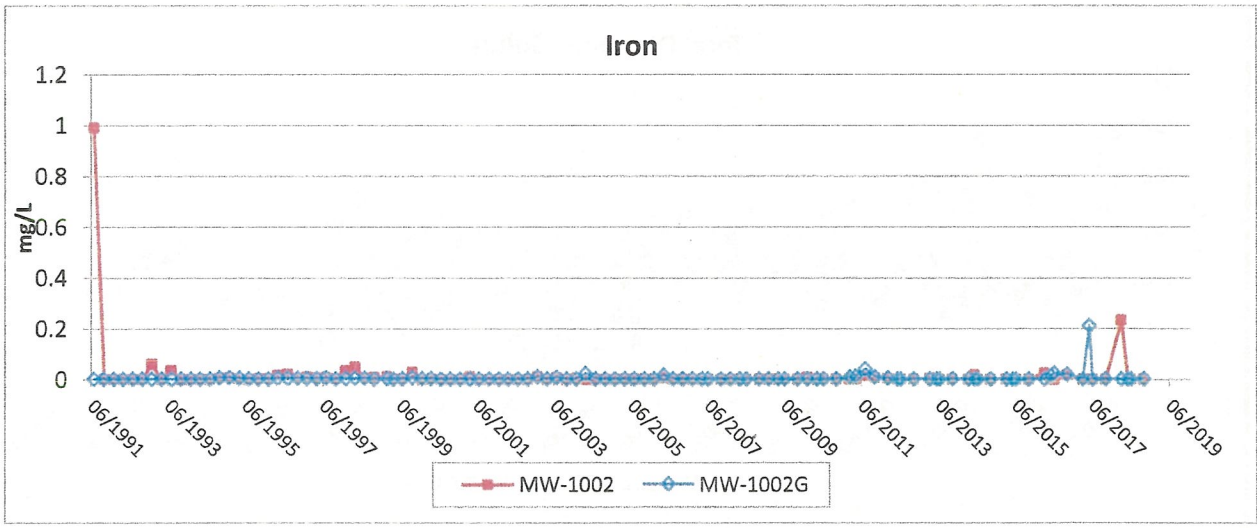

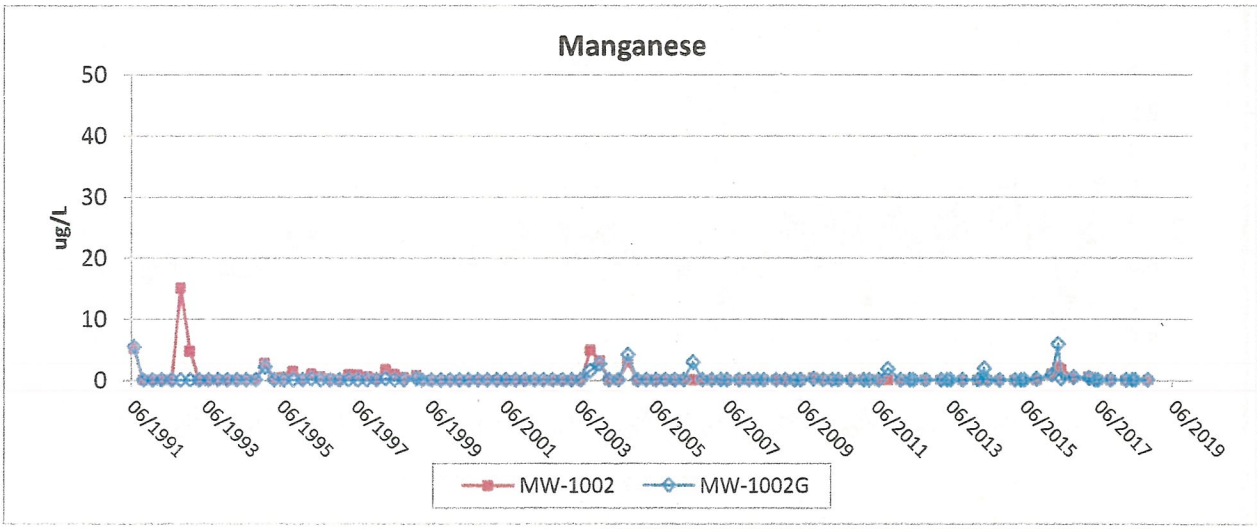

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Figure B-2b Groundwater Trend Graphs - Quarterly Results MW-1002/MW-1002G		
Scale: NA	Date: January 2019	
Prepared By: SGL	Checked By: SVF	Project: 17F777.18

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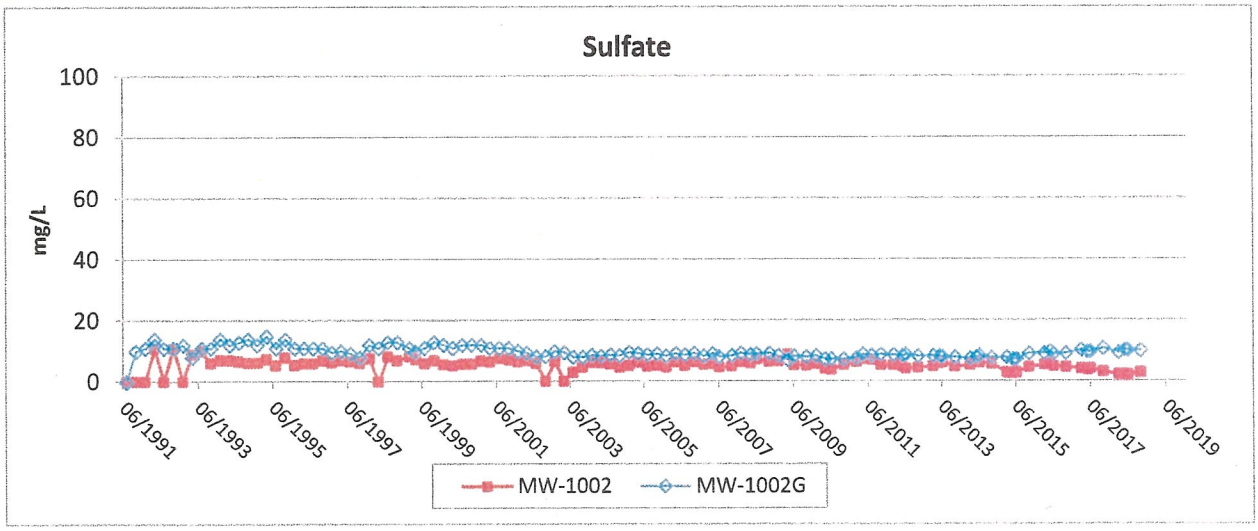

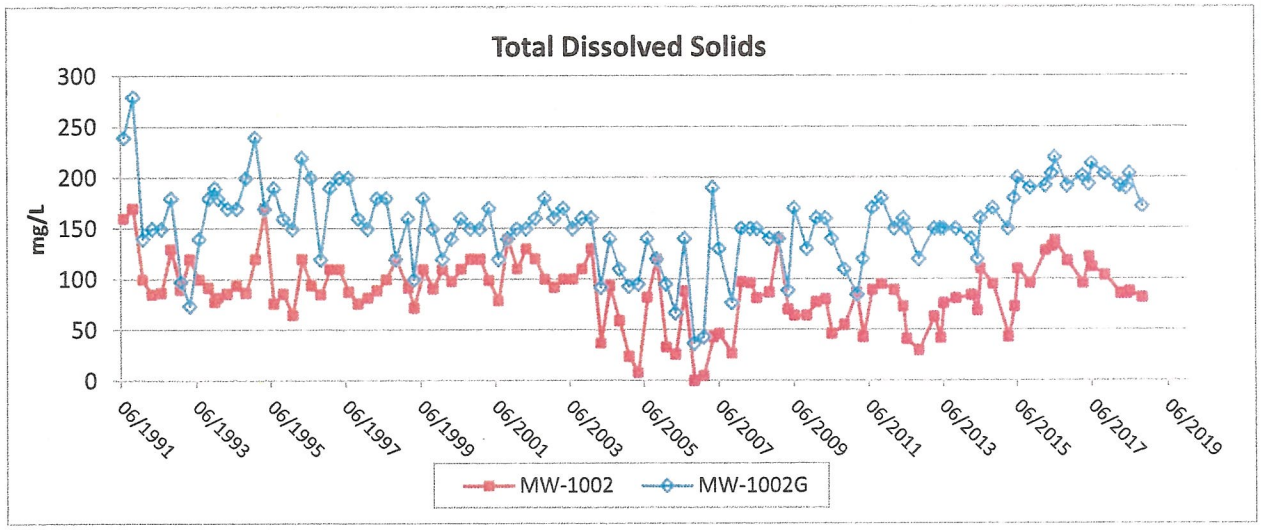

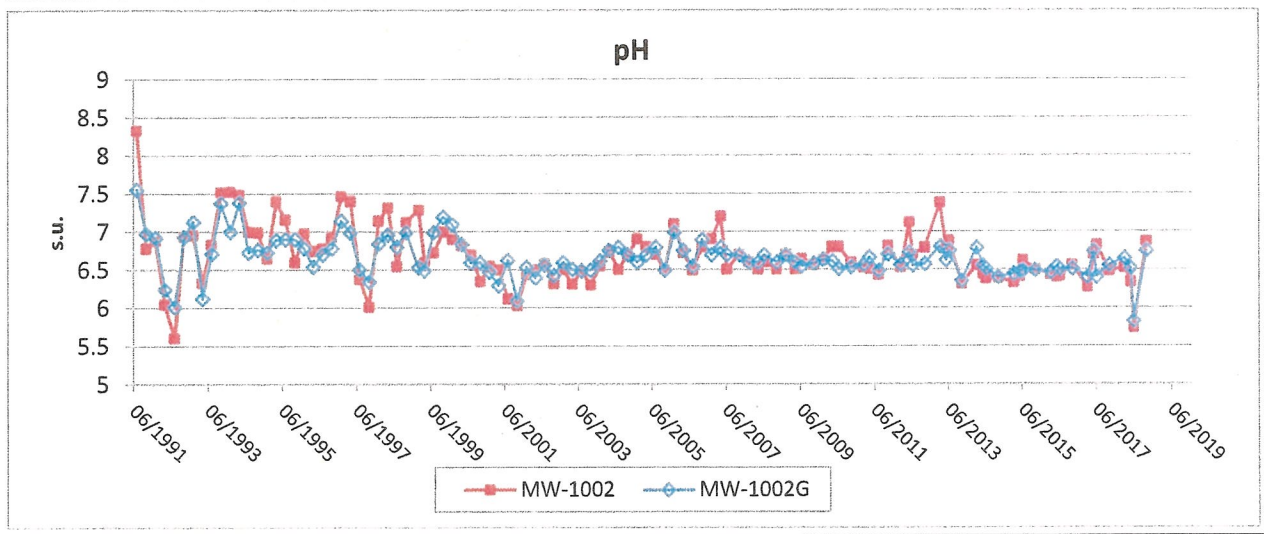

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FLAMBEAU MINING COMPANY

Figure B-2c

Groundwater Trend Graphs - Quarterly Results

MW-1002/MW-1002G

Scale: NA	Date: January 2019	
Prepared By: SGL	Checked By: SVF	Project: 17F777.18

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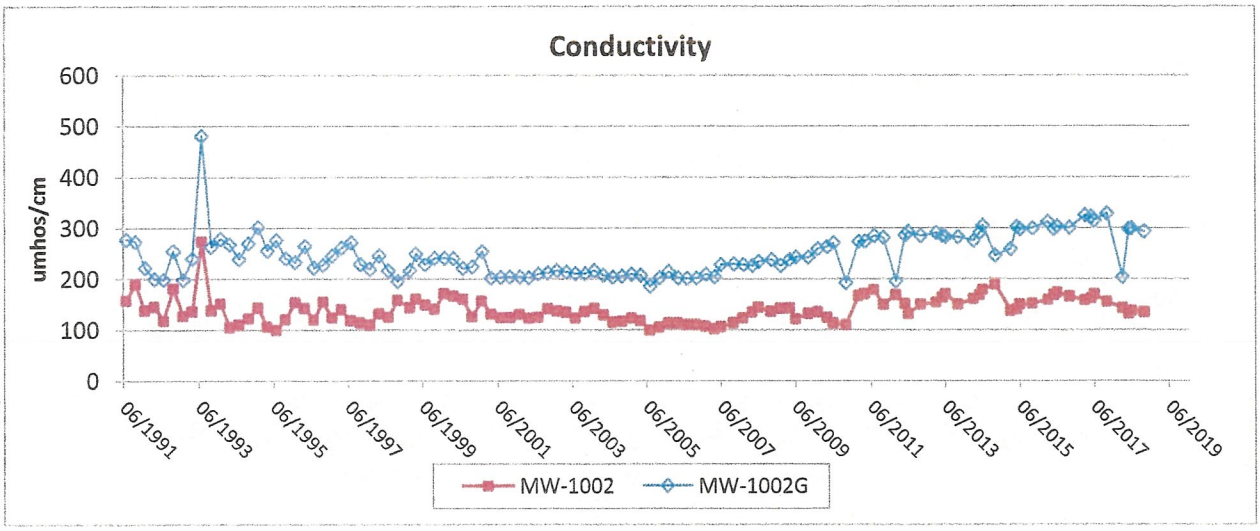

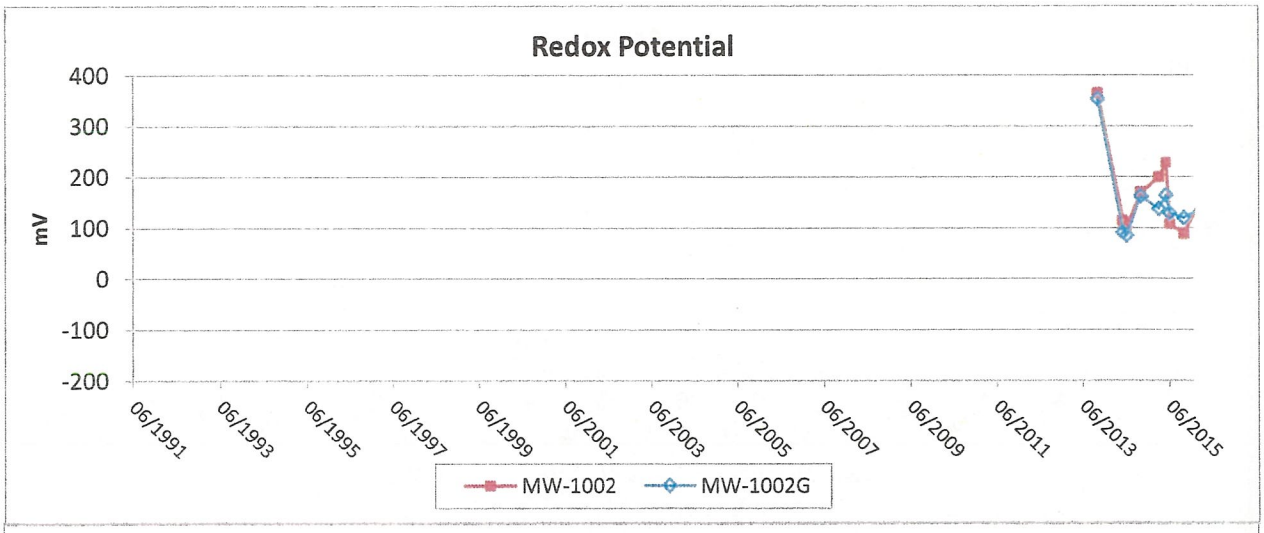

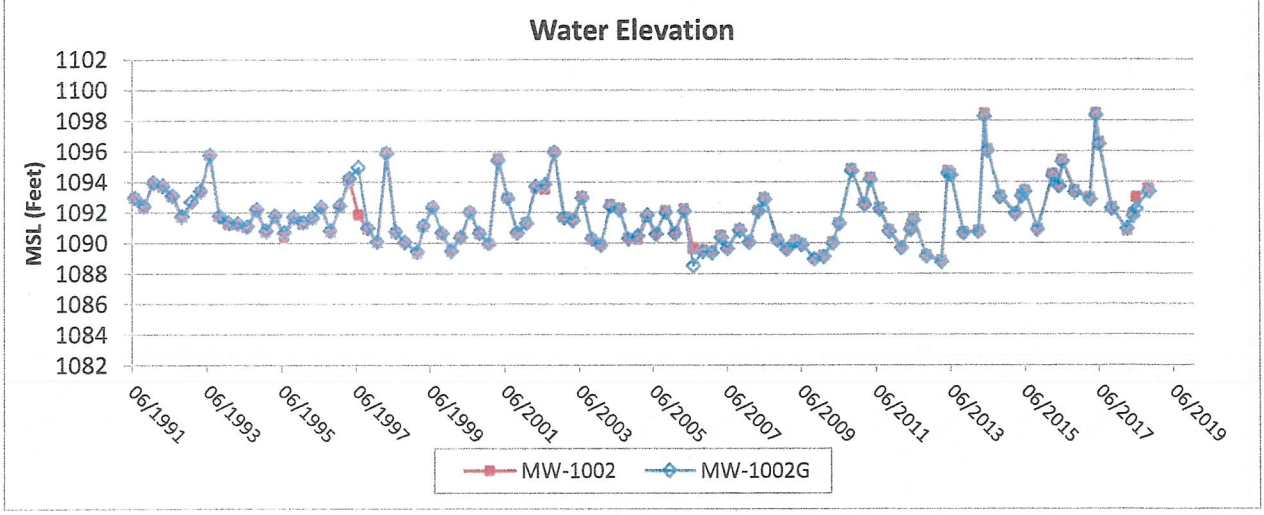

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FLAMBEAU MINING COMPANY

Figure B-2d

Groundwater Trend Graphs - Quarterly Results

MW-1002/MW-1002G

Scale: NA	Date: January 2019	
Prepared By: SGL	Checked By: SVF	Project: 17F777.18

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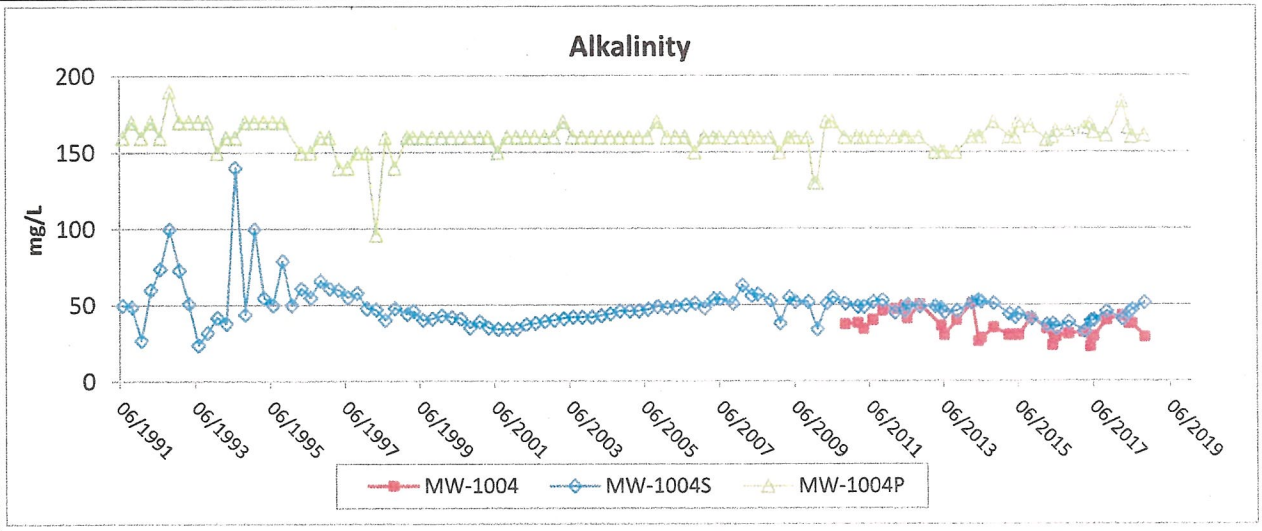

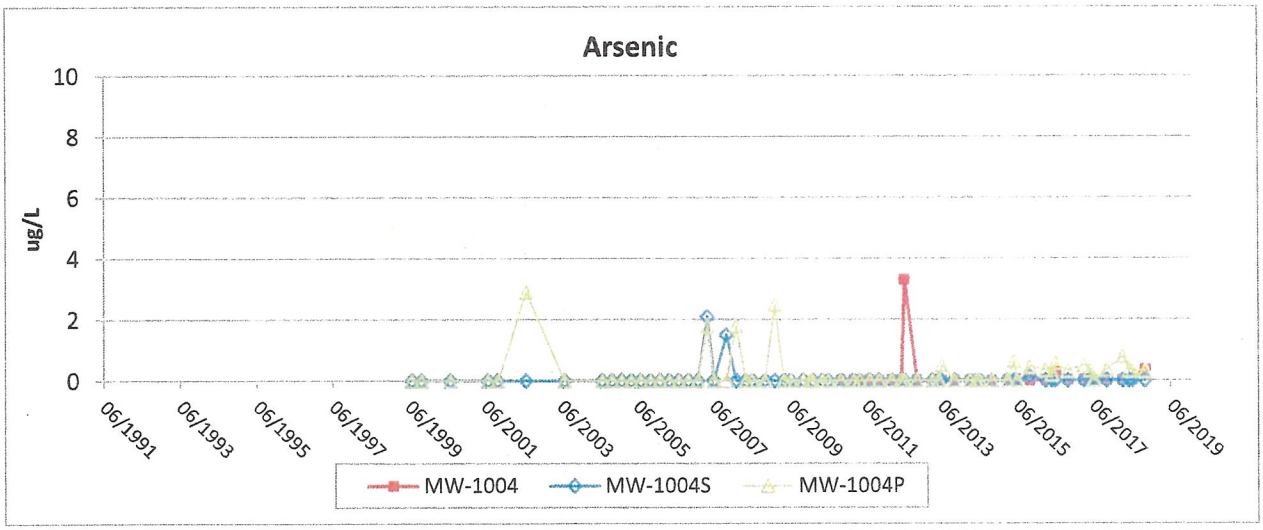

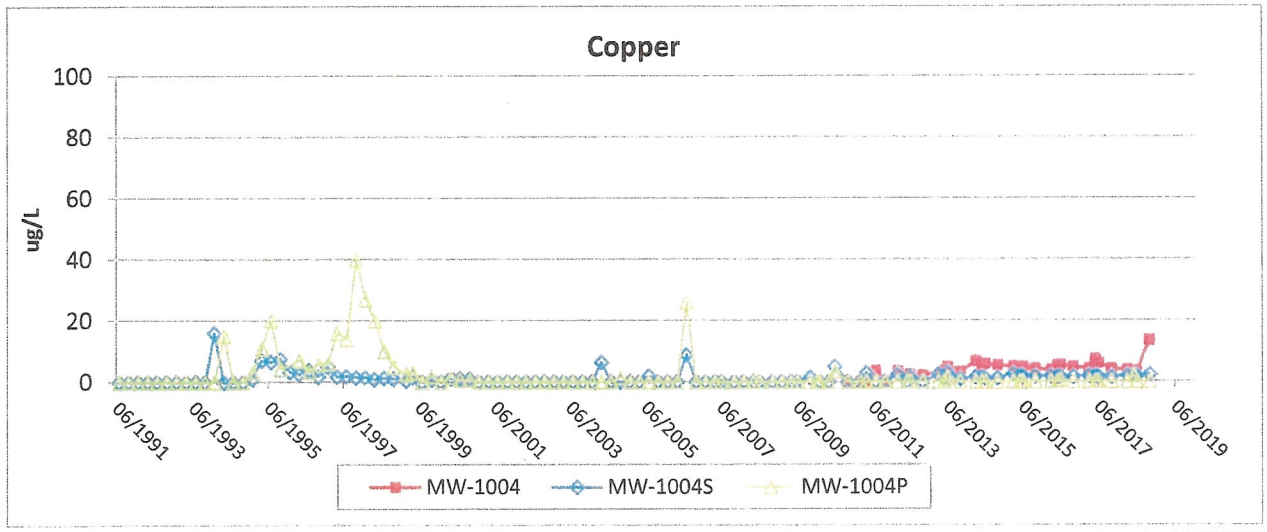

Note: Fourth quarter 2010 was the first time MW-1004 had sufficient water recovery for sampling.

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Figure B-3a

Groundwater Trend Graphs - Quarterly Results

MW-1004/MW-1004S/MW-1004P

Scale: NA	Date: January 2019	
Prepared By: SGL	Checked By: SVF	Project: 17F777.18

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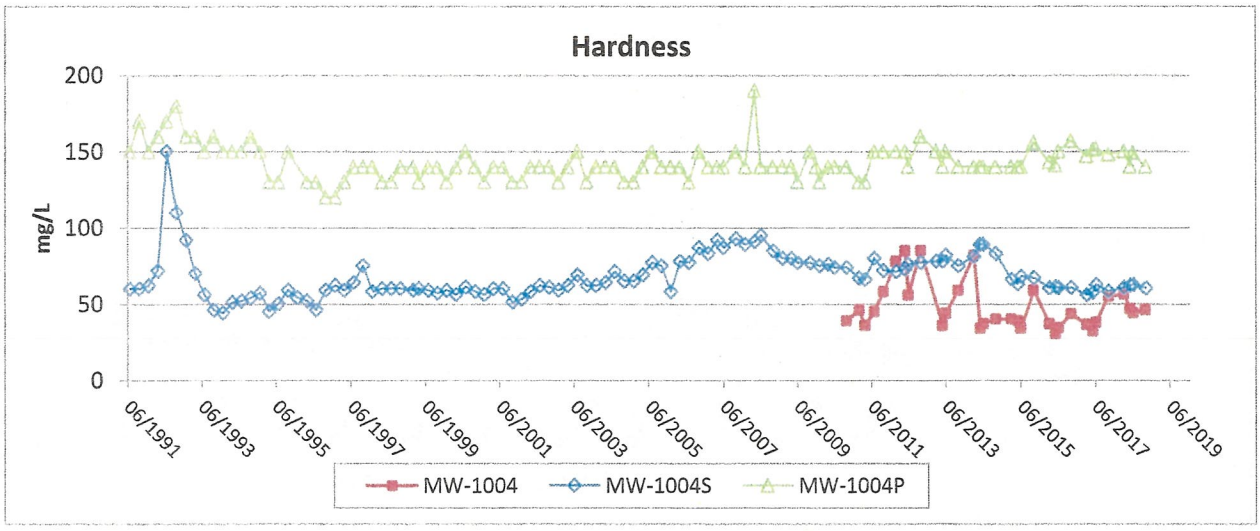

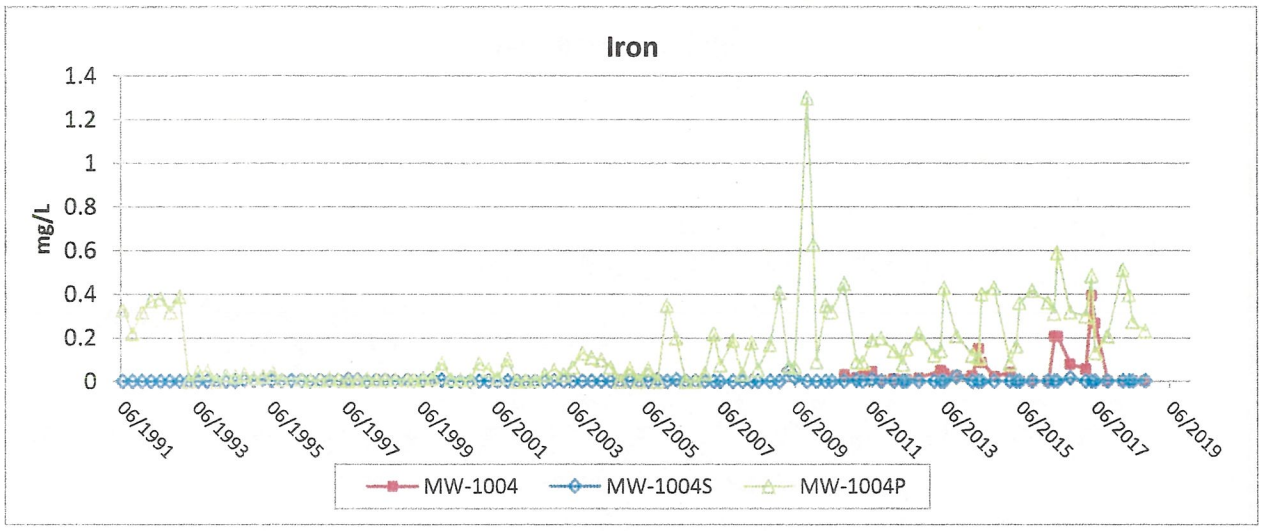

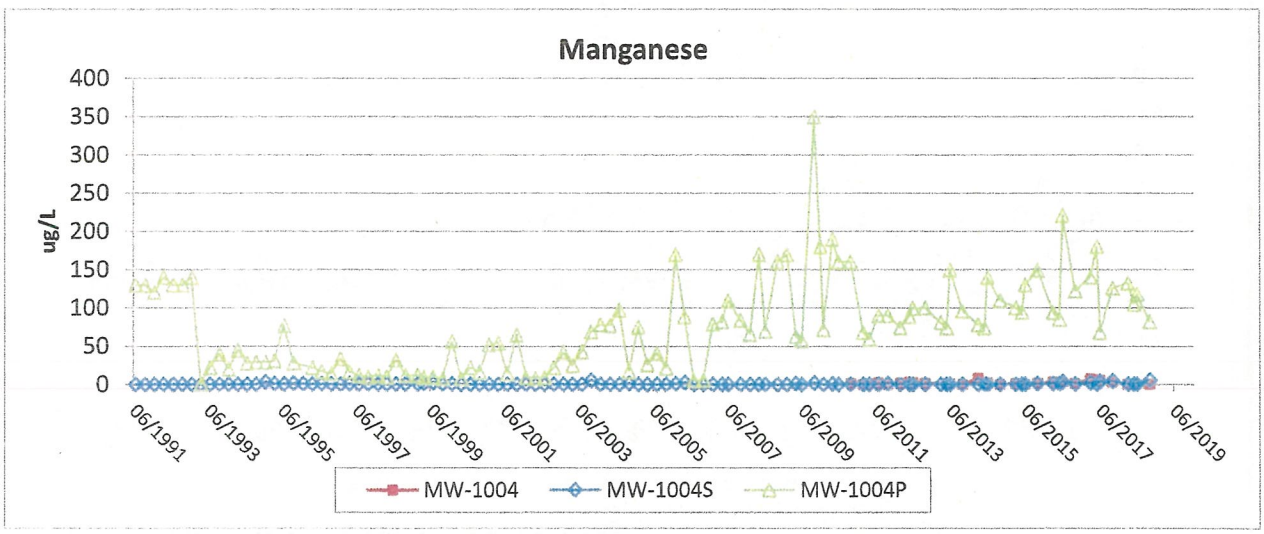

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Figure B-3b

Groundwater Trend Graphs - Quarterly Results

MW-1004/MW-1004S/MW-1004P

Scale: NA	Date: January 2019
Prepared By: SGL	Checked By: SVF	Project: 17F777.18

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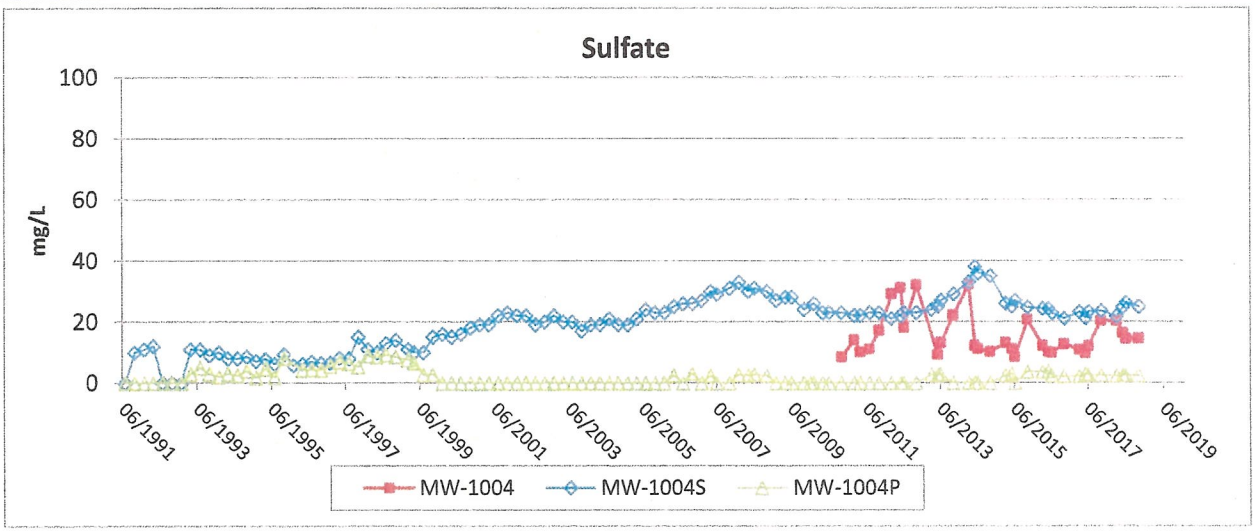

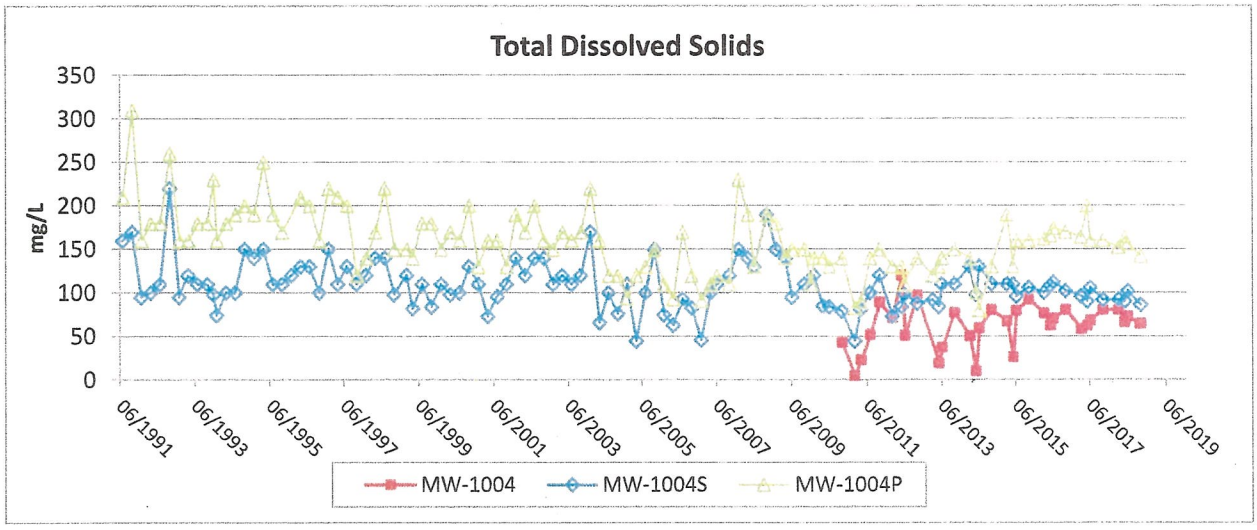

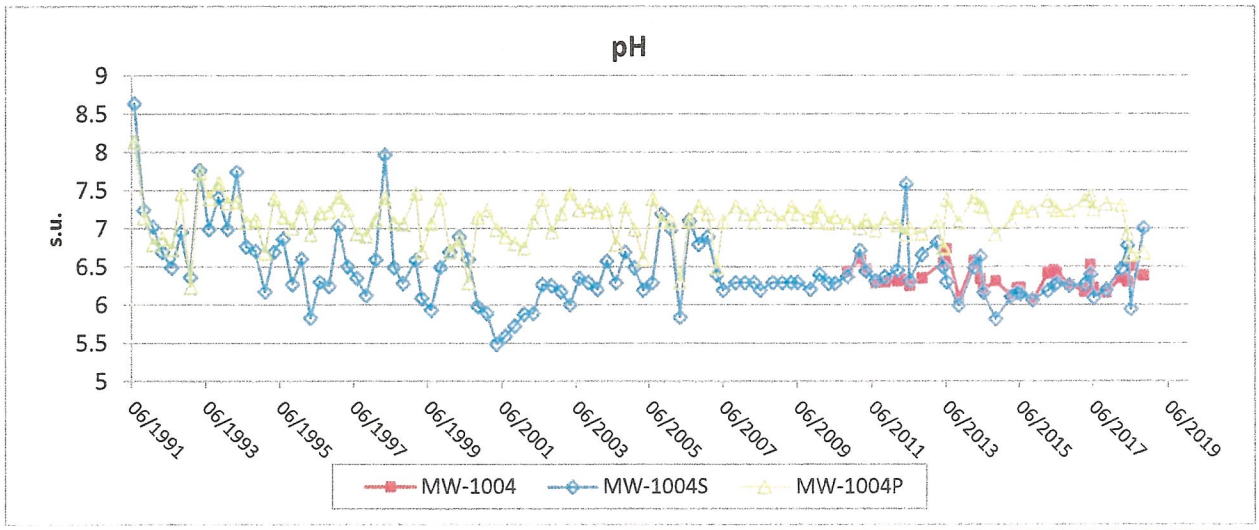

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Figure B-3c Groundwater Trend Graphs - Quarterly Results MW-1004/MW-1004S/MW-1004P		
Scale: NA	Date: January 2019	
Prepared By: SGL	Checked By: SVF	Project: 17F777.18

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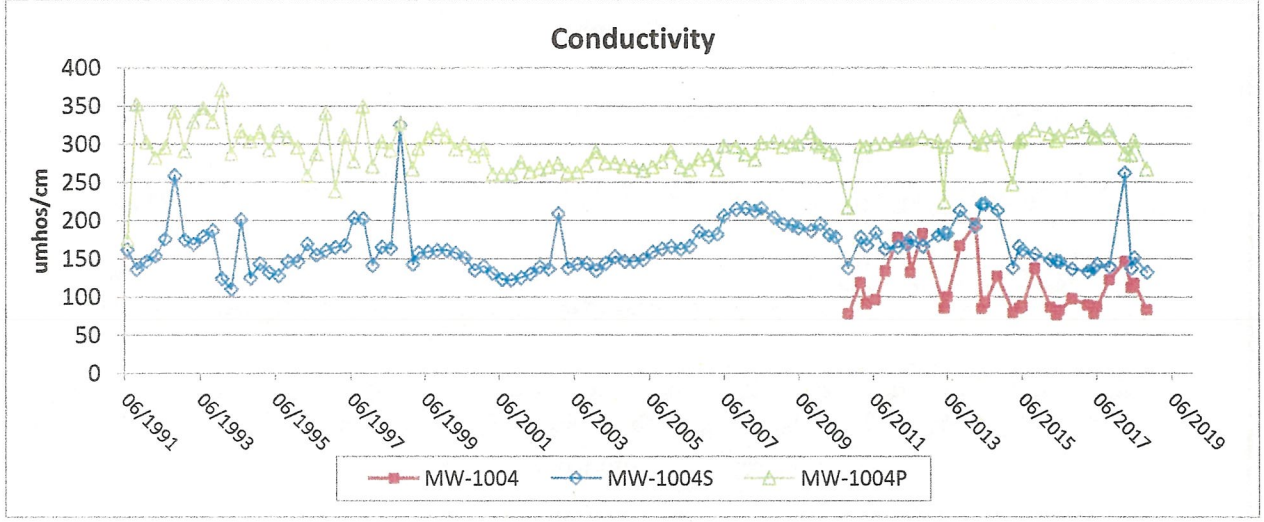

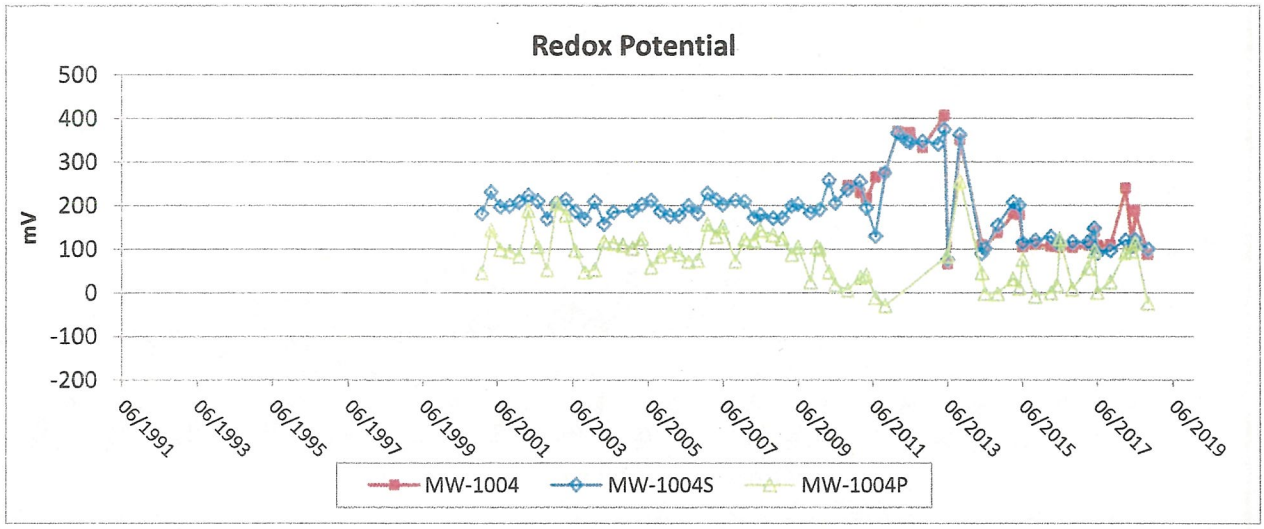

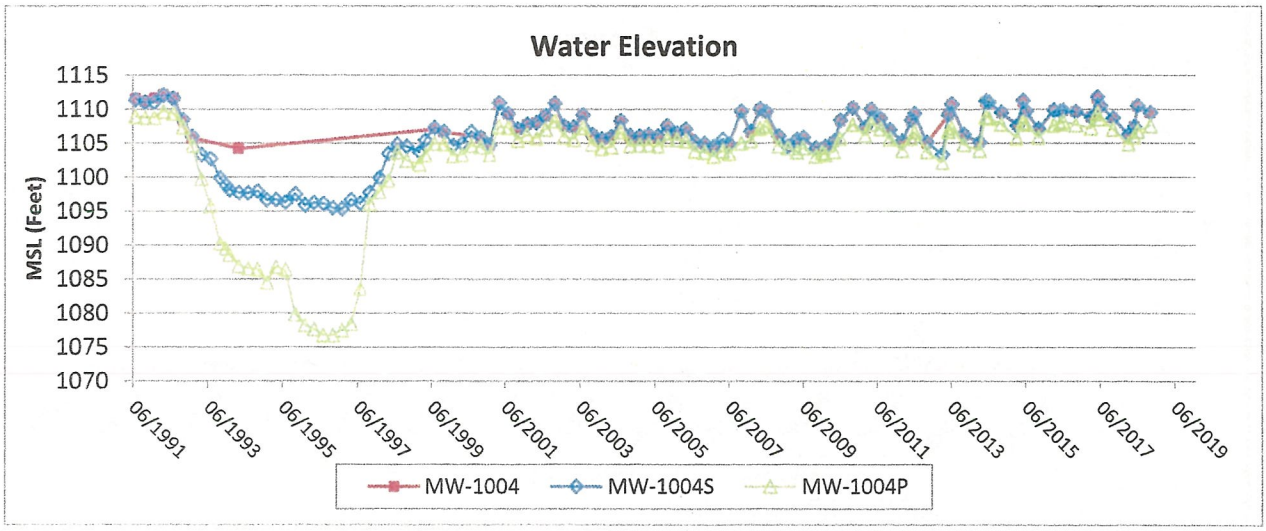

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Figure B-3d Groundwater Trend Graphs - Quarterly Results MW-1004/MW-1004S/MW-1004P		
Scale: NA		Date: January 2019
Prepared By: SGL	Checked By: SVF	Project: 17F777.18

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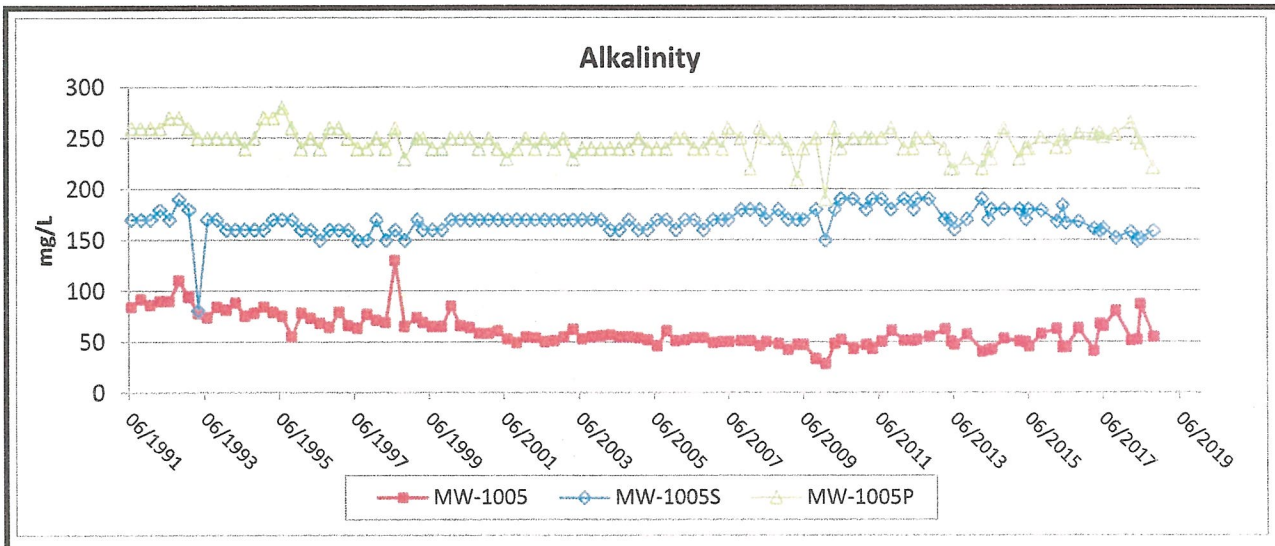

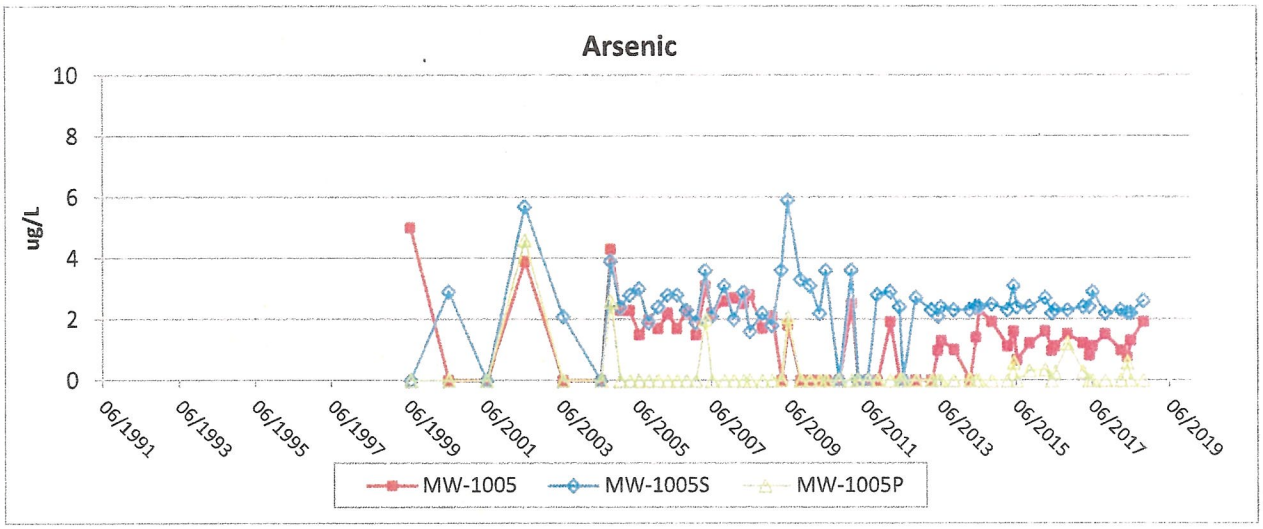

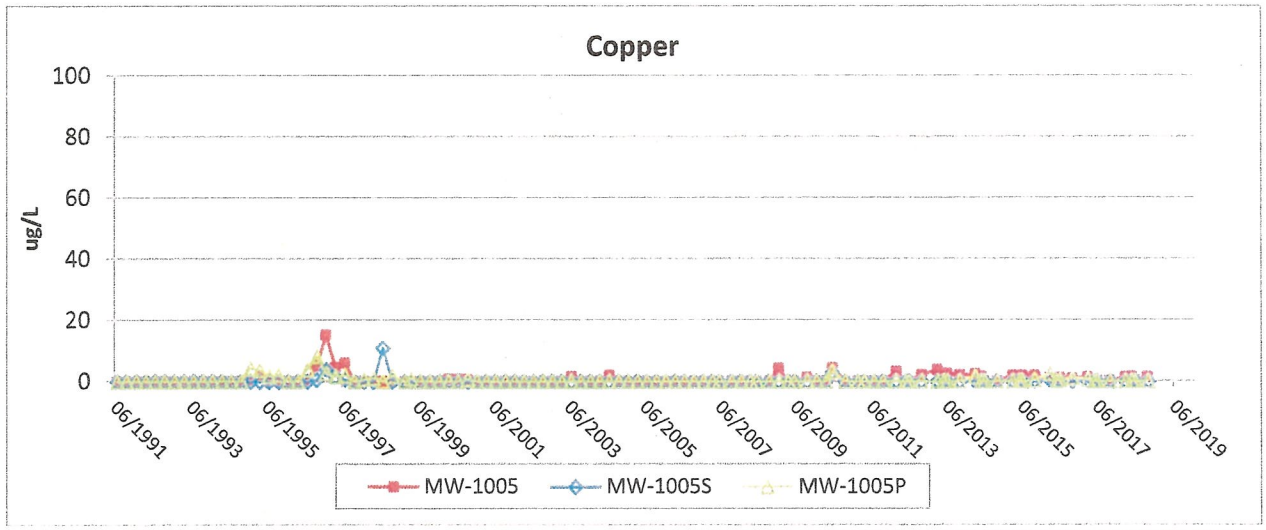

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Figure B-4a

Groundwater Trend Graphs - Quarterly Results

MW-1005/MW-1005S/MW-1005P

Scale: NA	Date: January 2019	
Prepared By: SGL	Checked By: SVF	Project: 17F777.18

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2018 Annual Summary Memorandum

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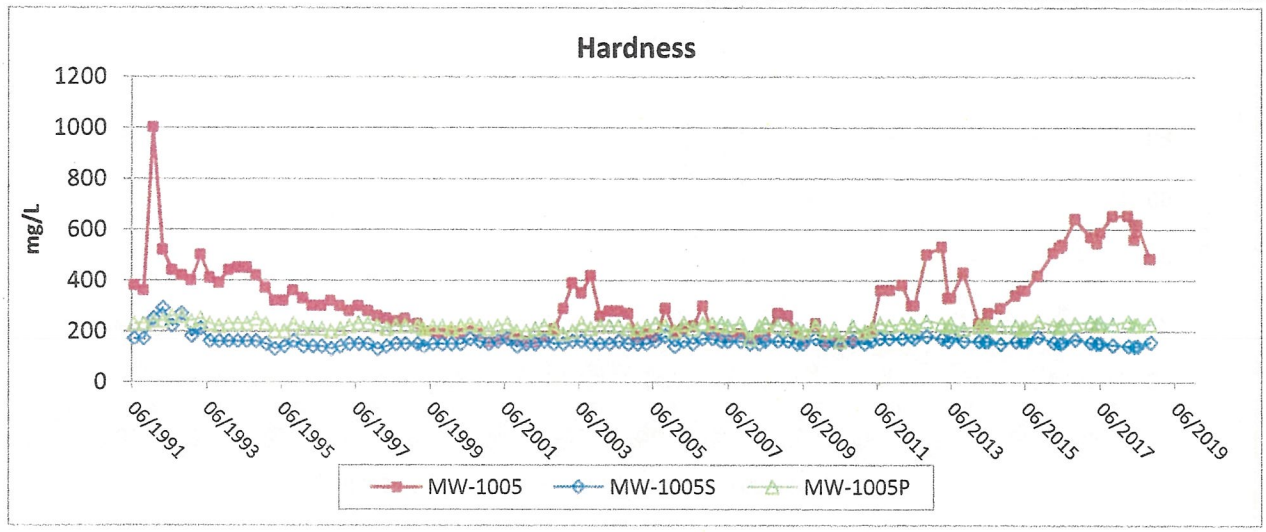

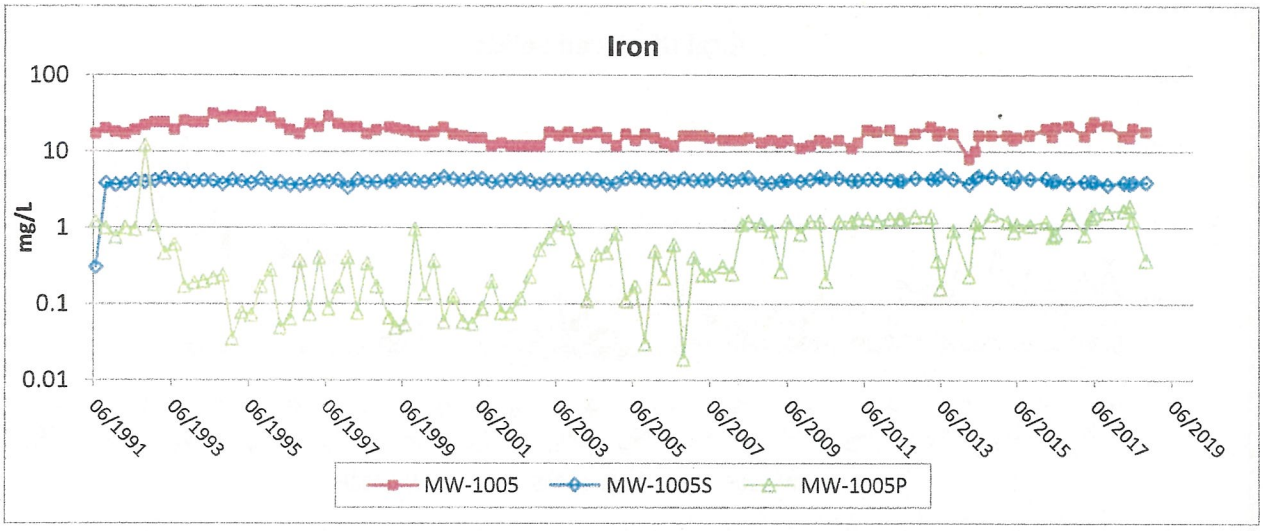

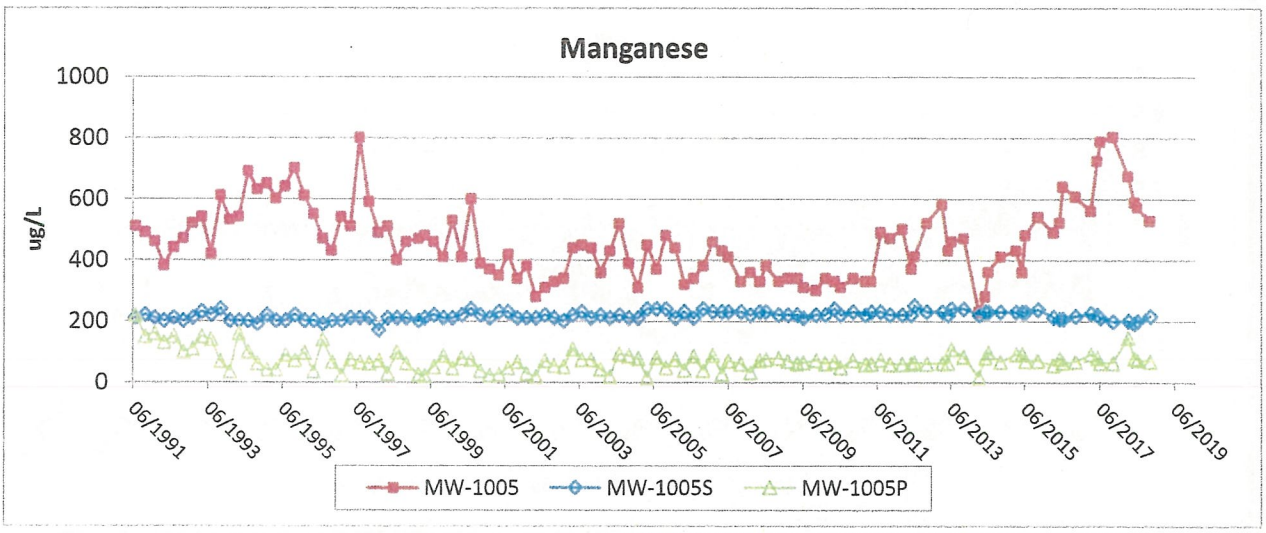

Note: Iron trend graphs are displayed on a logarithmic scale so the trend patterns of MW-1005, MW-1005S and MW-1005P are visible at different concentration scales.

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Figure B-4b
Groundwater Trend Graphs - Quarterly Results
MW-1005/MW-1005S/MW-1005P

Scale: NA	Date: January 2019
Prepared By: SGL	Checked By: SVF	Project: 17F777.18

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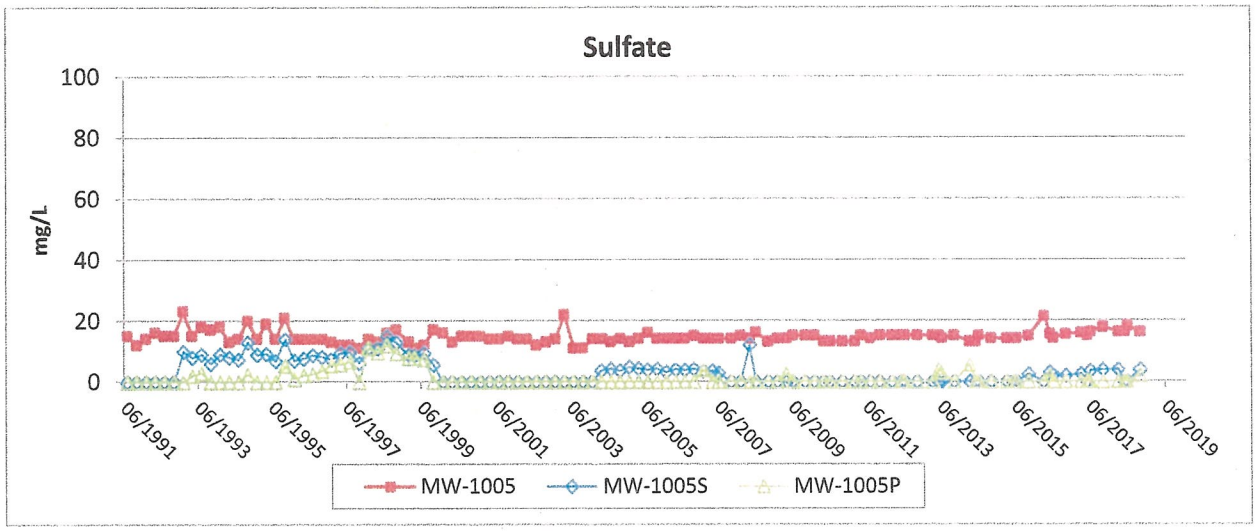

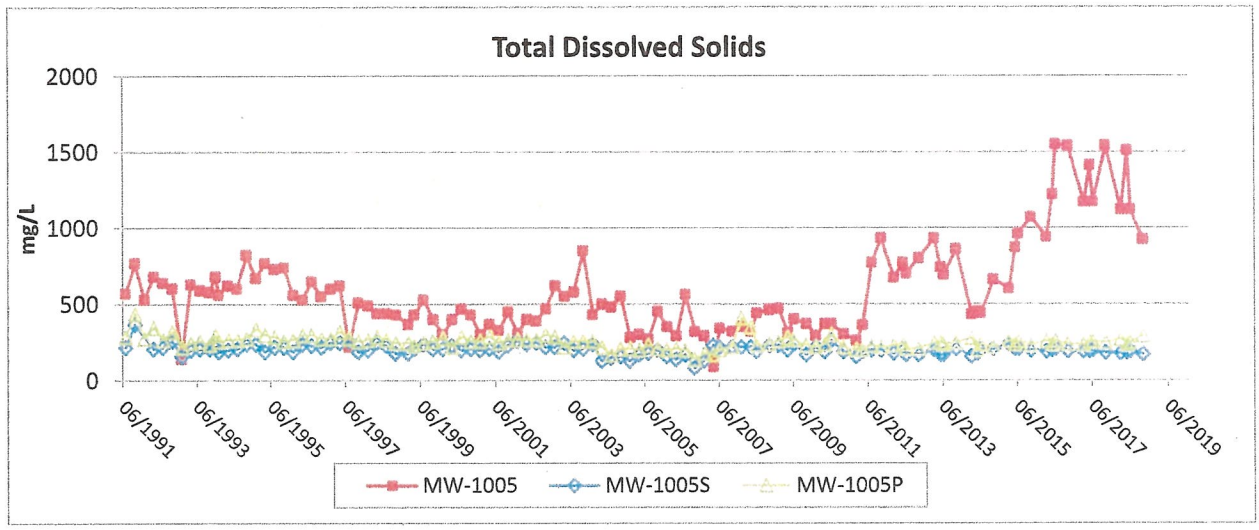

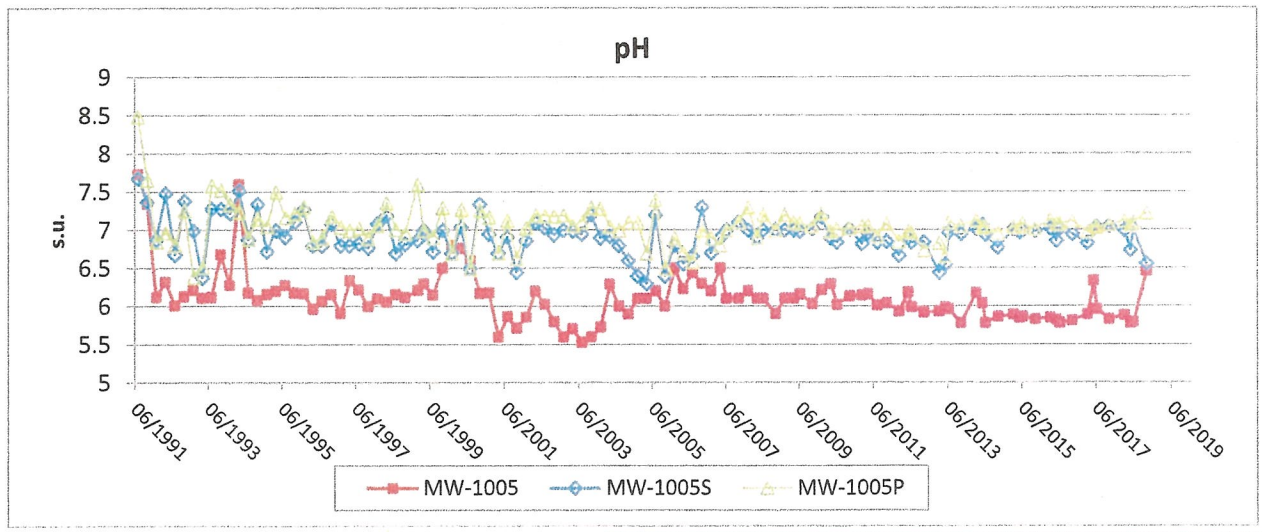

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FLAMBEAU MINING COMPANY

Figure B-4c

Groundwater Trend Graphs - Quarterly Results

MW-1005/MW-1005S/MW-1005P

Scale: NA	Date: January 2019	
Prepared By: SGL	Checked By: SVF	Project: 17F777.18

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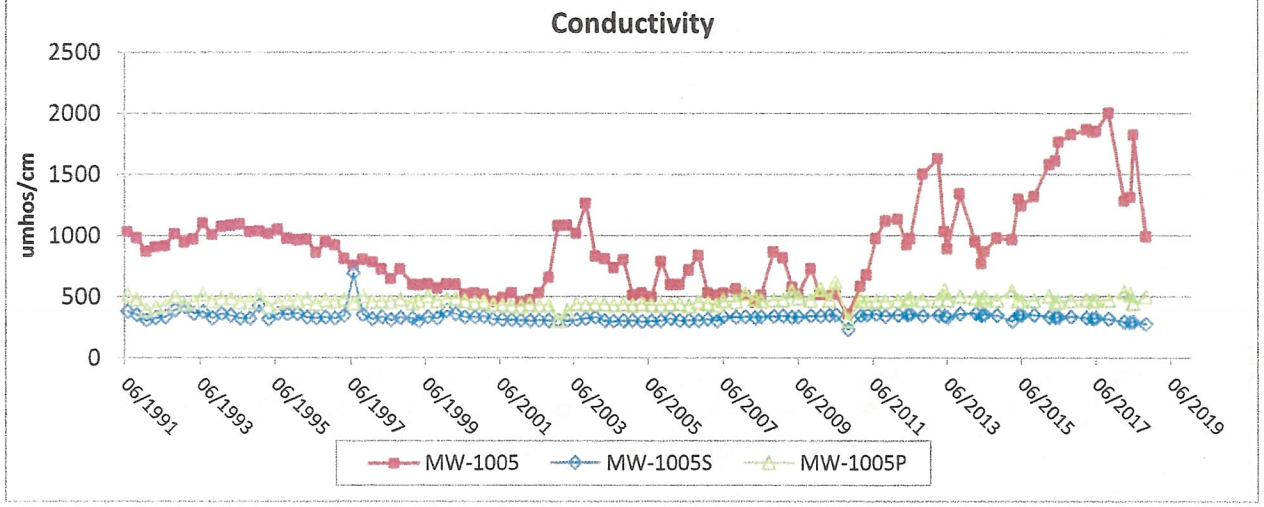

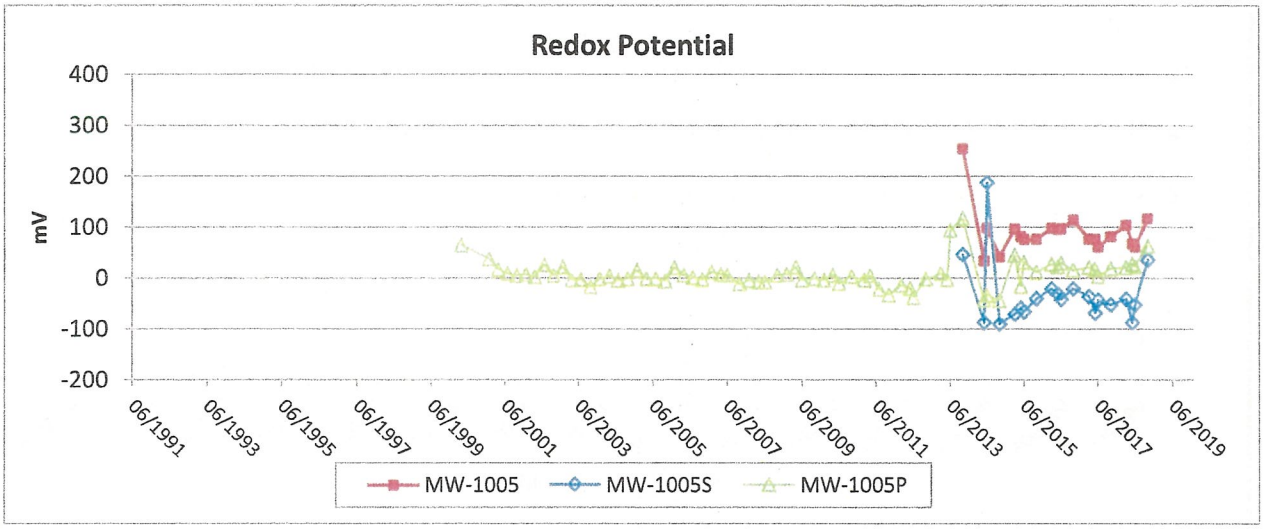

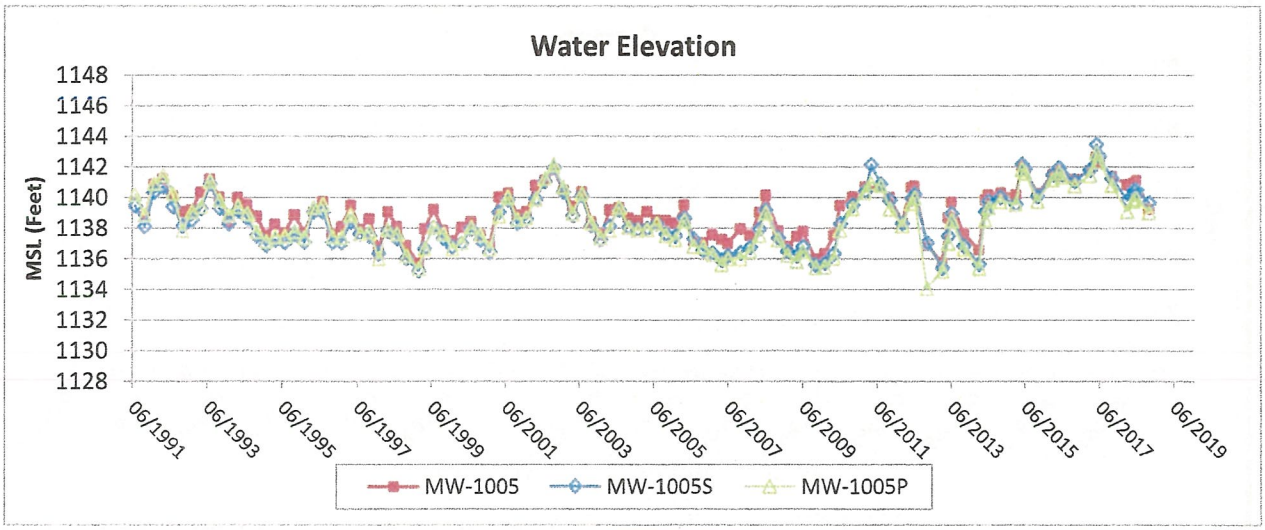

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FLAMBEAU MINING COMPANY

Figure B-4d

Groundwater Trend Graphs - Quarterly Results

MW-1005/MW-1005S/MW-1005P

Scale: NA	Date: January 2019	
Prepared By: SGL	Checked By: SVF	Project: 17F777.18

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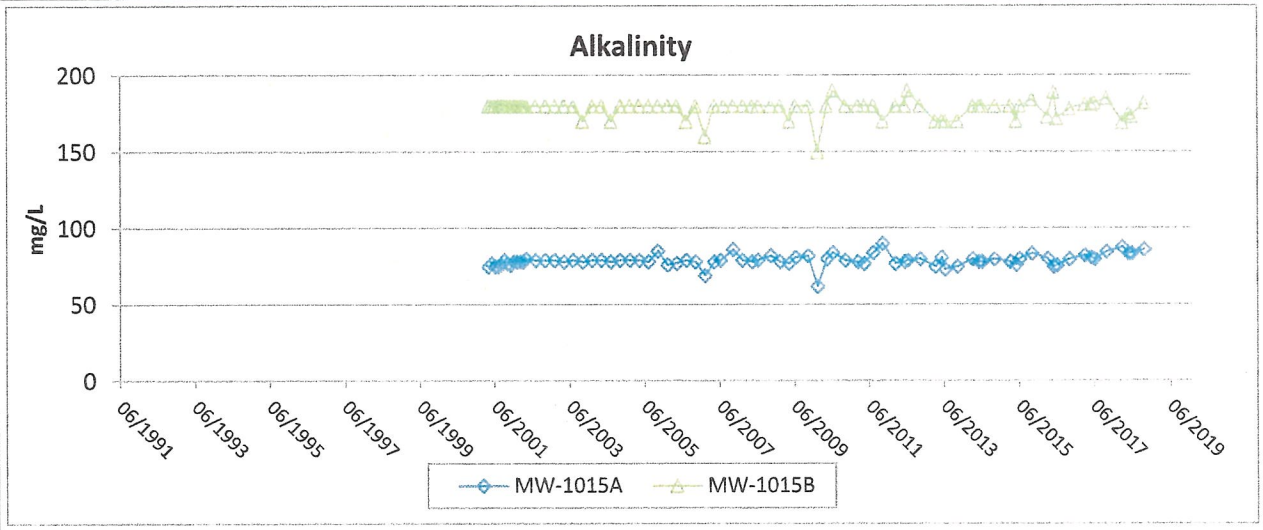

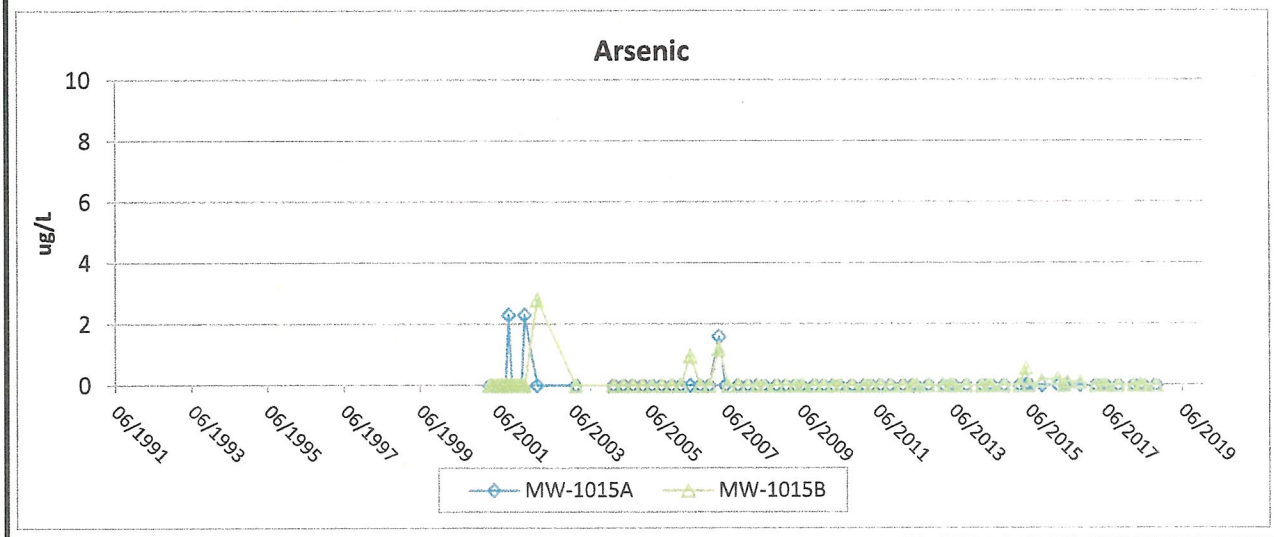

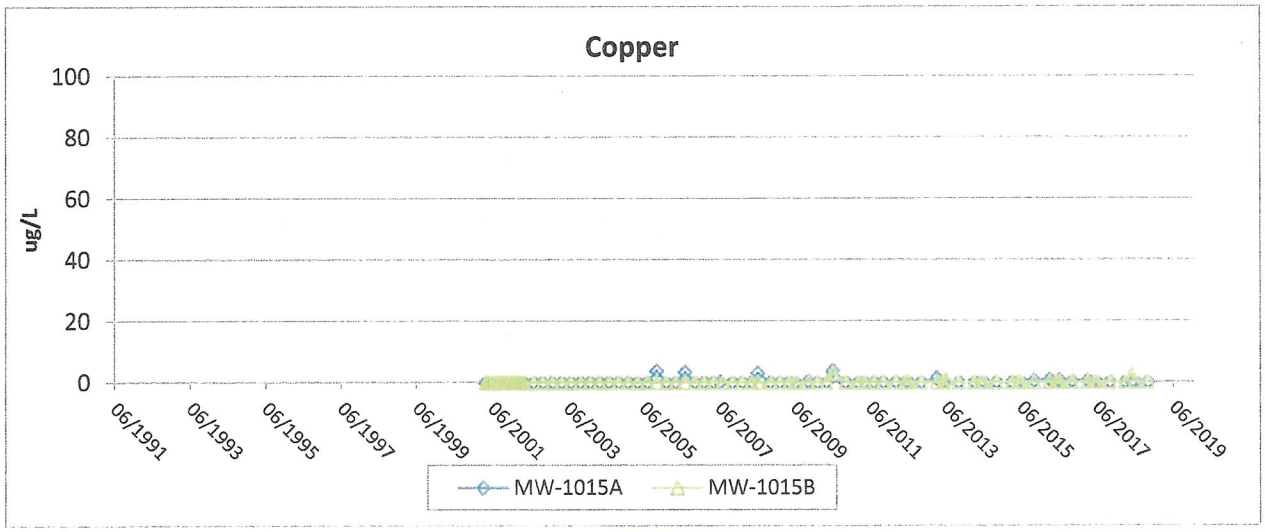

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FLAMBEAU MINING COMPANY

Figure B-5a

Groundwater Trend Graphs - Quarterly Results

MW-1015A/MW-1015B

Scale: NA	Date: January 2019	
Prepared By: SGL	Checked By: SVF	Project: 17F777.18

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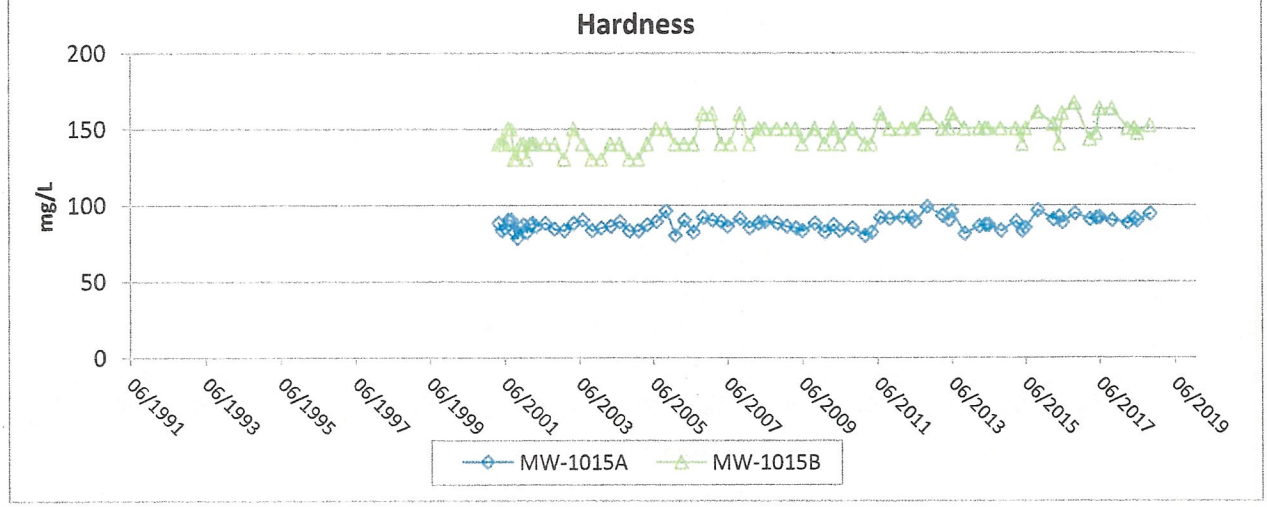

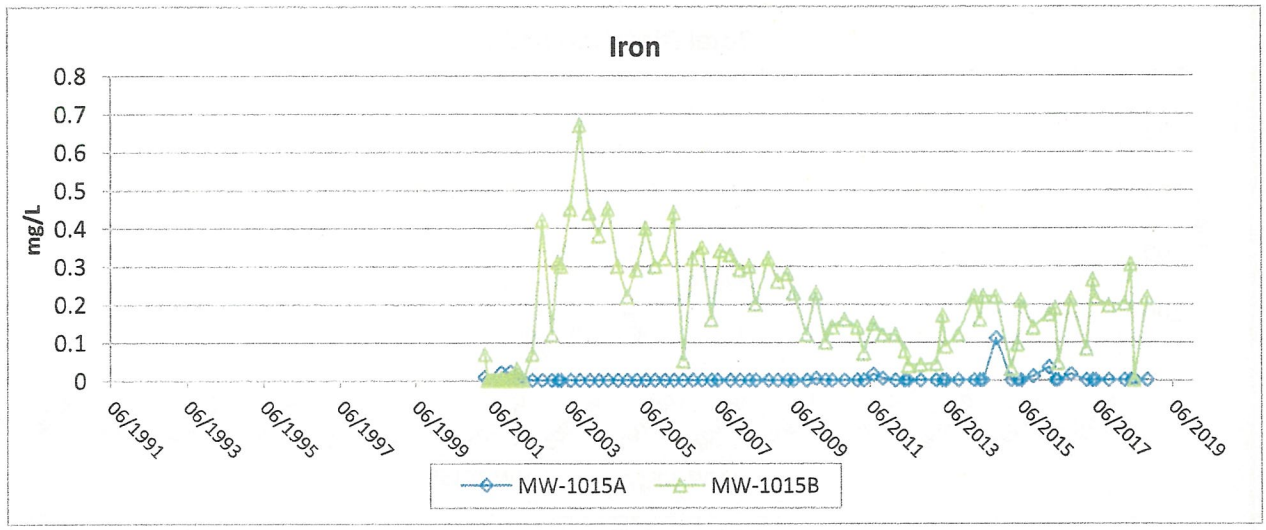

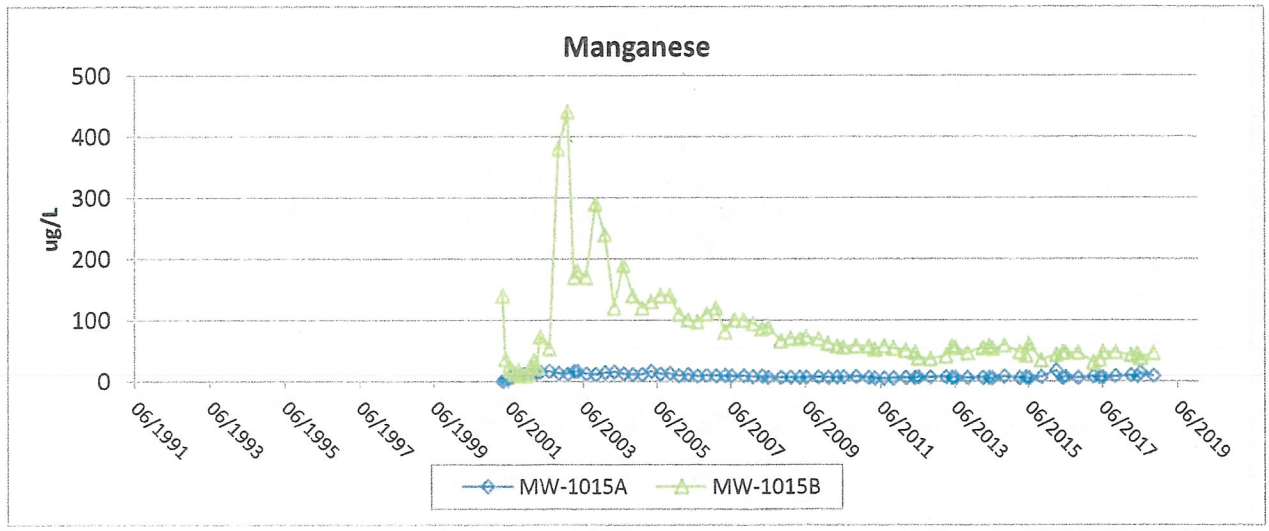

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Figure B-5b

Groundwater Trend Graphs - Quarterly Results

MW-1015A/MW-1015B

Scale: NA	Date: January 2019	
Prepared By: SGL	Checked By: SVF	Project: 17F777.18

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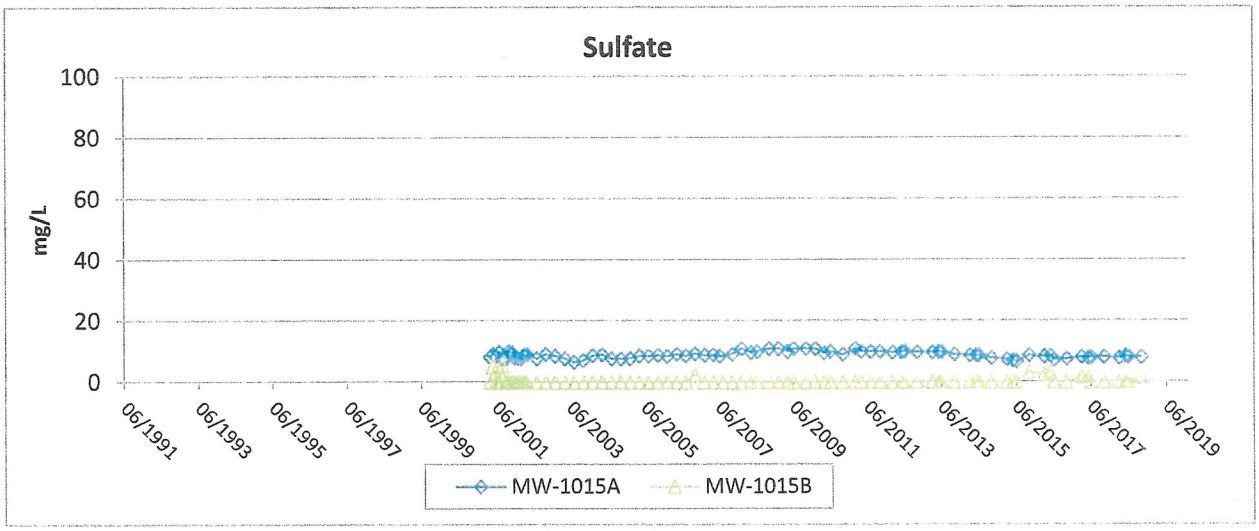

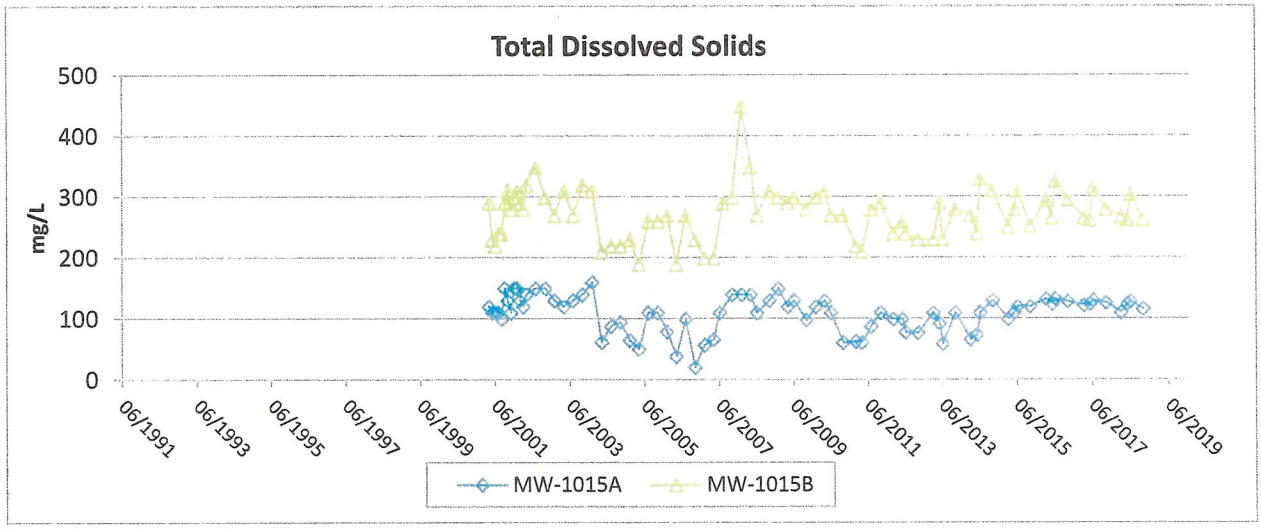

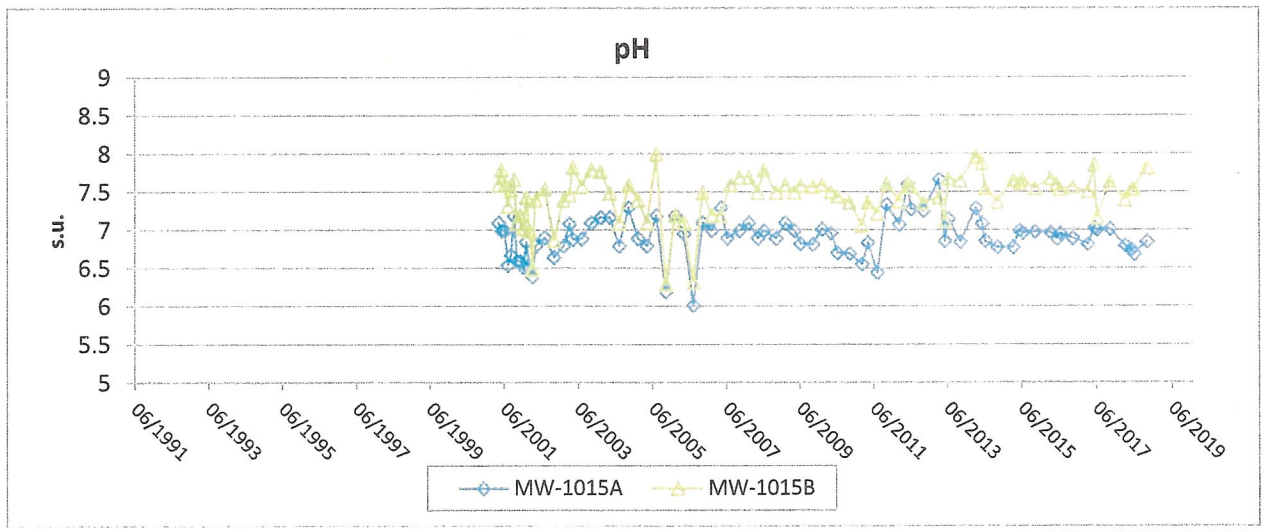

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Figure B-5c

Groundwater Trend Graphs - Quarterly Results

MW-1015A/MW-1015B

Scale: NA	Date: January 2019	
Prepared By: SGL	Checked By: SVF	Project: 17F777.18

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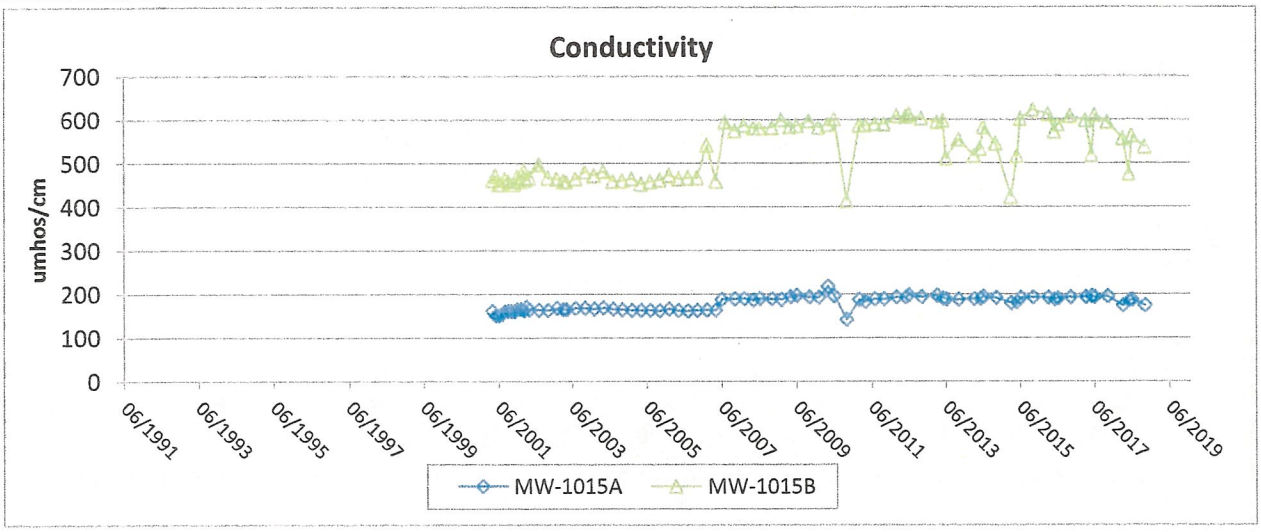

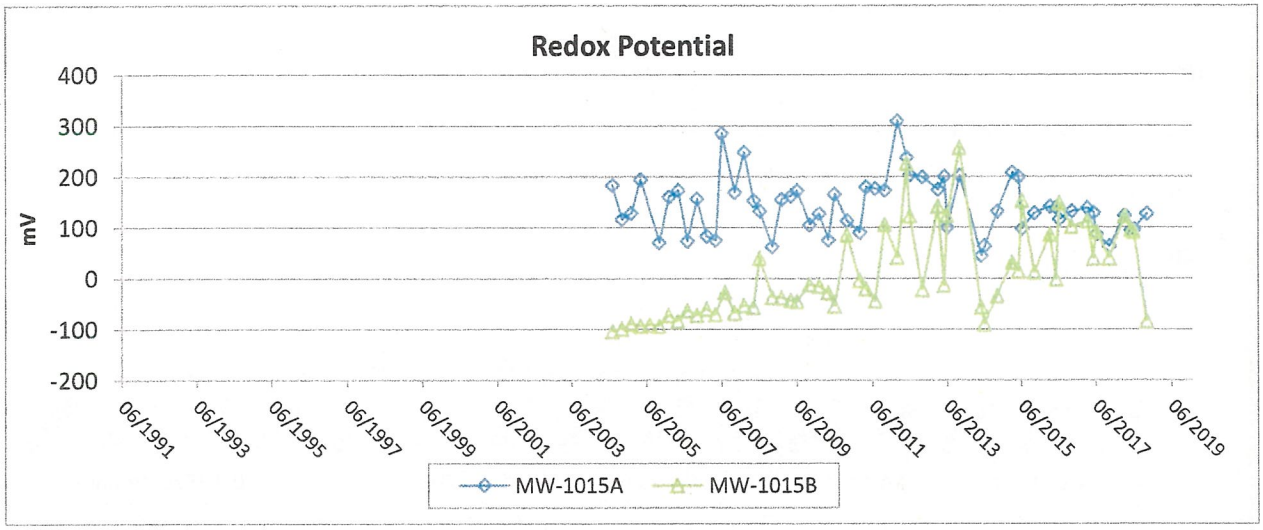

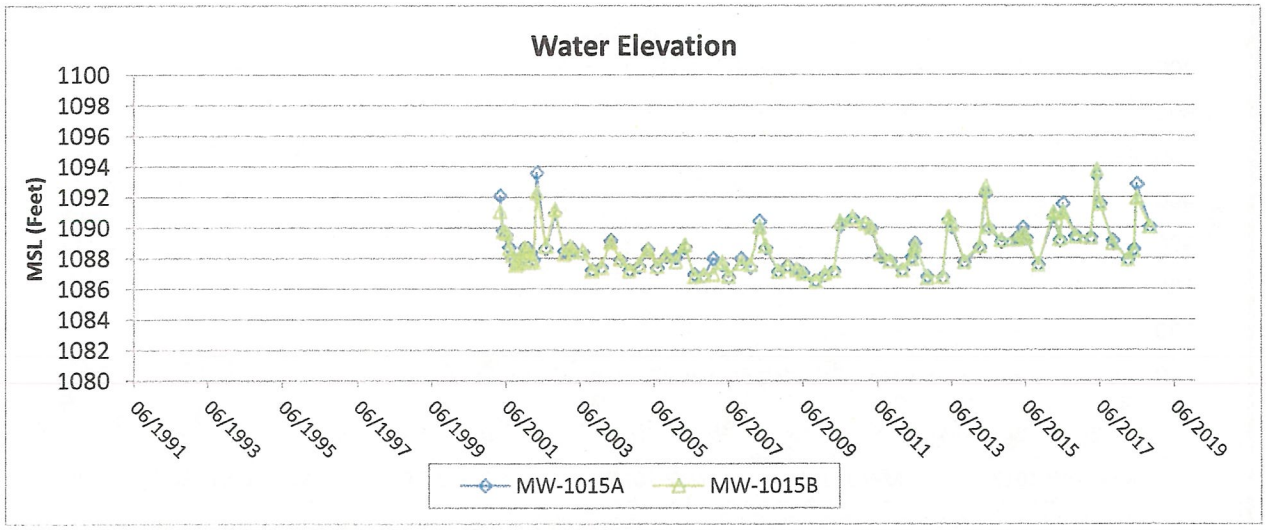

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FLAMBEAU MINING COMPANY

Figure B-5d

Groundwater Trend Graphs - Quarterly Results

MW-1015A/MW-1015B

Scale: NA	Date: January 2019
Prepared By: SGL	Checked By: SVF	Project: 17F777.18

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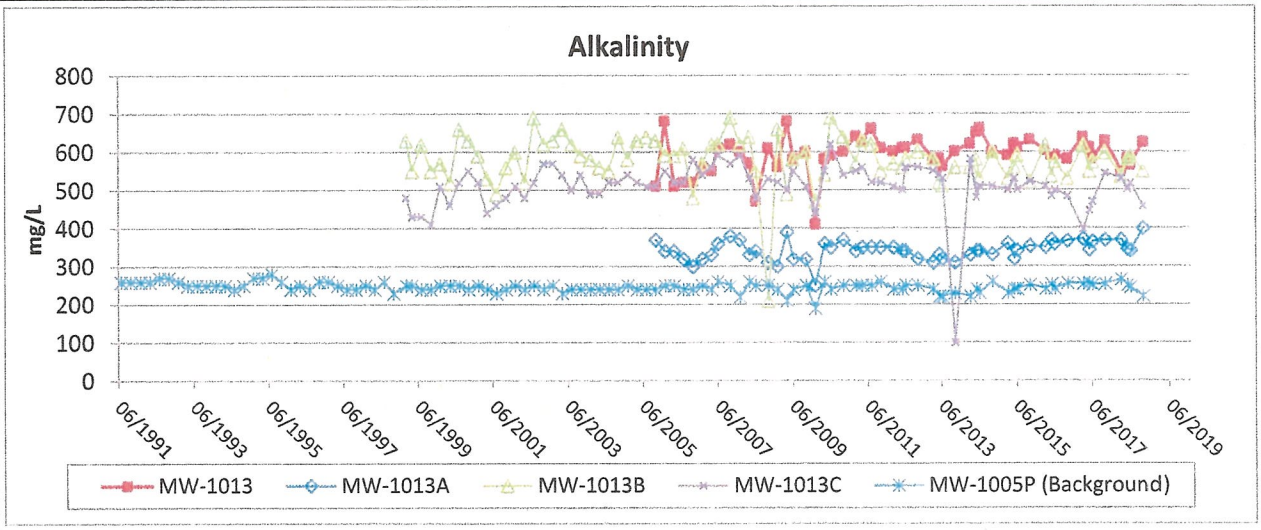

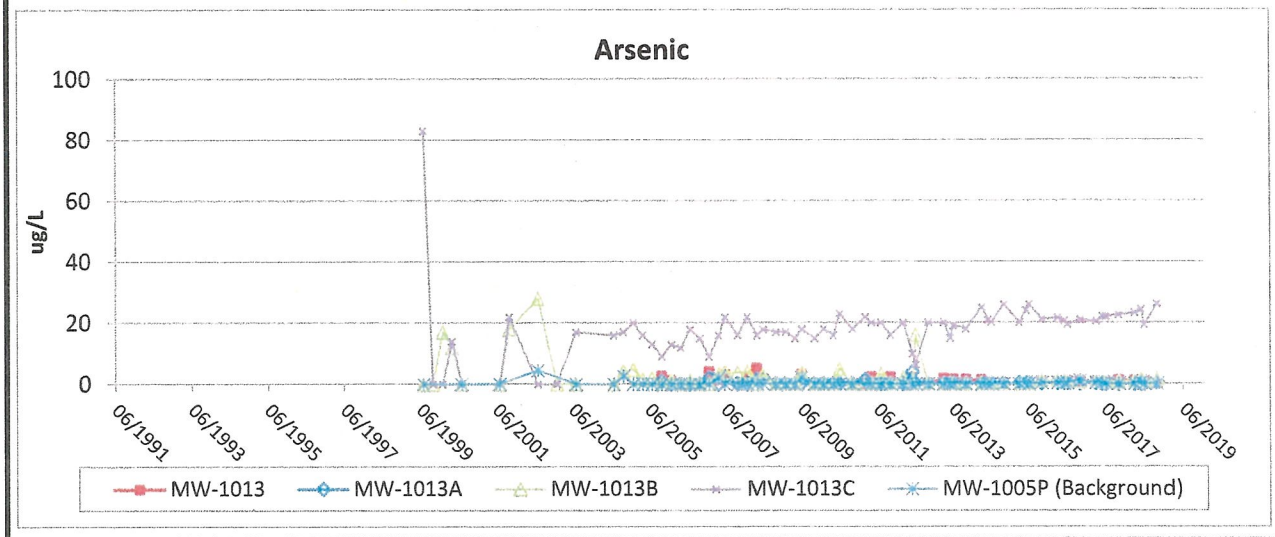

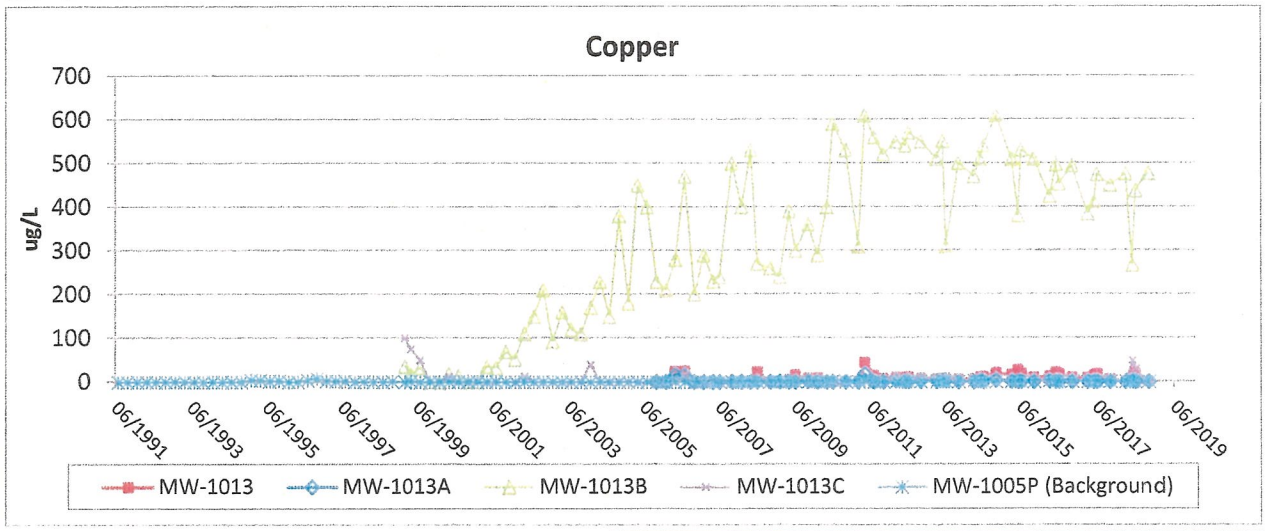

Note: Fourth quarter 2005 was the first time MW-1013 had sufficient water recovery for sampling.

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FLAMBEAU MINING COMPANY

Figure B-6a

Groundwater Trend Graphs - Quarterly Results (In-Pit Wells)

MW-1013/MW-1013A/MW-1013B/MW-1013C

Scale: NA	Date: January 2019	
Prepared By: SGL	Checked By: SVF	Project: 17F777.18

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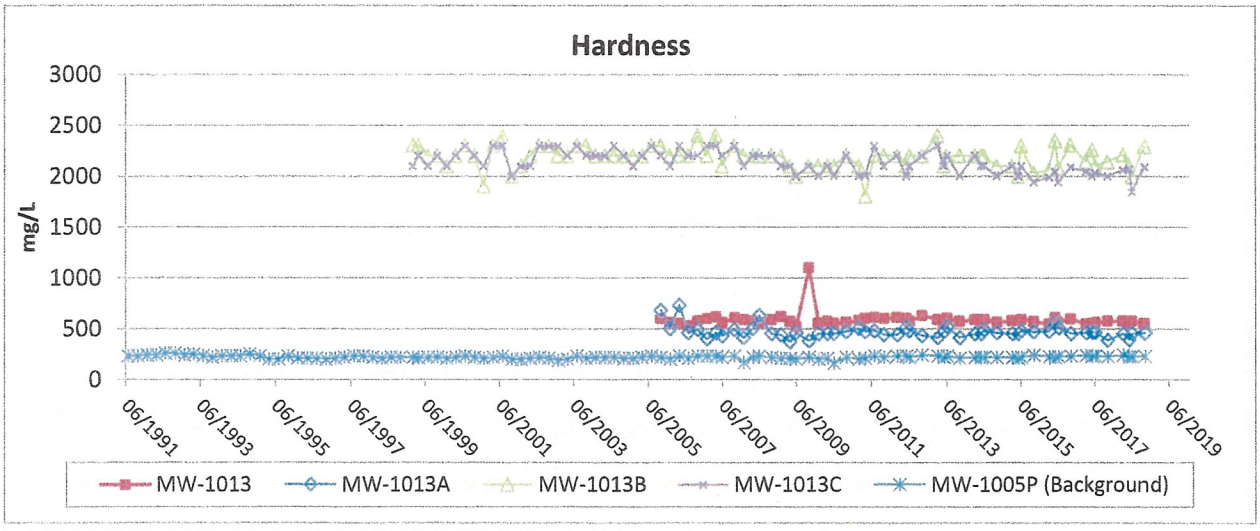

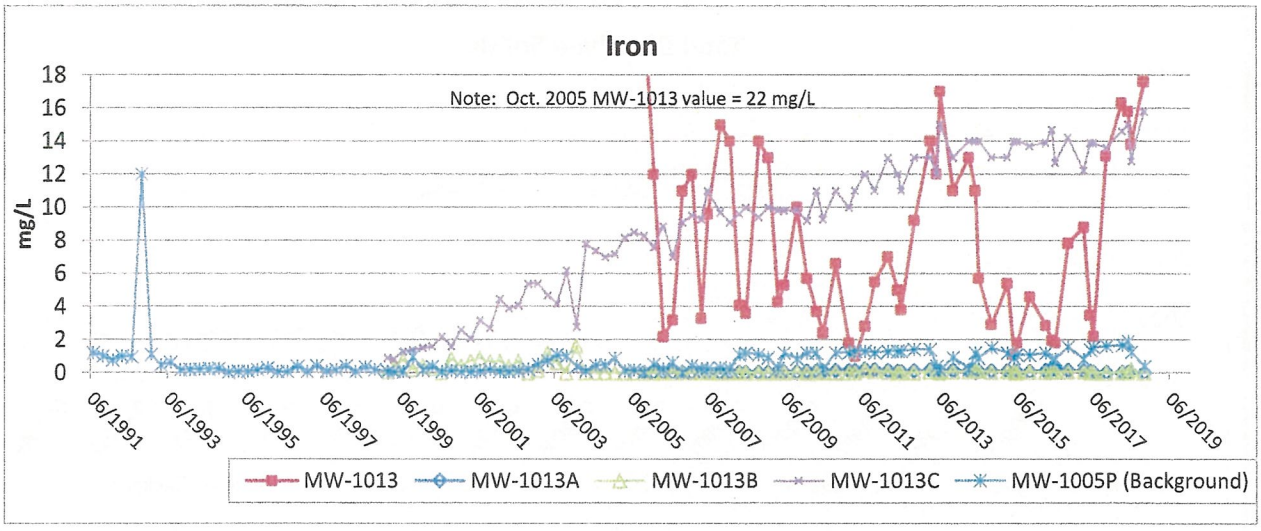

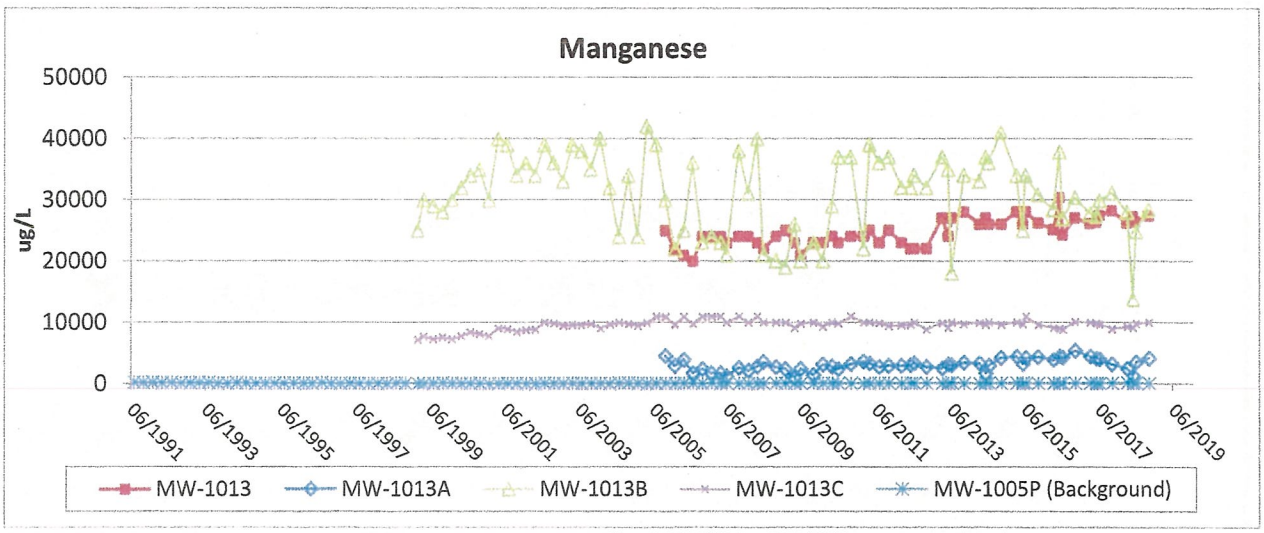

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FLAMBEAU MINING COMPANY

Figure B-6b

Groundwater Trend Graphs - Quarterly Results (In-Pit Wells)

MW-1013/MW-1013A/MW-1013B/MW-1013C

Scale: NA	Date: January 2019	
Prepared By: SGL	Checked By: SVF	Project: 17F777.18

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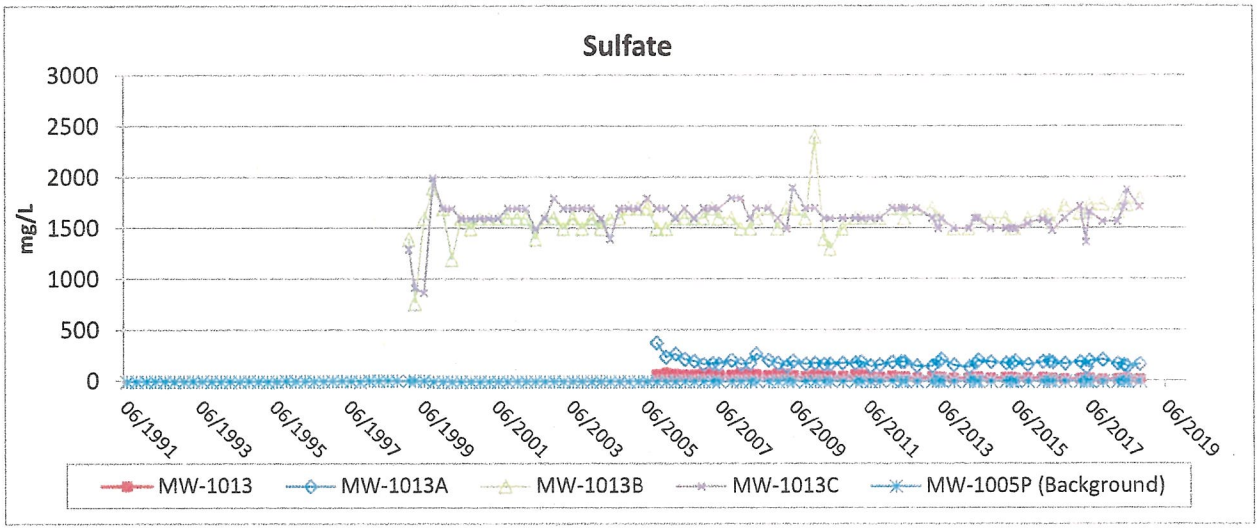

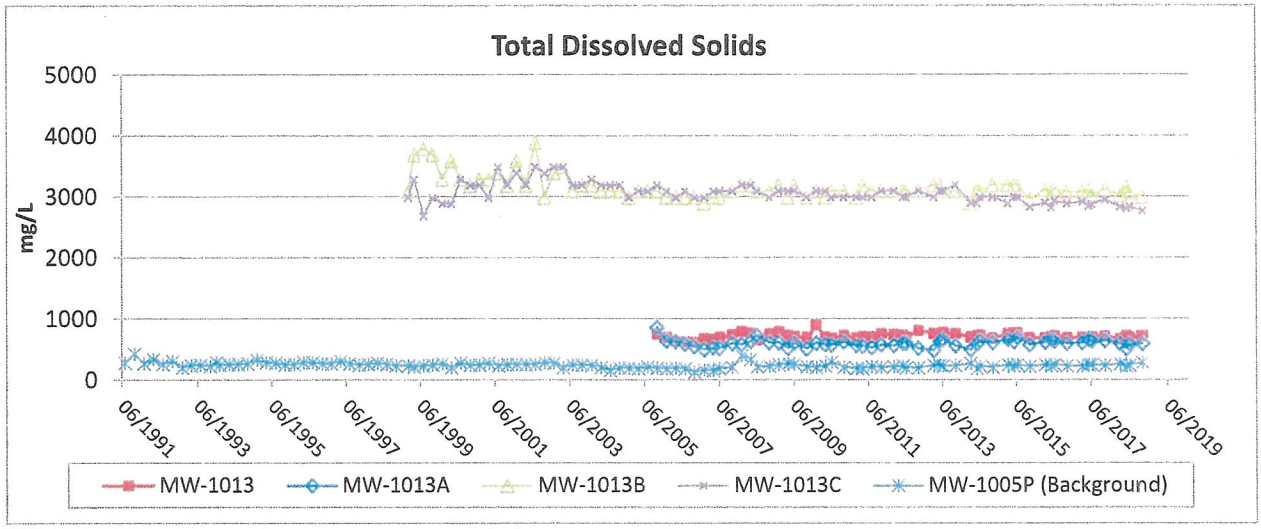

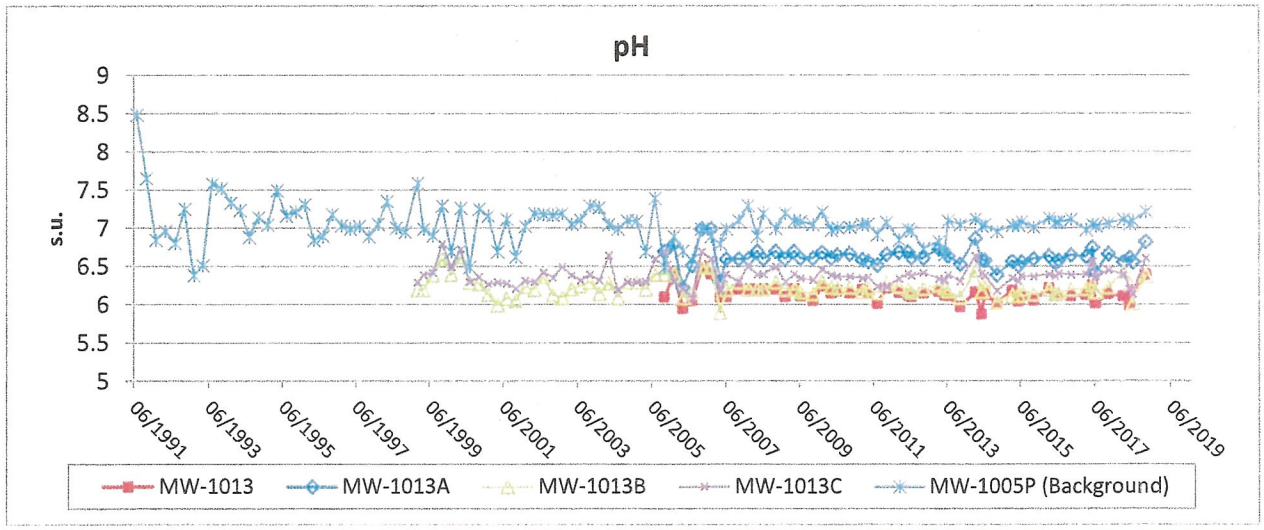

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FLAMBEAU MINING COMPANY

Figure B-6c

Groundwater Trend Graphs - Quarterly Results (In-Pit Wells)

MW-1013/MW-1013A/MW-1013B/MW-1013C

Scale: NA	Date: January 2019	
Prepared By: SGL	Checked By: SVF	Project: 17F777.18

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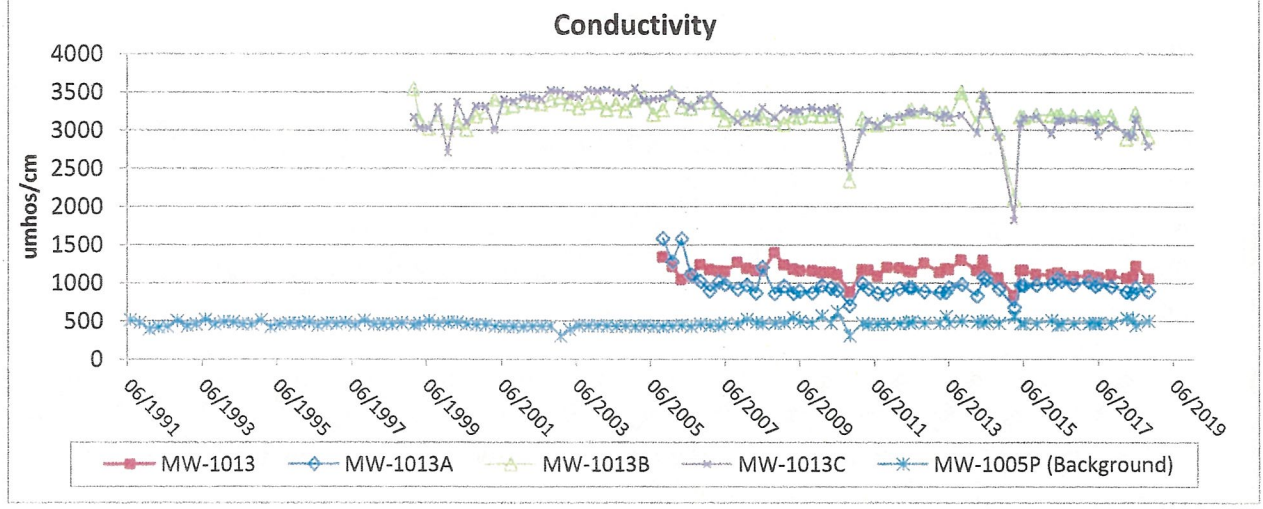

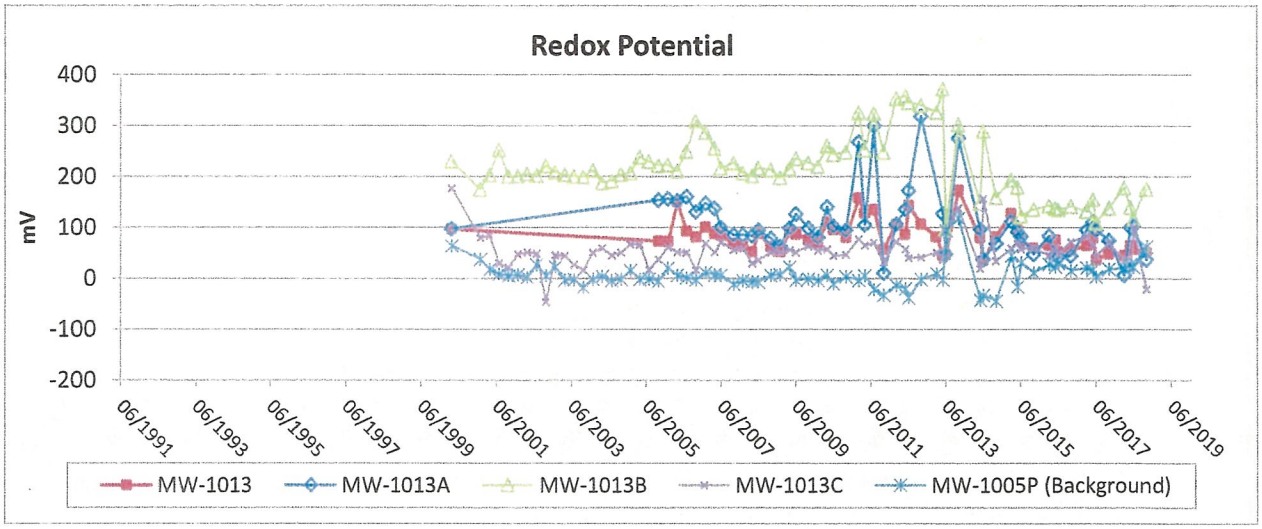

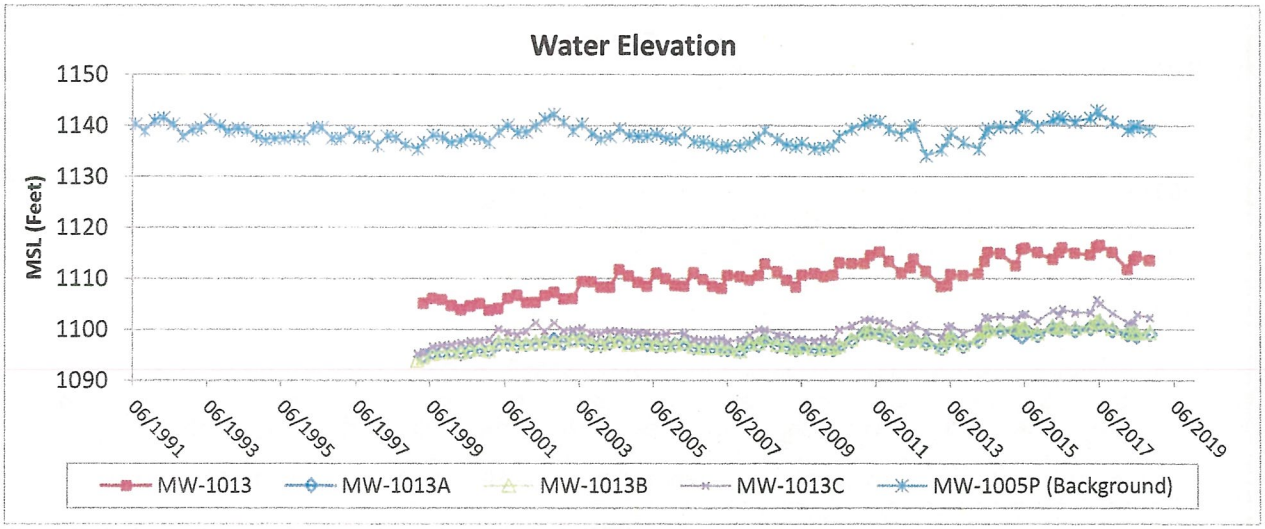

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FLAMBEAU MINING COMPANY

Figure B-6d

Groundwater Trend Graphs - Quarterly Results (In-Pit Wells)

MW-1013/MW-1013A/MW-1013B/MW-1013C

Scale: NA	Date: January 2019	
Prepared By: SGL	Checked By: SVF	Project: 17F777.18

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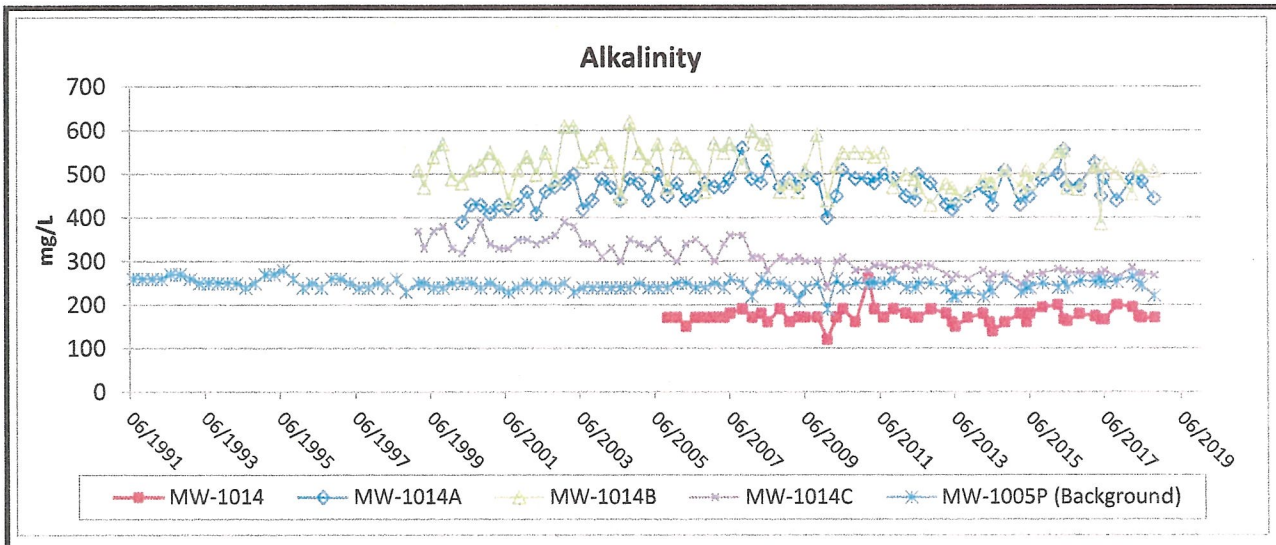

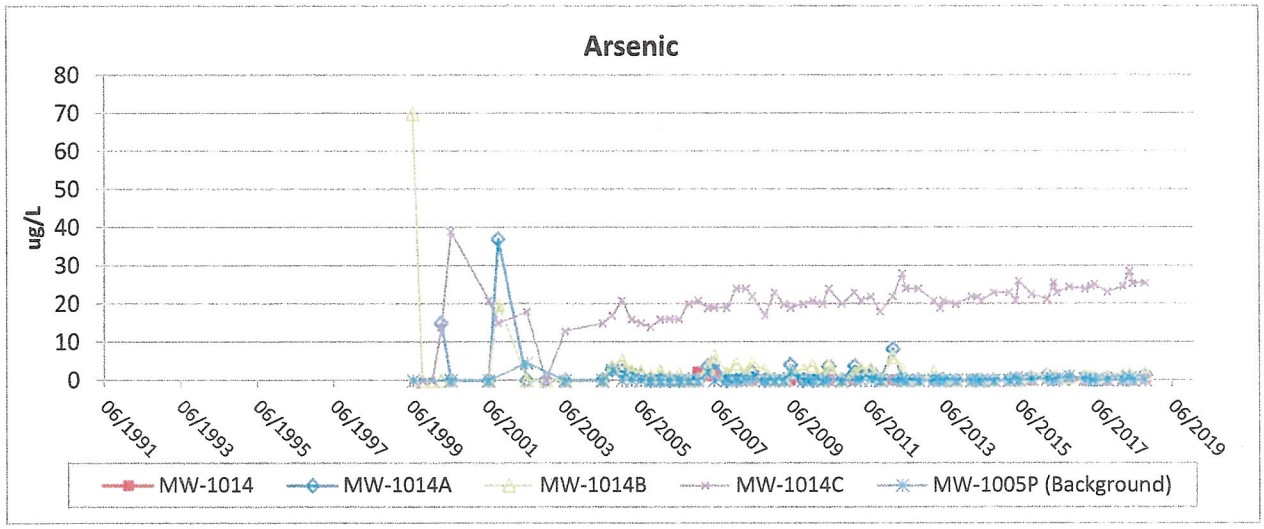

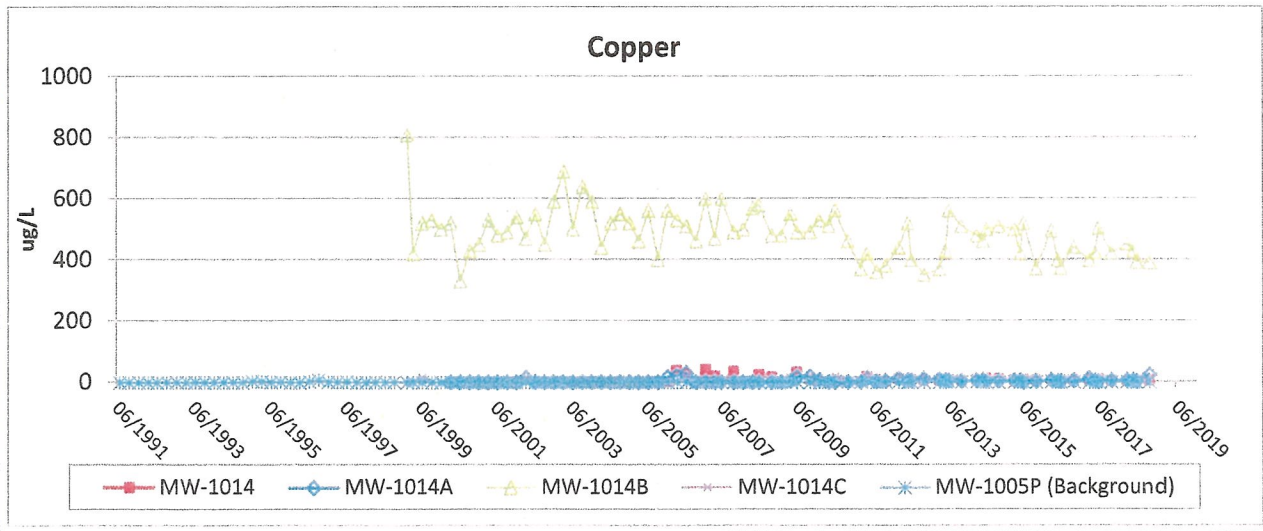

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FLAMBEAU MINING COMPANY

Figure B-7a

Groundwater Trend Graphs - Quarterly Results (In-Pit Wells)

MW-1014/MW-1014A/MW-1014B/MW-1014C

Scale: NA	Date: January 2019	
Prepared By: SGL	Checked By: SVF	Project: 17F777.18

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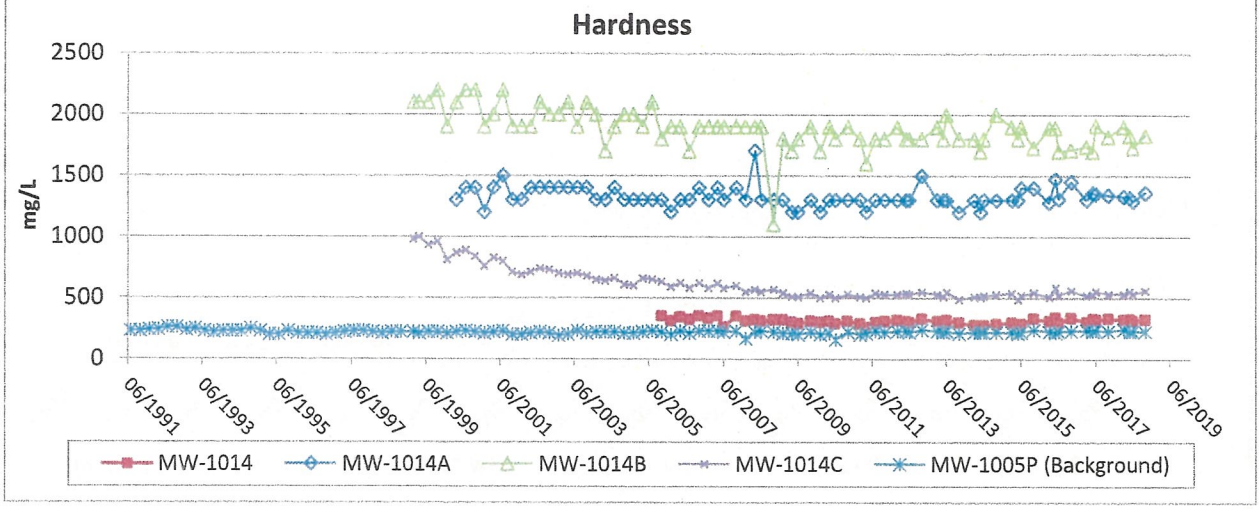

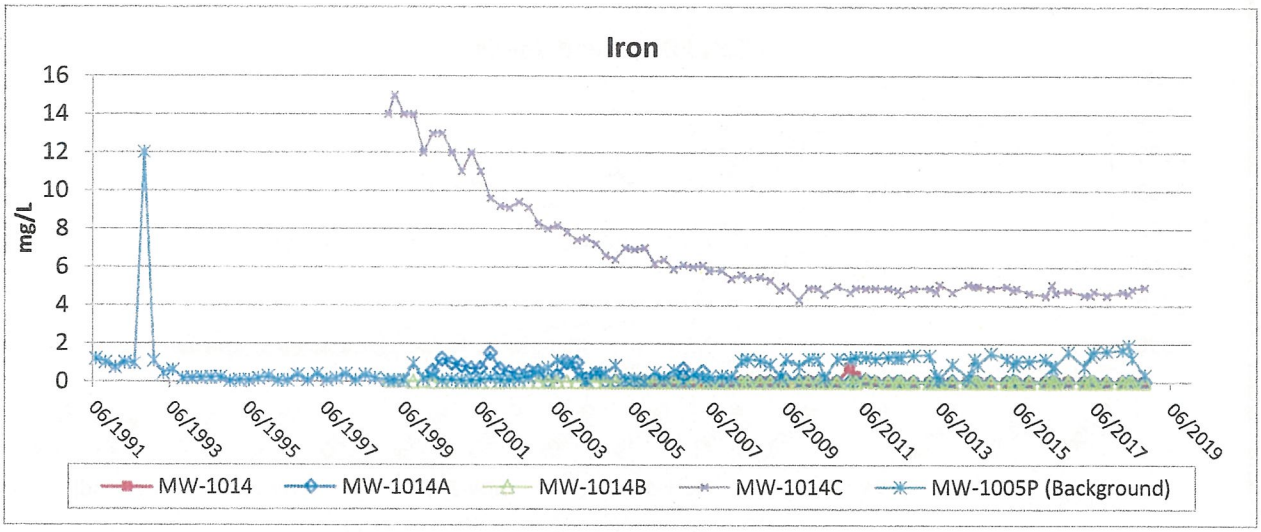

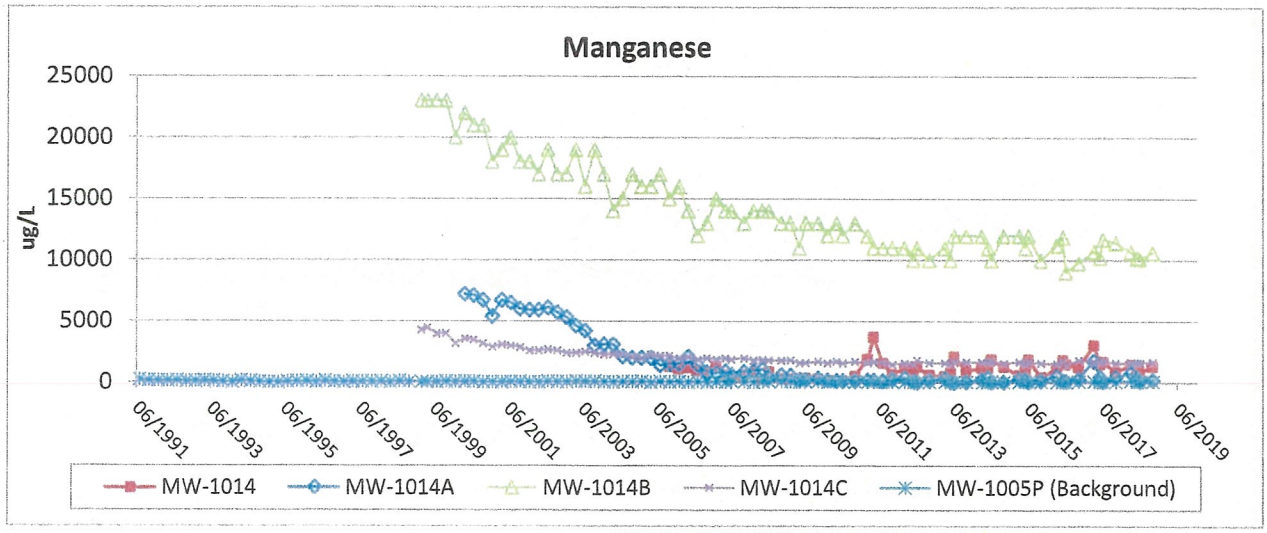

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FLAMBEAU MINING COMPANY

Figure B-7b

Groundwater Trend Graphs - Quarterly Results (In-Pit Wells)

MW-1014/MW-1014A/MW-1014B/MW-1014C

Scale: NA	Date: January 2019	
Prepared By: SGL	Checked By: SVF	Project: 17F777.18

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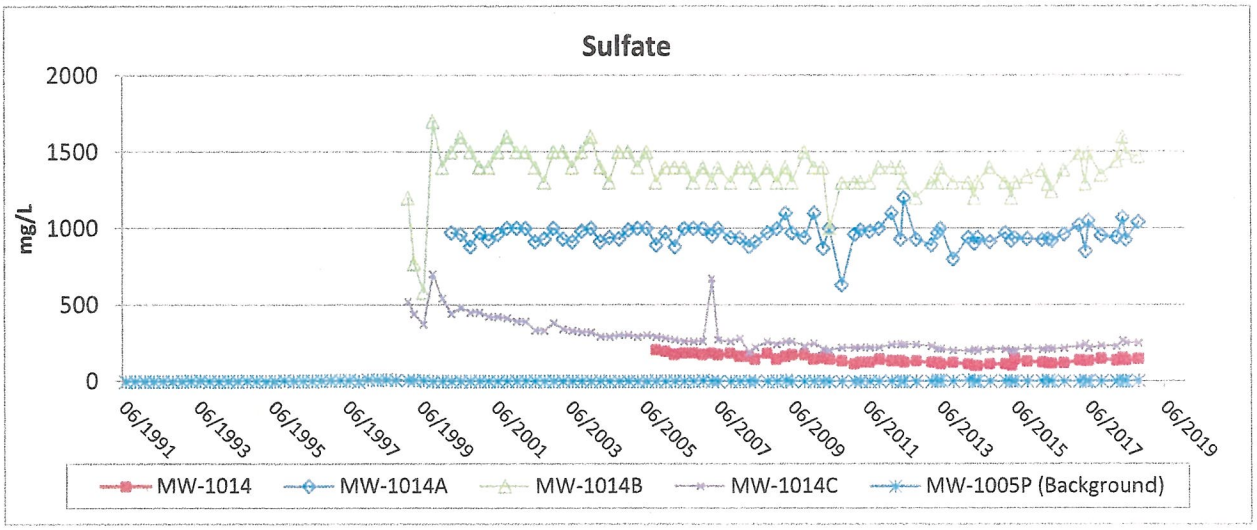

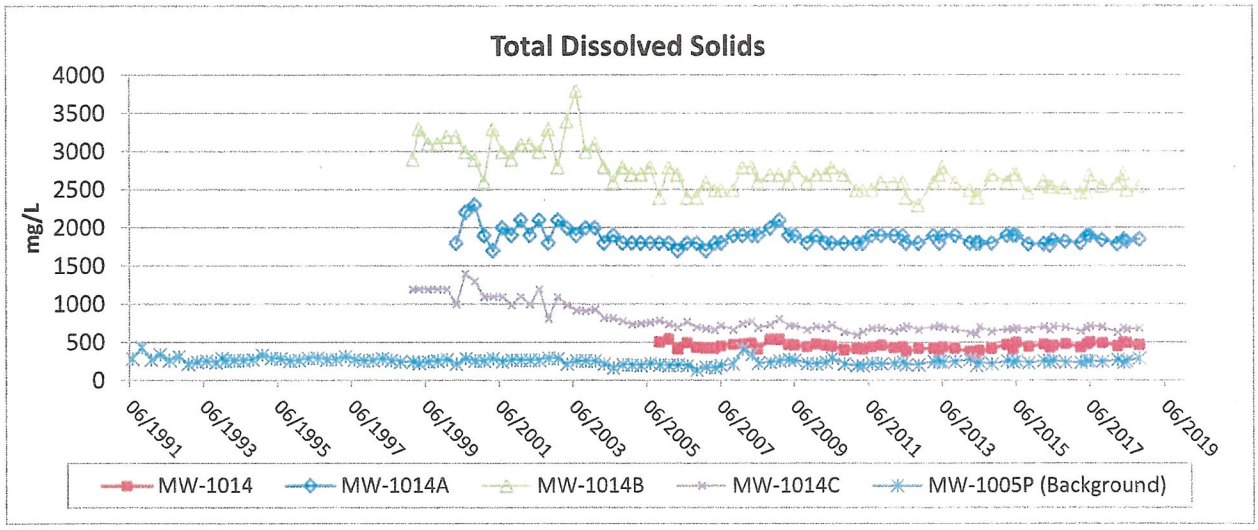

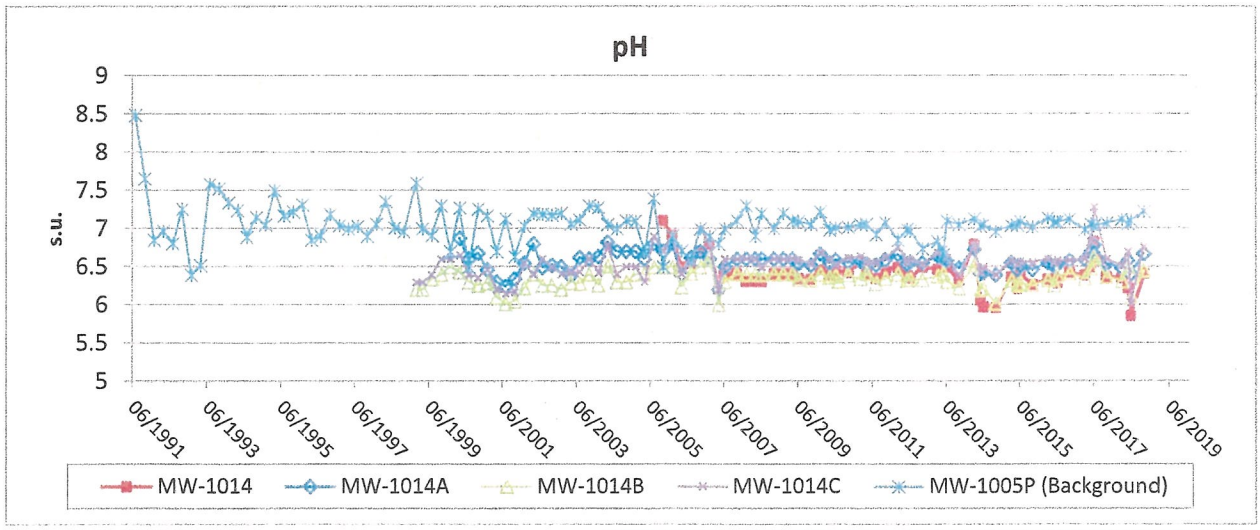

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FLAMBEAU MINING COMPANY

Figure B-7c

Groundwater Trend Graphs - Quarterly Results (In-Pit Wells)

MW-1014/MW-1014A/MW-1014B/MW-1014C

Scale: NA	Date: January 2019	
Prepared By: SGL	Checked By: SVF	Project: 17F777.18

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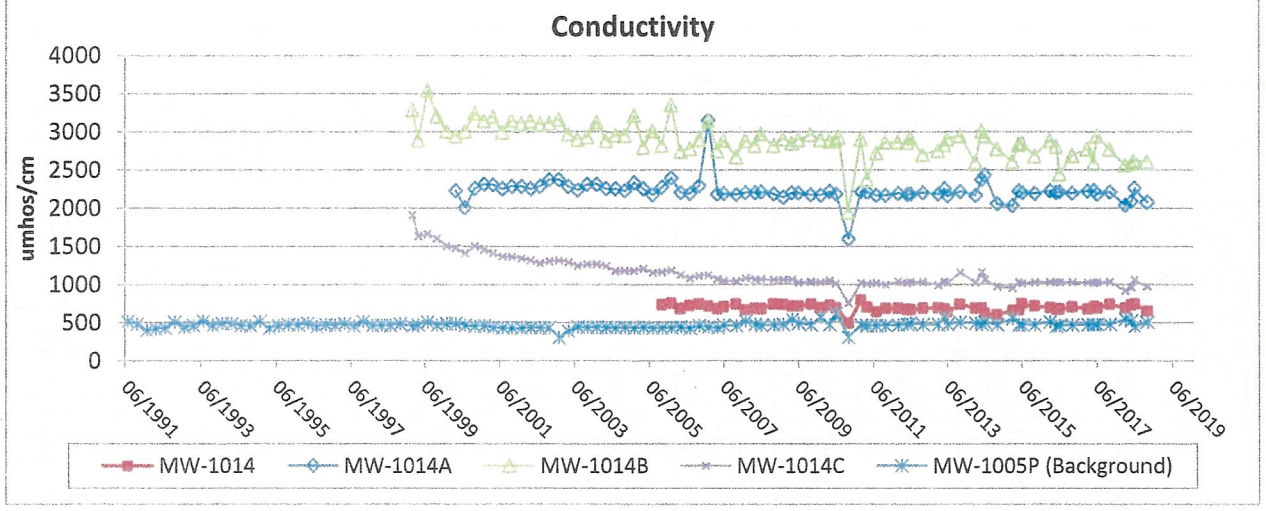

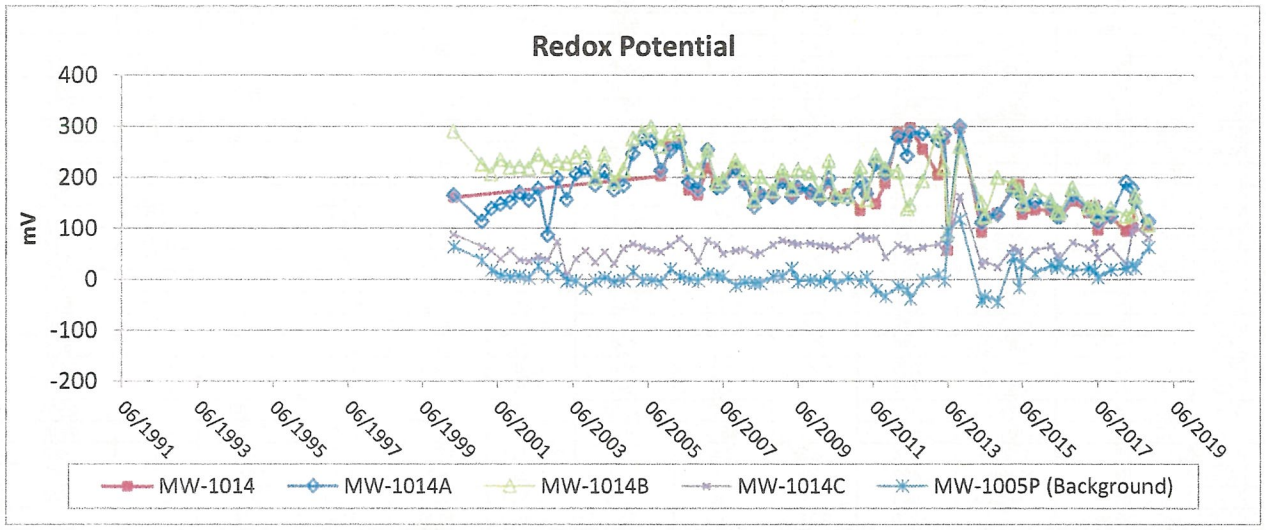

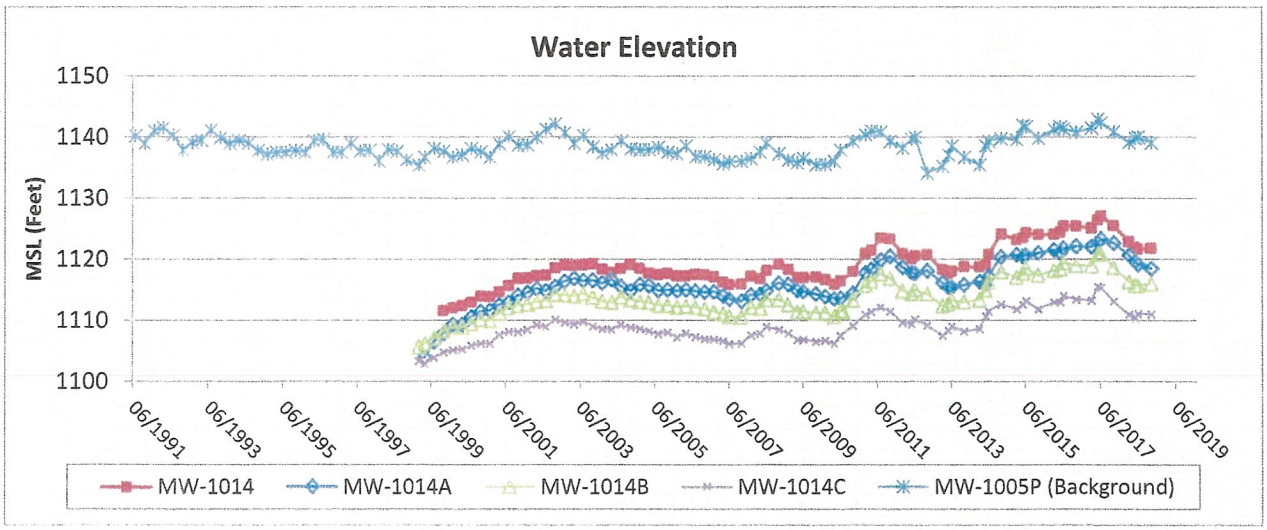

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FLAMBEAU MINING COMPANY

Figure B-7d

Groundwater Trend Graphs - Quarterly Results (In-Pit Wells)

MW-1014/MW-1014A/MW-1014B/MW-1014C

Scale: NA	Date: January 2019
Prepared By: SGL	Checked By: SVF	Project: 17F777.18

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2018 Groundwater Results - Quarterly Parameters

Sample Date (yyyy-mm)	Location		Water Elevation ft	Alkalinity as CaCO3 mg/l	Arsenic ug/l	Copper ug/l	Hardness mg/l	Iron mg/l	Manganese ug/l	Sulfate mg/l	Total Dissolved Solids mg/l	pH s.u.	Conductivity umhos/cm	Redox Potential mV
2018-03	MW-1000PR	N	1087.43	222	12.5	1.7	405	1.43	1840	189	514	6.68	718	67.9
2018-03	MW-1000R	N	1088.48	175	< 0.28	51.7	225	< 0.111	3070	37.3	306	6.3	449	98.2
2018-03	MW-1002	Dup.		44.7	< 0.28	< 1.1	62.9	< 0.111	< 2.7	2.1	80.0			
2018-03	MW-1002	N	1090.77	44.0	< 0.28	1.3	61.9	0.232	< 2.7	2.2	86.0	6.53	142	149.3
2018-03	MW-1002G	N	1090.87	111	< 0.28	< 1.1	147	< 0.111	< 2.7	9.4	192	6.65	202	89.3
2018-03	MW-1004	N	1106.14	42.5	< 0.28	3.7	56.4	< 0.111	< 2.7	20.0	80.0	6.35	145	238
2018-03	MW-1004P	N	1104.85	183	0.79	< 1.1	150	0.511	132	2.2	152	7.31	287	91.8
2018-03	MW-1004S	N	1106.2	40.5	< 0.28	1.9	60.5	< 0.111	< 2.7	21.7	92.0	6.48	261	119
2018-03	MW-1005	N	1140.84	50.9	0.97	1.1	653	15.8	674	16.1	1120	5.88	1282	104
2018-03	MW-1005P	N	1139.08	265	< 0.28	< 1.1	239	1.66	147	< 1.0	272	7.12	536	20
2018-03	MW-1005S	N	1139.8	158	2.3	< 1.1	142	3.86	200	3.9	180	7	290	-41.9
2018-03	MW-1010P	N	1087.24	153	17.2	< 1.1	184	< 0.111	39.3	28.7	206	7.43	334	201.5
2018-03	MW-1013	N	1111.69	549	0.82	< 10.9	573	16.3	26200	16.1	672	6.11	1055	45.1
2018-03	MW-1013A	N	1099.05	369	< 0.28	< 1.1	448	< 0.111	2450	175	604	6.56	879	6.1
2018-03	MW-1013B	N	1099.6	535	0.77	476	2210	< 1.11	28000	1670	3030	6.43	2887	178
2018-03	MW-1013C	N	1101.36	530	23.2	< 10.9	2060	14.6	9290	1570	2840	6.4	2948	35
2018-03	MW-1014	N	1122.85	195	< 0.28	3.4	323	< 0.111	1490	133	450	6.35	680	93.1
2018-03	MW-1014A	N	1120.61	490	0.86	6.8	1330	< 0.221	766	942	1790	6.48	2031	189.8
2018-03	MW-1014B	N	1116.32	455	1.6	452	1900	< 1.11	10700	1440	2580	6.31	2558	124.1
2018-03	MW-1014C	Dup.		290	24.2	< 1.1	528	4.69	1590	223	668			
2018-03	MW-1014C	N	1110.88	287	24.7	< 1.1	534	4.71	1600	228	636	6.51	912	29.3
2018-03	MW-1015A	N	1087.9	87.5	< 0.28	< 1.1	88.0	< 0.111	9.2	7.8	110	6.8	172	123.4
2018-03	MW-1015B	N	1087.95	169	< 0.28	< 1.1	150	0.2	42.3	< 1.0	268	7.4	555	121.8
2018-05	MW-1000PR	N	1088.13	216	3.2	1.2	396	1.24	1960	208	538	6.61	766	80.1
2018-05	MW-1000R	N	1089.25	174	< 0.28	41.3	245	< 0.111	1110	65.6	348	6.08	504	98.7
2018-05	MW-1002	Dup.		54.4	< 0.28	< 1.1	61.6	< 0.111	< 2.7	< 5.0	86.0			
2018-05	MW-1002	N	1091.88	56.5	< 0.28	< 1.1	60.4	< 0.111	< 2.7	2.2	86.0	6.34	131	84
2018-05	MW-1002G	N	1091.72	104	< 0.28	< 1.1	140	< 0.111	< 2.7	10.3	190	6.52	297	89.5
2018-05	MW-1004	N	1107.4	37.3	< 0.28	3.1	46.6	< 0.111	< 2.7	16.1	66.0	6.3	111	101.3
2018-05	MW-1004P	N	1105.9	166	0.33	1.8	140	0.397	105	2.4	164	6.94	285	94.4
2018-05	MW-1004S	N	1107.43	45.1	< 0.28	2.1	62.0	< 0.111	< 2.7	24.7	90.0	6.78	136	106.6
2018-05	MW-1005	N	1140.94	52.0	0.75	1.3	560	15	589	16.2	1510	5.78	1309	67.4
2018-05	MW-1005P	N	1139.77	250	0.58	< 1.1	225	1.91	79.2	< 5.0	238	7.06	518	27.5
2018-05	MW-1005S	N	1140.44	149	2.2	< 1.1	140	3.73	192	< 5.0	184	6.74	286	-88.6
2018-05	MW-1010P	N	1087.84	160	16.5	1.7	169	< 0.111	53.6	26.6	212	6.95	358	47.2
2018-05	MW-1013	N	1113.6	580	0.83	3.4	550	15.8	27200	18.1	722	5.99	1077	64.2
2018-05	MW-1013A	N	1099.13	344	< 0.28	1.6	393	< 0.111	1260	160	516	6.62	862	99.7
2018-05	MW-1013B	N	1099.65	580	1.6	267	2110	< 0.553	13800	1800	3180	6.27	2959	139.2
2018-05	MW-1013C	N	1101.37	501	24.4	48.0	2070	15	9100	1710	2820	6.21	2905	18.7
2018-05	MW-1014	N	1121.9	174	< 0.28	3.4	327	< 0.111	1270	148	498	6.21	722	101.5
2018-05	MW-1014A	N	1119.55	492	0.73	5.4	1320	< 0.221	396	1070	1840	6.58	2083	178
2018-05	MW-1014B	N	1115.63	521	1.6	428	1830	< 0.553	10200	1600	2710	6.49	2580	129
2018-05	MW-1014C	Dup.		268	27.8	< 1.1	555	4.44	1620	264	714			
2018-05	MW-1014C	N	1110.41	274	28.6	< 2.2	555	4.59	1660	265	690	6.7	954	91.2
2018-05	MW-1015A	N	1088.59	83.3	< 0.28	< 1.1	91.1	< 0.111	7.8	8.4	124	6.75	183	94
2018-05	MW-1015B	N	1088.5	175	< 0.28	2.4	150	0.304	45.0	< 5.0	262	7.53	474	94.6
2018-06	MW-1000PR	N	1094.54	217	20.3	34.8	371	3.07	1870	207	512	6.46	747	129.6
2018-06	MW-1000R	N	1095.11	72.0	< 0.28	11.9	71.0	< 0.111	70.0	36.6	144	6.97	123	164.7
2018-06	MW-1002	Dup.		50.9	< 0.28	< 1.1	57.0	< 0.111	< 2.7	2.2	94.0			
2018-06	MW-1002	N	1092.95	60.1	< 0.28	< 1.1	58.0	< 0.111	< 2.7	2.1	88.0	5.74	136	103.2
2018-06	MW-1002G	N	1092.18	107	< 0.28	< 1.1	150	< 0.111	< 2.7	10.2	204	5.83	298	110.1
2018-06	MW-1004	N	1110.4	37.4	< 0.28	3.2	43.9	< 0.111	< 2.7	14.3	72.0	6.5	116	185.4
2018-06	MW-1004P	N	1106.71	160	0.32	< 1.1	149	0.273	118	2.5	156	6.67	304	113
2018-06	MW-1004S	N	1110.49	46.4	< 0.28	1.8	62.6	< 0.111	< 2.7	26.2	102	5.95	150	120.9
2018-06	MW-1005	N	1141.12	86.6	1.3	< 1.1	619	20	572	18.0	1120	5.79	1822	60.7
2018-06	MW-1005P	N	1139.92	245	< 0.28	< 1.1	226	1.25	74.7	< 1.0	252	7.1	443	22.1
2018-06	MW-1005S	N	1140.48	151	2.2	< 1.1	141	3.88	199	< 5.0	194	7.03	289	-53.5
2018-06	MW-1010P	N	1094.4	160	25.4	< 1.1	179	< 0.111	58.2	31.2	224	6.98	339	161.9
2018-06	MW-1013	N	1114.26	563	0.81	16.3	574	13.8	26400	16.6	694	6.18	1218	56.7
2018-06	MW-1013A	N	1098.7	340	< 0.28	< 1.1	450	< 0.111	3480	149	590	6.56	935	103.5
2018-06	MW-1013B	N	1099.31	589	0.66	437	1990	0.21	24800	1730	3080	6.02	3217	118.7
2018-06	MW-1013C	N	1102.95	516	19.2	29.6	1840	12.8	9790	1880	2850	6.14	3144	100.3
2018-06	MW-1014	N	1121.64	170	< 0.28	3.8	314	< 0.111	809	134	490	5.85	737	157.2
2018-06	MW-1014A	N	1119.07	483	0.59	2.6	1290	< 0.111	96.7	925	1820	6.4	2254	152.2
2018-06	MW-1014B	N	1115.61	517	0.99	392	1730	< 0.111	10100	1490	2500	6.1	2619	164.4
2018-06	MW-1014C	Dup.		265	25.0	< 1.1	485	4.53	1460	253	690			
2018-06	MW-1014C	N	1111.06	272	25.4	< 1.1	534	4.85	1650	252	672	6.03	1050	103.2
2018-06	MW-1015A	N	1092.82	83.5	< 0.28	< 1.1	89.5	< 0.111	13.3	8.1	128	6.69	185	95.4
2018-06	MW-1015B	N	1091.95	173	< 0.28	< 1.1	147	< 0.111	37.9	< 1.0	304	7.54	561	90.9
2018-10	MW-1000PR	N	1089.82	212	1.3	1.8	418	< 0.111	1320	205	506	7.07	622.22	24.9
2018-10	MW-1000R	N	1090.93	211	0.32	40.5	271	< 0.111	743	75.1	362	6.49	527.97	95.7
2018-10	MW-1002	Dup.		66.7	< 0.28	< 1.1	59.5	< 0.111	< 2.7	2.8	92.0			
2018-10	MW-1002	N	1093.49	71.5	< 0.28	2.2	65.2	< 0.111	< 2.7	2.8	82.0	6.87	133.73	141.3
2018-10	MW-1002G	N	1093.32	120	< 0.28	< 1.1	148	< 0.111	< 2.7	10.1	172	6.75	291.88	145.4
2018-10	MW-1004	N	1109.38	28.4	0.34	13.3	46.0	< 0.111	< 2.7	14.4	64.0	6.38	81.84	86.7
2018-10	MW-1004P	N	1107.57	161	0.30	< 1.1	140	0.23	81.9	2.3	142	6.69	266.85	-24.5
2018-10	MW-1004S	N	1109.47	51.3	< 0.28	2.3	60.2	< 0.111	5.4	24.9	86.0	7.01	131.09	98.5
2018-10	MW-1005	N	1139.26	54.3	1.9	1.2	485	18	528	16.1	922	6.46	989.00	116.8
2018-10	MW-1005P	N	1139	221	< 0.28	< 1.1	227	0.371	69.4	1.8	294	7.22	496.00	62.7
2018-10	MW-1005S	N	1139.64	159	2.6	< 1.1	157	3.87	216	3.9	174	6.56	273.00	34.6

2018 Groundwater Results - Quarterly Parameters

Sample Date (yyyy-mm)	Location		Water Elevation ft	Alkalinity as CaCO3 mg/l	Arsenic ug/l	Copper ug/l	Hardness mg/l	Iron mg/l	Manganese ug/l	Sulfate mg/l	Total Dissolved Solids mg/l	pH s.u.	Conductivity umhos/cm	Redox Potential mV
2018-10	MW-1010P	N	1081.42	148	20.3	< 1.1	185	< 0.111	50.0	32.8	202	7.87	335.73	37.9
2018-10	MW-1013	N	1113.51	623	< 1.4	< 5.5	547	17.6	27400	14.6	720	6.39	1054.50	51.4
2018-10	MW-1013A	N	1099.03	399	0.38	< 1.1	456	< 0.111	4100	172	608	6.83	883.71	36.4
2018-10	MW-1013B	N	1099.42	549	1.6	477	2290	< 0.553	28400	1800	3010	6.38	2905.00	175.2
2018-10	MW-1013C	N	1102.33	457	26.2	< 2.2	2090	15.8	10000	1710	2780	6.61	2788.60	-21.1
2018-10	MW-1014	N	1121.81	170	0.32	4.8	326	< 0.111	1320	142	462	6.40	638.58	106.9
2018-10	MW-1014A	N	1118.44	444	1.4	24.2	1360	< 0.111	219	1040	1850	6.67	2067.90	113.7
2018-10	MW-1014B	N	1115.97	508	2.0	390	1830	< 0.221	10600	1470	2550	6.45	2602.30	106.8
2018-10	MW-1014C	Dup.		254	22.9	< 1.1	507	4.4	1530	256	656			
2018-10	MW-1014C	N	1111.01	269	25.5	< 1.1	561	4.96	1700	248	686	6.76	966.20	81.4
2018-10	MW-1015A	N	1090.06	85.8	< 0.28	< 1.1	93.9	< 0.111	8.1	8.0	116	6.85	172.00	126.2
2018-10	MW-1015B	N	1090.07	182	< 0.28	< 1.1	152	0.216	45.7	1.5	262	7.82	535.32	-84.5

Attachment 2

Groundwater - Annual Parameters

Statistical Results
Trend Graphs
2018 Data

Trend Analysis Results - Groundwater (Annual Parameters)
Year Ending 2018

	Barium	Cadmium	Calcium	Chloride	Chromium	Lead	Magnesium	Mercury	Potassium	Selenium	Silver	Sodium	Zinc
MW-1000PR													
Trend Results for Most Recent 5 Years													
Sample Size	5	5	5	5	5	5	5	5	5	5	5	5	5
Mann-Kendall S	2	1	-4	-7	2	5	-2	-2	-2	9	4	-8	2
p-Level	0.816	1.000	0.484	0.159	0.816	0.359	0.816	0.816	0.816	0.050	0.484	0.084	0.816
Trend										+			
Trend Results for All Data Since Oct. 1997													
Sample Size	24	24	24	18	24	24	24	24	16	24	24	15	32
Mann-Kendall S	-35	53	-231	23	48	51	-229	17	-9	66	12	-33	-305
p-Level	0.404	0.199	0.000	0.410	0.246	0.217	0.000	0.694	0.723	0.108	0.788	0.114	0.000
Trend			-				-						-
MW-1000R													
Trend Results for Most Recent 5 Years													
Sample Size	5	5	5	5	5	5	5	5	5	5	5	5	5
Mann-Kendall S	-1	4	-10	-2	-9	0	-10	0	-8	5	0	-10	-4
p-Level	1	0.484	0.016	0.816	0.05	1	0.016	1	0.084	0.359	1	0.016	0.484
Trend			-		-		-					-	
Trend Results for All Data Since Oct. 1997													
Sample Size	8	8	8	8	8	8	8	8	8	8	8	7	8
Mann-Kendall S	3	13	-10	6	-3	-5	-12	-5	-10	11	-9	-3	-1
p-Level	0.812	0.143	0.276	0.548	0.812	0.634	0.178	0.634	0.276	0.227	0.337	0.772	0.952
Trend													
MW-1010P													
Trend Results for Most Recent 5 Years													
Sample Size	5	5	5	5	5	5	5	5	5	5	5	5	5
Mann-Kendall S	2	0	3	-1	0	0	6	0	4	0	0	-8	-1
p-Level	0.816	1.000	0.650	1.000	1.000	1.000	0.234	1.000	0.484	1.000	1.000	0.084	1.000
Trend													
Trend Results for All Data Since Oct. 1997													
Sample Size	24	24	24	18	24	24	24	24	16	24	24	15	32
Mann-Kendall S	111	-24	178	89	-9	15	183	0	19	-22	-1	-65	72
p-Level	0.006	0.572	0.000	0.000	0.845	0.731	0.000	1.000	0.424	0.606	0.990	0.000	0.252
Trend	+		+	+			+					-	
MW-1002													
Trend Results for Most Recent 5 Years													
Sample Size	5	5	5	5	5	5	5	5	5	5	5	5	5
Mann-Kendall S	-4	0	-4	-4	-4	0	-2	0	-2	0	0	-4	0
p-Level	0.484	1.000	0.484	0.484	0.484	1.000	0.816	1.000	0.816	1.000	1.000	0.484	1.000
Trend													
Trend Results for All Data Since Oct. 1997													
Sample Size	20	20	19	15	20	20	19	20	15	20	20	14	30
Mann-Kendall S	23	-19	30	61	-17	7	41	0	23	-1	-1	31	0
p-Level	0.480	0.564	0.315	0.002	0.608	0.847	0.164	1.000	0.282	0.987	0.987	0.100	1.000
Trend				+									
MW-1002G													
Trend Results for Most Recent 5 Years													
Sample Size	5	5	5	5	5	5	5	5	5	5	5	5	5
Mann-Kendall S	7	0	8	8	0	0	9	0	4	0	0	8	0
p-Level	0.159	1.000	0.084	0.084	1.000	1.000	0.050	1.000	0.484	1.000	1.000	0.084	1.000
Trend							+						
Trend Results for All Data Since Oct. 1997													
Sample Size	20	20	19	15	20	20	19	20	15	20	20	14	30
Mann-Kendall S	126	-19	95	93	0	0	96	0	16	-27	0	65	-19
p-Level	0.000	0.564	0.000	0.000	1.000	1.000	0.000	1.000	0.466	0.404	1.000	0.000	0.750
Trend	+		+	+			+					+	

Trend Analysis Results - Groundwater (Annual Parameters)
Year Ending 2018

	Barium	Cadmium	Calcium	Chloride	Chromium	Lead	Magnesium	Mercury	Potassium	Selenium	Silver	Sodium	Zinc
MW-1004													
Trend Results for Most Recent 5 Years													
Sample Size	5	5	5	5	5	5	5	5	5	5	5	5	5
Mann-Kendall S	0	0	4	5	3	0	4	0	1	0	0	-2	0
p-Level	1	1	0.484	0.359	0.65	1	0.484	1	1	1	1	0.816	1
Trend													
Trend Results for All Data Since Oct. 1997													
Sample Size	8	8	8	8	8	8	8	8	8	8	8	7	8
Mann-Kendall S	-1	0	-11	14	-9	3	-12	0	-5	3	-3	-13	3
p-Level	0.952	1	0.227	0.108	0.337	0.812	0.178	1	0.634	0.812	0.812	0.07	0.812
Trend													
MW-1004S													
Trend Results for Most Recent 5 Years													
Sample Size	5	5	5	5	5	5	5	5	5	5	5	5	5
Mann-Kendall S	-4	0	-4	-10	-2	0	-6	0	-4	0	0	-10	0
p-Level	0.484	1.000	0.484	0.016	0.816	1.000	0.234	1.000	0.484	1.000	1.000	0.016	1.000
Trend				-								-	
Trend Results for All Data Since Oct. 1997													
Sample Size	22	22	22	16	22	22	22	22	16	22	22	15	31
Mann-Kendall S	64	-19	68	-57	-5	22	55	0	-28	2	0	-51	0
p-Level	0.075	0.616	0.058	0.010	0.912	0.559	0.128	1.000	0.228	0.978	1.000	0.012	1.000
Trend				-									
MW-1004P													
Trend Results for Most Recent 5 Years													
Sample Size	5	5	5	5	5	5	5	5	5	5	5	5	5
Mann-Kendall S	0	0	8	4	0	0	5	0	2	0	0	-8	0
p-Level	1.000	1.000	0.084	0.484	1.000	1.000	0.359	1.000	0.816	1.000	1.000	0.084	1.000
Trend													
Trend Results for All Data Since Oct. 1997													
Sample Size	22	22	22	16	22	22	22	22	16	22	22	15	31
Mann-Kendall S	79	-14	70	27	-41	0	46	0	11	3	0	-17	6
p-Level	0.026	0.717	0.051	0.247	0.262	1.000	0.208	1.000	0.658	0.956	1.000	0.436	0.933
Trend													
MW-1005													
Trend Results for Most Recent 5 Years													
Sample Size	5	5	5	5	5	5	5	5	5	5	5	5	5
Mann-Kendall S	10	0	10	10	-3	0	10	0	6	0	0	8	0
p-Level	0.016	1.000	0.016	0.016	0.650	1.000	0.016	1.000	0.234	1.000	1.000	0.084	1.000
Trend	+		+	+			+						
Trend Results for All Data Since Oct. 1997													
Sample Size	20	20	19	15	20	20	19	20	15	20	20	14	30
Mann-Kendall S	85	13	59	57	-54	9	64	0	59	0	-7	66	25
p-Level	0.005	0.701	0.042	0.004	0.086	0.798	0.026	1.000	0.002	1.000	0.847	0.000	0.672
Trend	+			+					+			+	
MW-1005S													
Trend Results for Most Recent 5 Years													
Sample Size	5	5	5	5	5	5	5	5	5	5	5	5	5
Mann-Kendall S	-8	2	-6	4	0	2	-7	0	-2	2	2	-10	0
p-Level	0.084	0.816	0.234	0.484	1.000	0.816	0.159	1.000	0.816	0.816	0.816	0.016	1.000
Trend												-	
Trend Results for All Data Since Oct. 1997													
Sample Size	20	20	19	15	20	20	19	20	15	20	20	14	30
Mann-Kendall S	13	17	-6	33	-6	23	4	0	-15	0	15	-46	0
p-Level	0.701	0.608	0.863	0.114	0.872	0.480	0.918	1.000	0.496	1.000	0.654	0.012	1.000
Trend													

Trend Analysis Results - Groundwater (Annual Parameters)
Year Ending 2018

	Barium	Cadmium	Calcium	Chloride	Chromium	Lead	Magnesium	Mercury	Potassium	Selenium	Silver	Sodium	Zinc
MW-1005P													
Trend Results for Most Recent 5 Years													
Sample Size	5	5	5	5	5	5	5	5	5	5	5	5	5
Mann-Kendall S	2	0	2	-6	0	0	1	0	2	0	0	-6	0
p-Level	0.816	1.000	0.816	0.234	1.000	1.000	1.000	1.000	0.816	1.000	1.000	0.234	1.000
Trend													
Trend Results for All Data Since Oct. 1997													
Sample Size	20	20	20	15	20	20	20	20	15	20	20	14	30
Mann-Kendall S	43	-26	15	36	-15	28	40	0	16	-1	0	24	3
p-Level	0.175	0.422	0.654	0.083	0.654	0.386	0.208	1.000	0.466	0.987	1.000	0.213	0.972
Trend													
MW-1015A													
Trend Results for Most Recent 5 Years													
Sample Size	5	5	5	5	5	5	5	5	5	5	5	5	5
Mann-Kendall S	-1	0	4	1	0	0	4	0	-5	0	0	-9	0
p-Level	1.000	1.000	0.484	1.000	1.000	1.000	0.484	1.000	0.359	1.000	1.000	0.050	1.000
Trend												-	
Trend Results for All Data Since Oct. 1997													
Sample Size	29	29	19	14	29	29	19	29	14	29	29	13	34
Mann-Kendall S	-338	23	22	30	24	33	49	0	-44	16	-20	1	0
p-Level	0.000	0.682	0.468	0.113	0.668	0.552	0.094	1.000	0.017	0.780	0.724	1.000	1.000
Trend	-												
MW-1015B													
Trend Results for Most Recent 5 Years													
Sample Size	5	5	5	5	5	5	5	5	5	5	5	5	5
Mann-Kendall S	4	4	2	6	0	0	2	0	2	0	0	2	0
p-Level	0.484	0.484	0.816	0.234	1.000	1.000	0.816	1.000	0.816	1.000	1.000	0.816	1.000
Trend													
Trend Results for All Data Since Oct. 1997													
Sample Size	29	29	19	14	29	29	19	29	14	29	29	13	34
Mann-Kendall S	-3	28	82	30	29	23	99	0	12	8	0	45	0
p-Level	0.971	0.616	0.004	0.113	0.603	0.682	0.000	1.000	0.554	0.896	1.000	0.005	1.000
Trend			+				+					+	
MW-1013													
Trend Results for Most Recent 5 Years													
Sample Size	5	5	5	5	5	5	5	5	5	5	5	5	5
Mann-Kendall S	0	0	-1	-4	5	4	-4	0	-2	7	0	-7	-2
p-Level	1.000	1.000	1.000	0.484	0.359	0.484	0.484	1.000	0.816	0.159	1.000	0.159	0.816
Trend													
Trend Results for All Data Since Oct. 1997													
Sample Size	14	14	14	14	14	14	14	14	13	14	14	12	14
Mann-Kendall S	-5	1	10	-67	50	-24	33	0	-6	24	3	-28	7
p-Level	0.830	1.000	0.629	0.000	0.005	0.213	0.080	1.000	0.766	0.213	0.914	0.062	0.748
Trend				-	+								
MW-1013A													
Trend Results for Most Recent 5 Years													
Sample Size	5	5	5	5	5	5	5	5	5	5	5	5	5
Mann-Kendall S	-6	4	-7	4	-2	0	-6	0	-2	0	0	7	0
p-Level	0.234	0.484	0.159	0.484	0.816	1.000	0.234	1.000	0.816	1.000	1.000	0.159	1.000
Trend													
Trend Results for All Data Since Oct. 1997													
Sample Size	14	14	14	14	14	14	14	14	13	14	14	12	14
Mann-Kendall S	-12	13	-13	0	7	-13	-9	0	7	0	-5	-1	-13
p-Level	0.554	0.518	0.518	1.000	0.748	0.518	0.668	1.000	0.721	1.000	0.830	0.973	0.518
Trend													

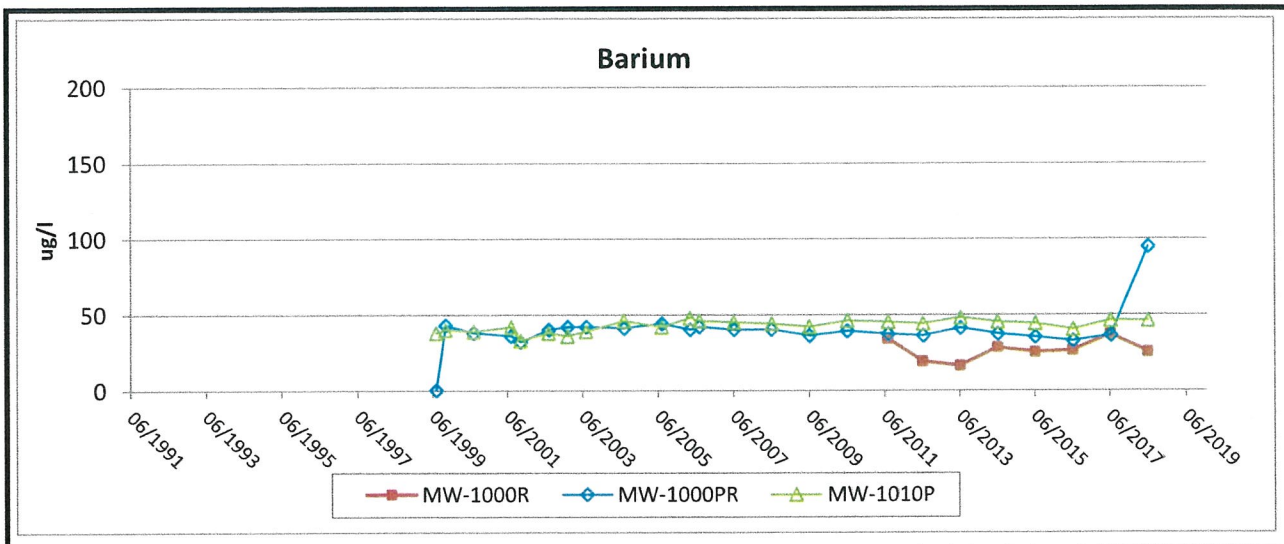
Trend Analysis Results - Groundwater (Annual Parameters)
Year Ending 2018

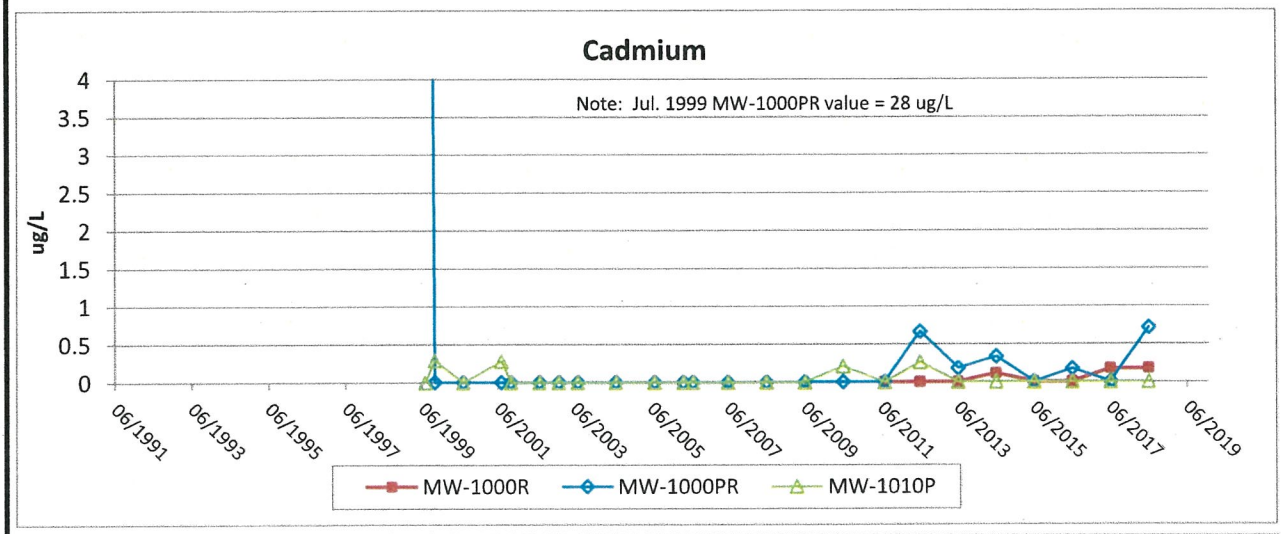
	Barium	Cadmium	Calcium	Chloride	Chromium	Lead	Magnesium	Mercury	Potassium	Selenium	Silver	Sodium	Zinc
MW-1013B													
Trend Results for Most Recent 5 Years													
Sample Size	5	5	5	5	5	5	5	5	5	5	5	5	5
Mann-Kendall S	0	-3	-7	2	2	0	-4	-2	-4	3	0	-3	-6
p-Level	1.000	0.650	0.159	0.816	0.816	1.000	0.484	0.816	0.484	0.650	1.000	0.650	0.234
Trend													
Trend Results for All Data Since Oct. 1997													
Sample Size	26	26	27	21	26	26	27	26	19	26	26	18	34
Mann-Kendall S	137	63	-73	40	-55	36	-114	19	-44	38	-33	-65	254
p-Level	0.002	0.174	0.134	0.242	0.236	0.445	0.017	0.694	0.134	0.419	0.484	0.014	0.000
Trend	+												+
MW-1013C													
Trend Results for Most Recent 5 Years													
Sample Size	5	5	5	5	5	5	5	5	5	5	5	5	5
Mann-Kendall S	-2	0	-7	-6	0	5	-7	4	-4	0	4	-3	2
p-Level	0.816	1.000	0.159	0.234	1.000	0.359	0.159	0.484	0.484	1.000	0.484	0.650	0.816
Trend													
Trend Results for All Data Since Oct. 1997													
Sample Size	26	26	27	21	26	26	27	26	19	26	26	18	34
Mann-Kendall S	129	-17	-47	68	-25	81	-148	25	-9	-25	-9	-76	-266
p-Level	0.004	0.726	0.340	0.042	0.600	0.078	0.002	0.600	0.782	0.600	0.862	0.003	0.000
Trend	+						-					-	-
MW-1014													
Trend Results for Most Recent 5 Years													
Sample Size	5	5	5	5	5	5	5	5	5	5	5	5	5
Mann-Kendall S	2	0	7	6	0	0	8	0	8	0	0	10	-6
p-Level	0.816	1.000	0.159	0.234	1.000	1.000	0.084	1.000	0.084	1.000	1.000	0.016	0.234
Trend												+	
Trend Results for All Data Since Oct. 1997													
Sample Size	14	14	14	14	14	14	14	14	13	14	14	12	14
Mann-Kendall S	16	0	-9	67	9	1	0	0	-24	-3	-5	-15	-7
p-Level	0.419	1.000	0.668	0.000	0.668	1.000	1.000	1.000	0.164	0.914	0.830	0.345	0.748
Trend				+									
MW-1014A													
Trend Results for Most Recent 5 Years													
Sample Size	5	5	5	5	5	5	5	5	5	5	5	5	5
Mann-Kendall S	-4	0	0	9	-7	0	0	0	0	0	0	-8	-4
p-Level	0.484	1.000	1.000	0.050	0.159	1.000	1.000	1.000	1.000	1.000	1.000	0.084	0.484
Trend				+									
Trend Results for All Data Since Oct. 1997													
Sample Size	23	23	24	18	23	23	24	23	16	23	23	15	31
Mann-Kendall S	12	10	-74	0	-7	14	-60	0	-24	15	-9	-3	140
p-Level	0.774	0.814	0.070	1.000	0.876	0.734	0.144	1.000	0.306	0.714	0.834	0.922	0.017
Trend													
MW-1014B													
Trend Results for Most Recent 5 Years													
Sample Size	5	5	5	5	5	5	5	5	5	5	5	5	5
Mann-Kendall S	-8	-4	0	-4	-7	0	-4	4	-3	5	0	-2	-2
p-Level	0.084	0.484	1.000	0.484	0.159	1.000	0.484	0.484	0.650	0.359	1.000	0.816	0.816
Trend													
Trend Results for All Data Since Oct. 1997													
Sample Size	26	26	27	20	26	26	27	26	19	26	26	18	34
Mann-Kendall S	127	-182	-158	84	-12	65	-209	25	-45	-3	-5	-79	-373
p-Level	0.004	0.000	0.000	0.006	0.811	0.160	0.000	0.600	0.124	0.966	0.930	0.002	0.000
Trend	+	-	-	+			-					-	-

Trend Analysis Results - Groundwater (Annual Parameters)
Year Ending 2018

	Barium	Cadmium	Calcium	Chloride	Chromium	Lead	Magnesium	Mercury	Potassium	Selenium	Silver	Sodium	Zinc
MW-1014C													
Trend Results for Most Recent 5 Years													
Sample Size	5	5	5	5	5	5	5	5	5	5	5	5	5
Mann-Kendall S	0	0	5	2	0	0	6	-4	-3	0	0	6	-3
p-Level	1.000	1.000	0.359	0.816	1.000	1.000	0.234	0.484	0.650	1.000	1.000	0.234	0.650
Trend													
Trend Results for All Data Since Oct. 1997													
Sample Size	26	26	27	21	26	26	27	26	19	26	26	18	34
Mann-Kendall S	205	15	-262	147	-31	5	-279	17	-61	-45	1	-22	-535
p-Level	0.000	0.760	0.000	0.000	0.512	0.930	0.000	0.726	0.034	0.336	1.000	0.432	0.000
Trend	+		-	+			-						-

Notes: Overall increasing trend denoted by "+".
Overall decreasing trend denoted by "-"
Long term trend tests performed at a Type I (two-tailed) error rate of 0.01.
5-Year Trend tests performed at a Type I (two-tailed) error rate of 0.05.
N/A - No trend test performed due to insufficient data.





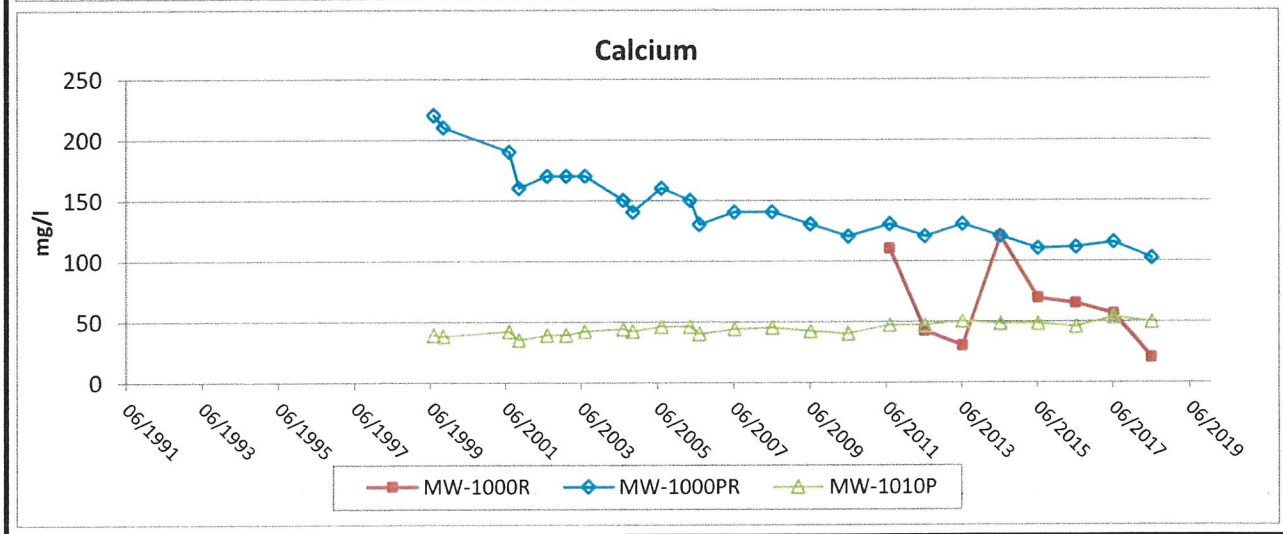


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Figure B-8a

Groundwater Trend Graphs - Annual Results

MW-1000R/MW-1000PR/MW-1010P

Scale: NA	Date: January 2019	
Prepared By: SGL	Checked By: SVF	Project: 17F777.18

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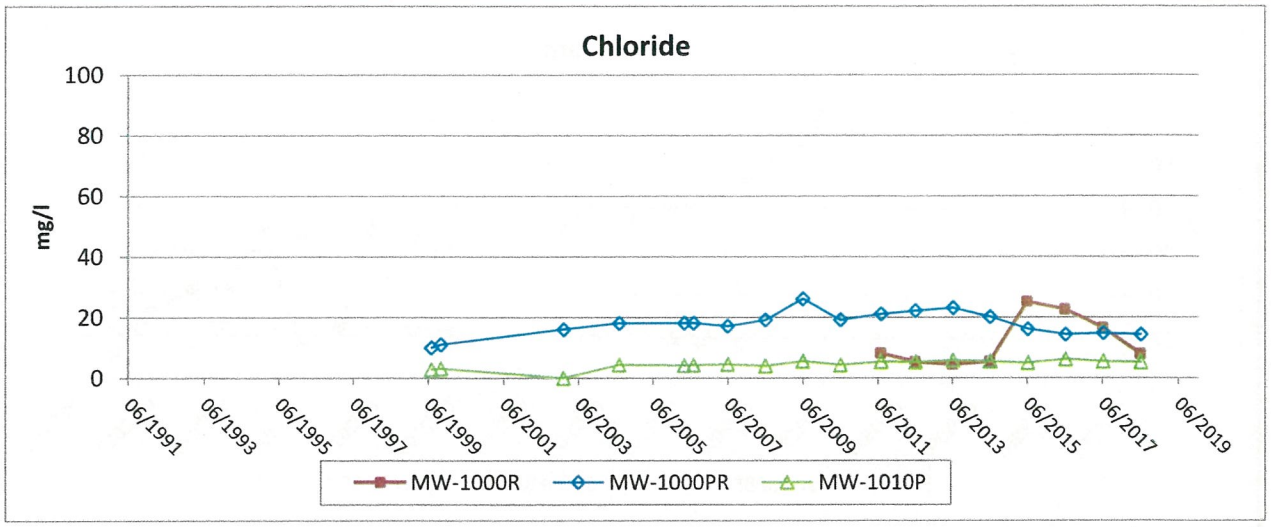

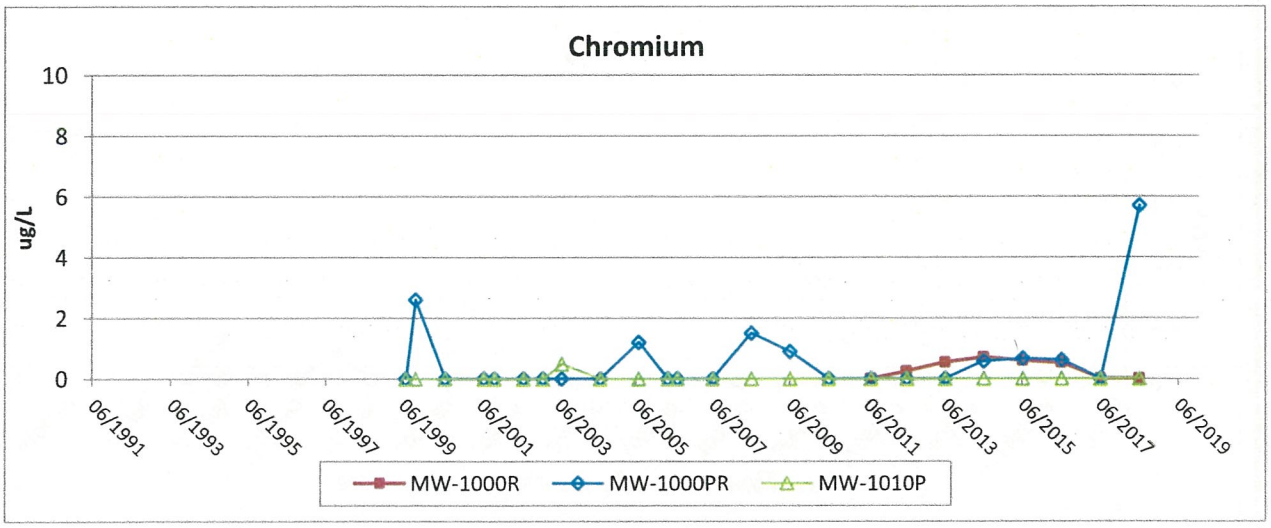

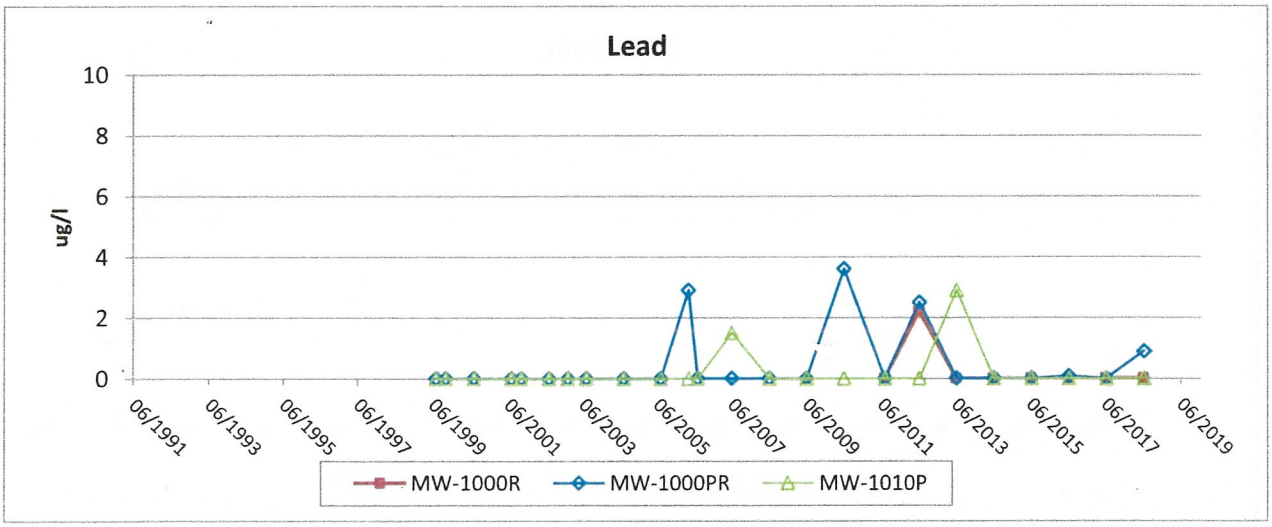

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FLAMBEAU MINING COMPANY

Figure B-8b

Groundwater Trend Graphs - Annual Results

MW-1000R/MW-1000PR/MW-1010P

Scale: NA	Date: January 2019	
Prepared By: SGL	Checked By: SVF	Project: 17F777.18

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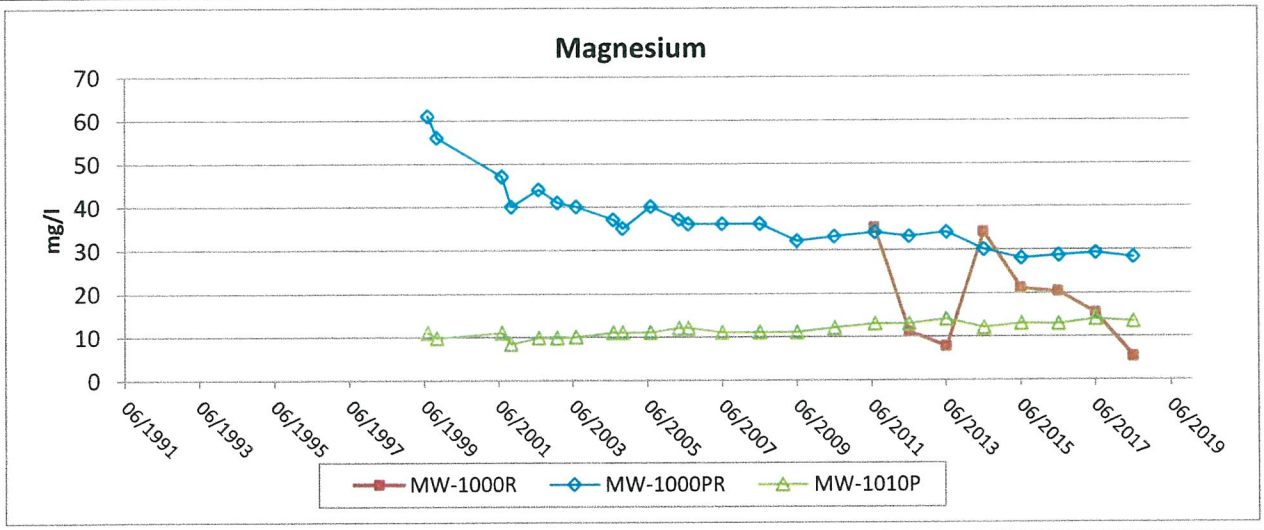

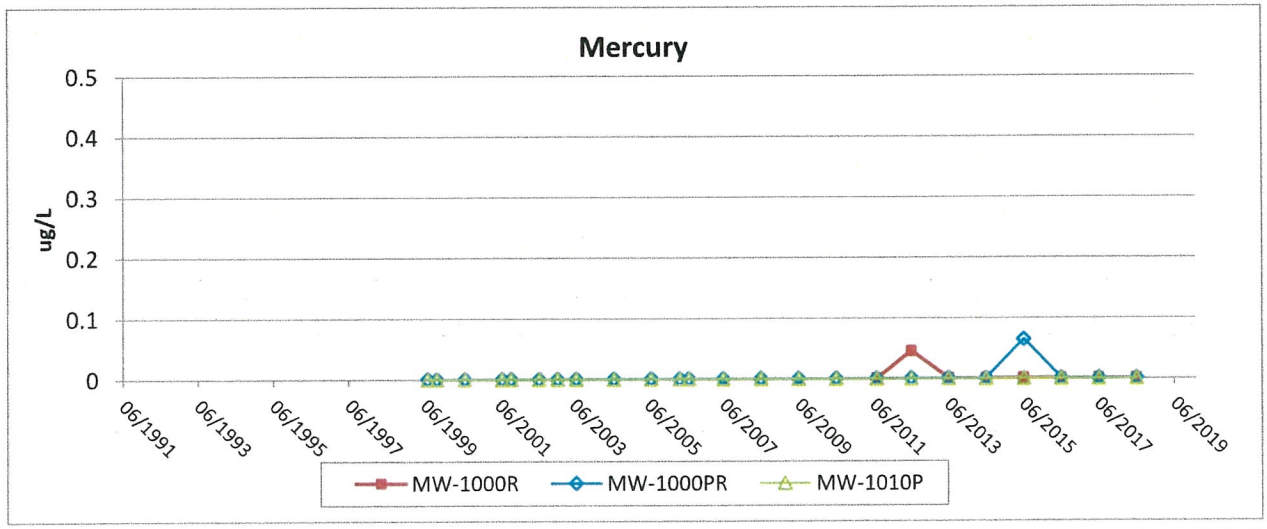

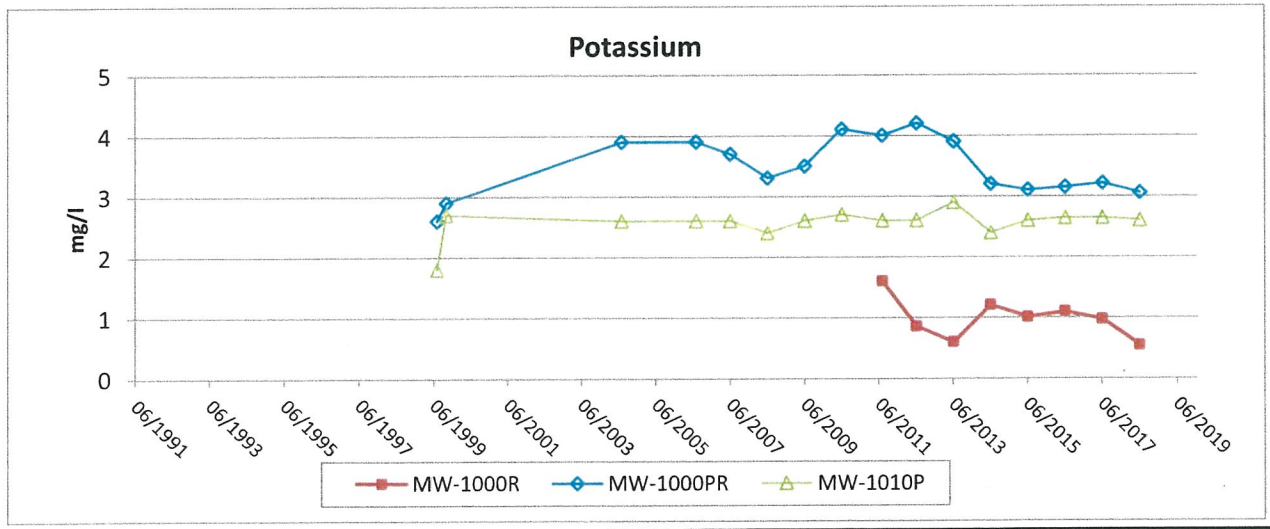

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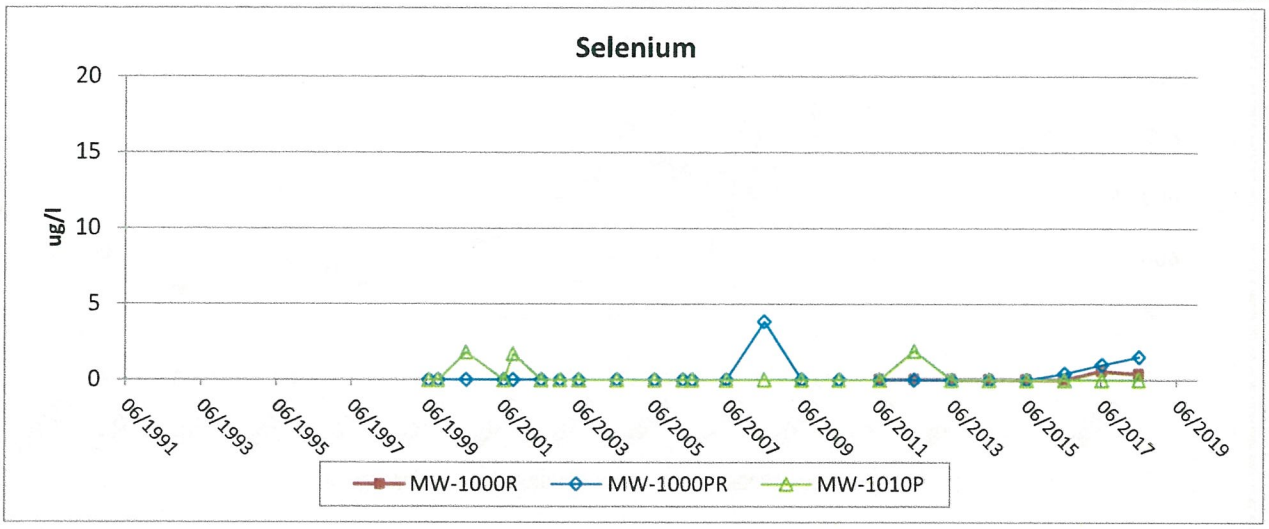
FLAMBEAU MINING COMPANY

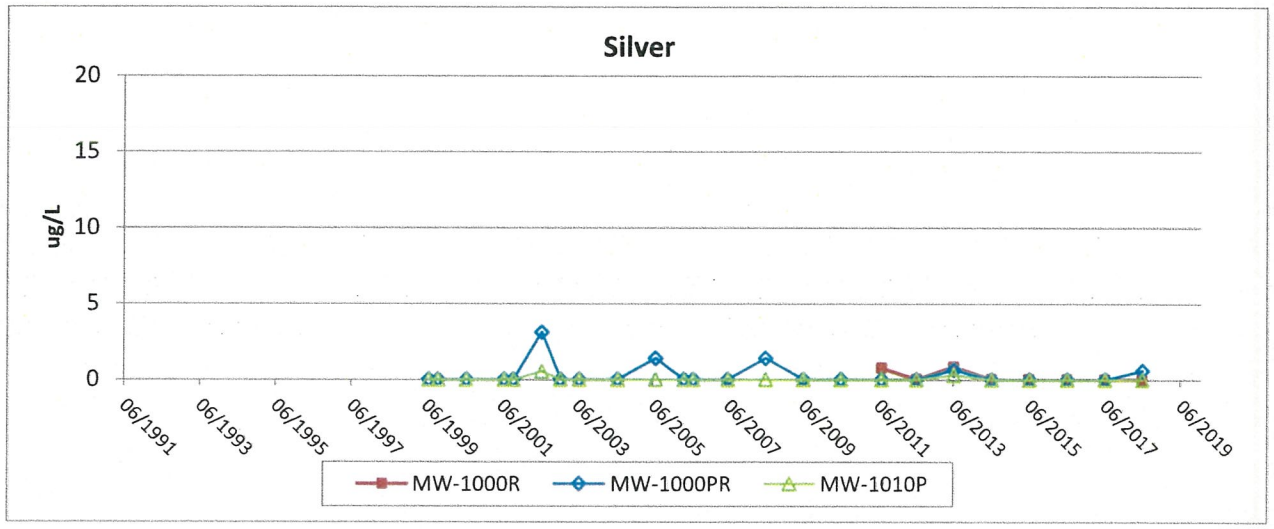
Figure B-8c

Groundwater Trend Graphs - Annual Results

MW-1000R/MW-1000PR/MW-1010P

Scale: NA	Date: January 2019	
Prepared By: SGL	Checked By: SVF	Project: 17F777.18





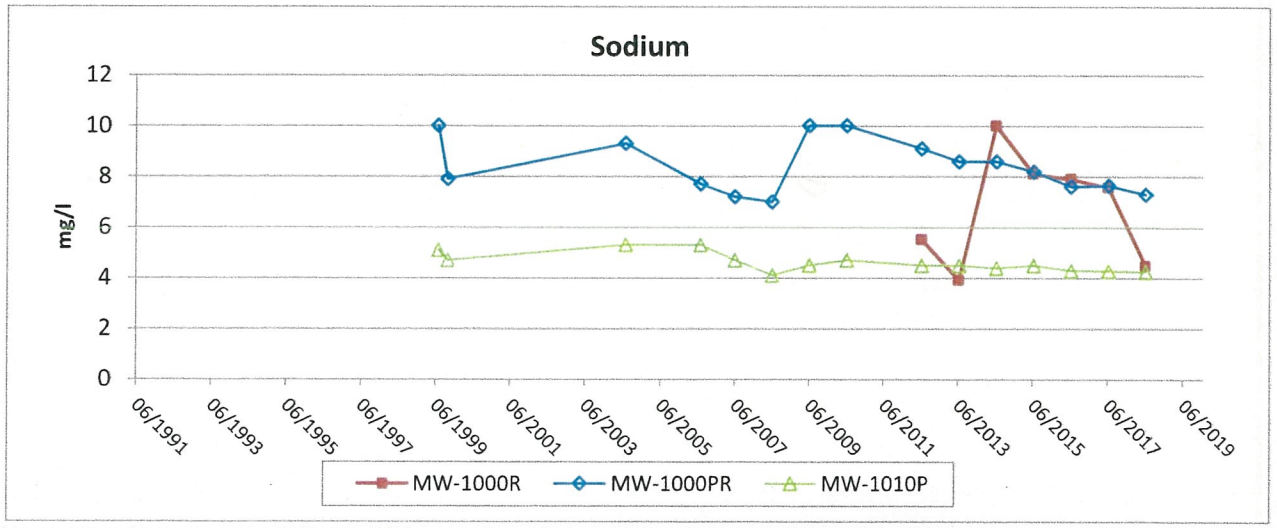


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Figure B-8d

Groundwater Trend Graphs - Annual Results

MW-1000R/MW-1000PR/MW-1010P

Scale: NA	Date: January 2019	
Prepared By: SGL	Checked By: SVF	Project: 17F777.18

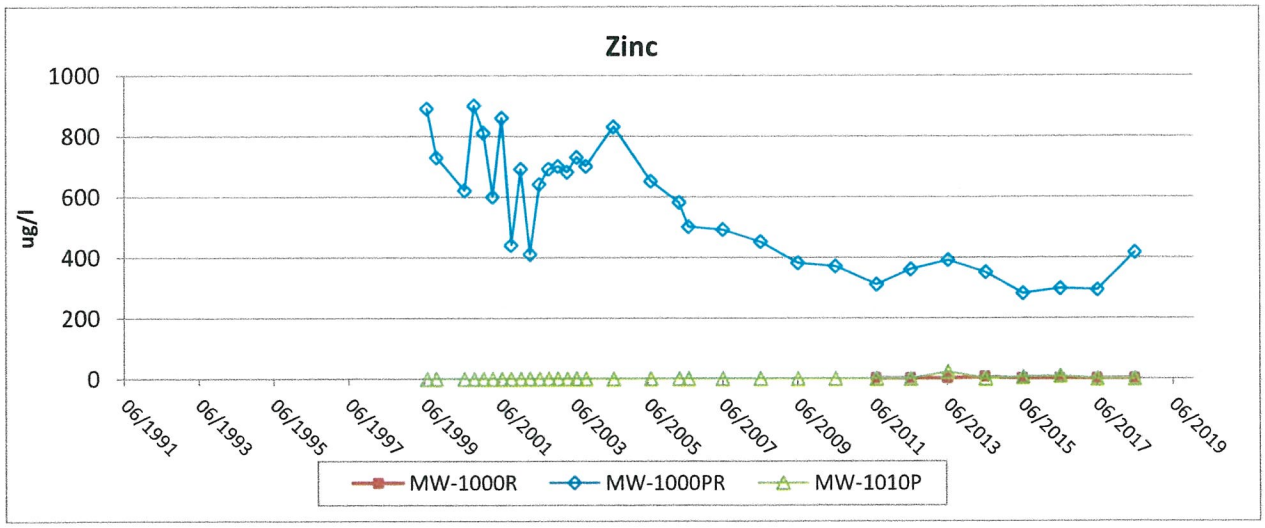

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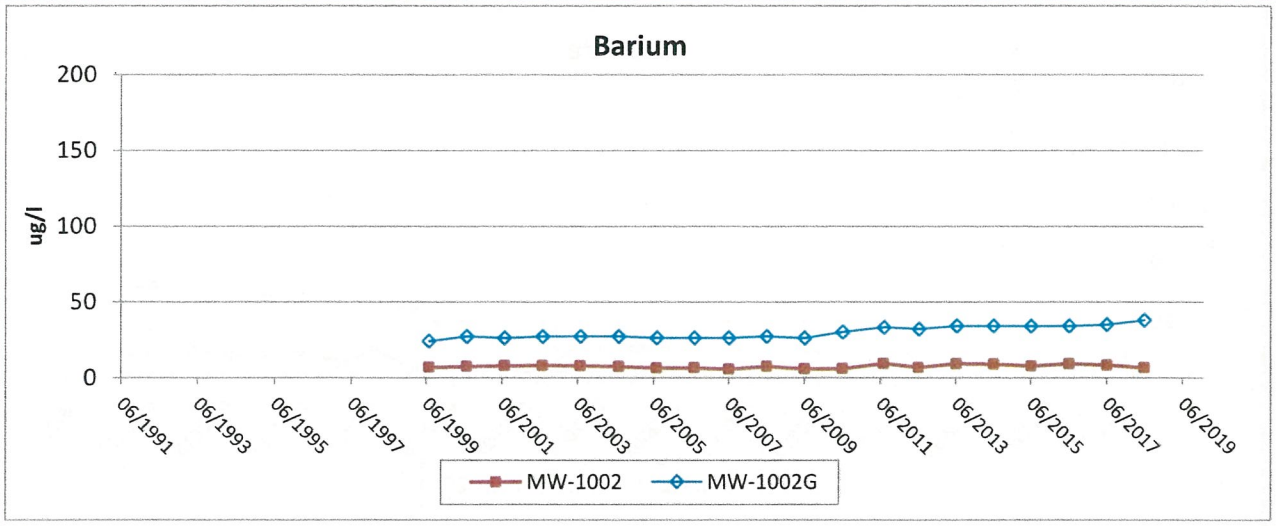
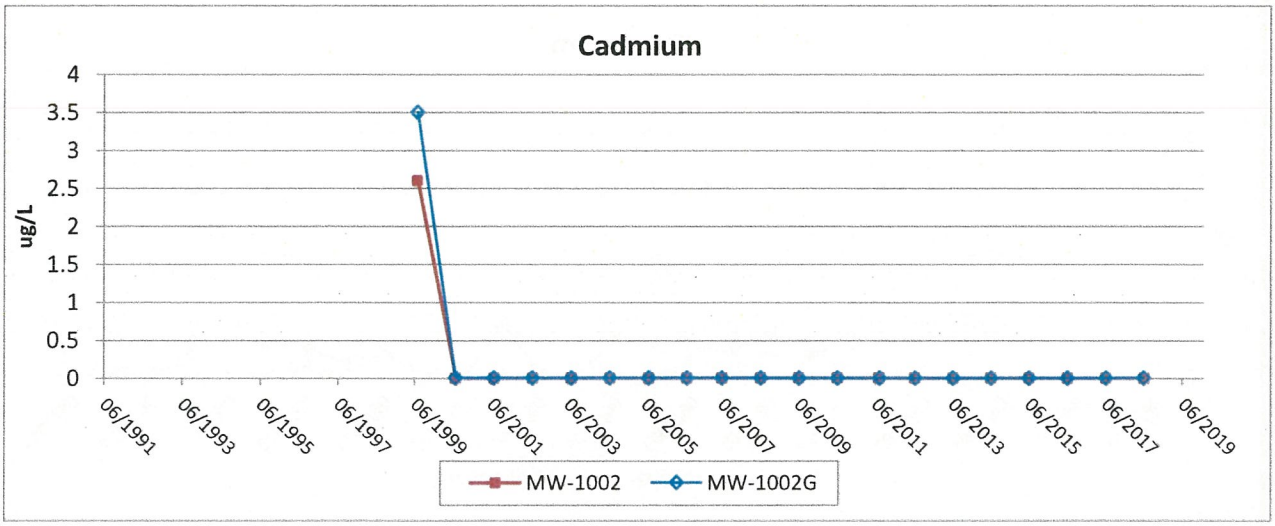
Figure B-8e

Groundwater Trend Graphs - Annual Results

MW-1000R/MW-1000PR/MW-1010P

Scale: NA	Date: January 2019	
Prepared By: SGL	Checked By: SVF	Project: 17F777.18





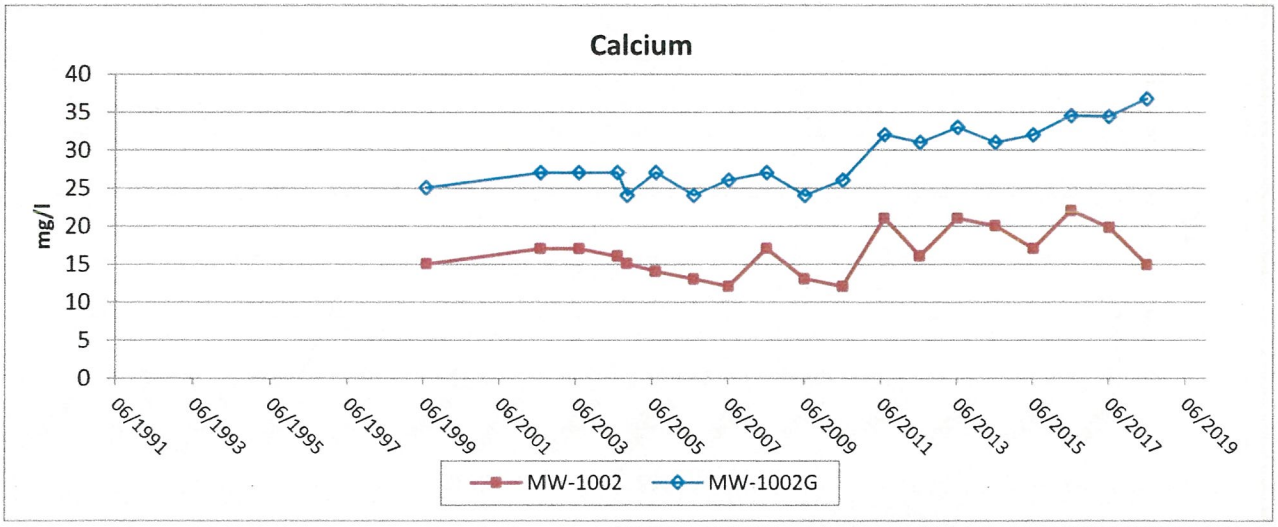


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Figure B-9a

Groundwater Trend Graphs - Annual Results

MW-1002/MW-1002G

Scale: NA	Date: January 2019	
Prepared By: SGL	Checked By: SVF	Project: 17F777.18

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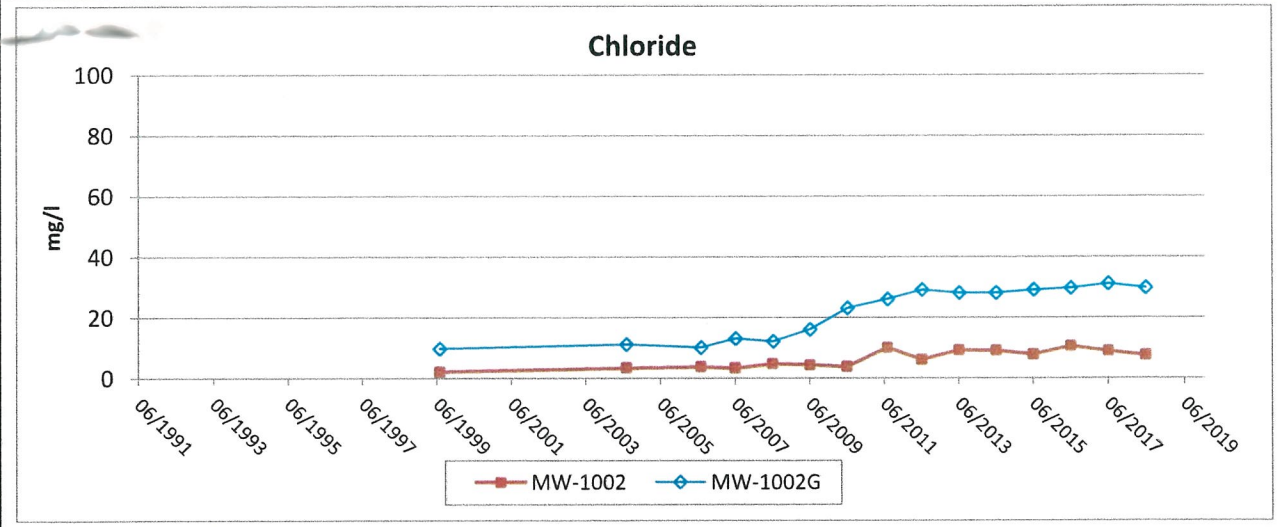

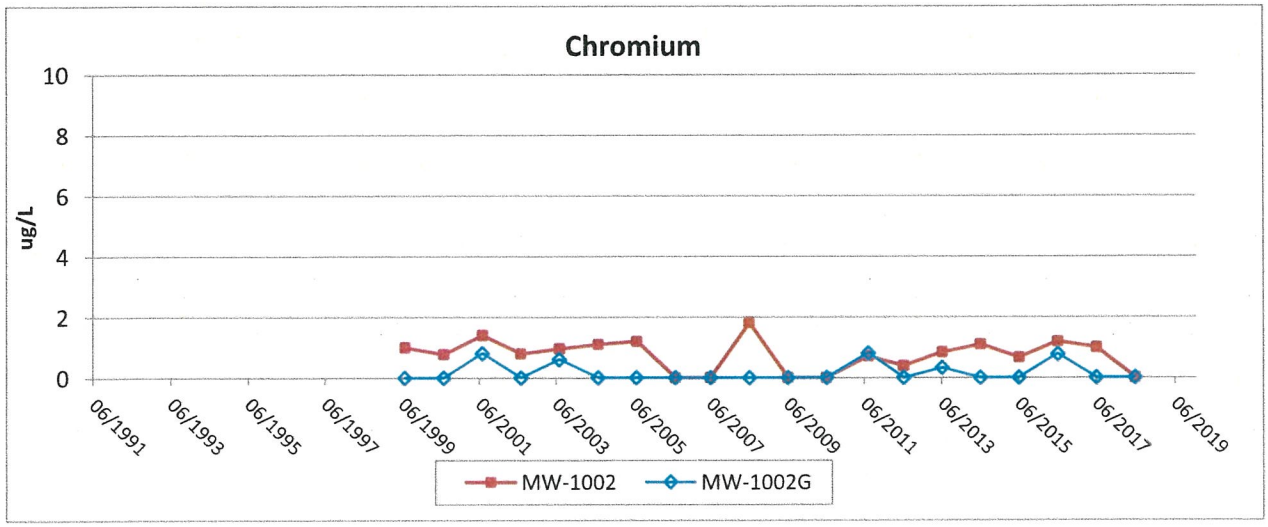

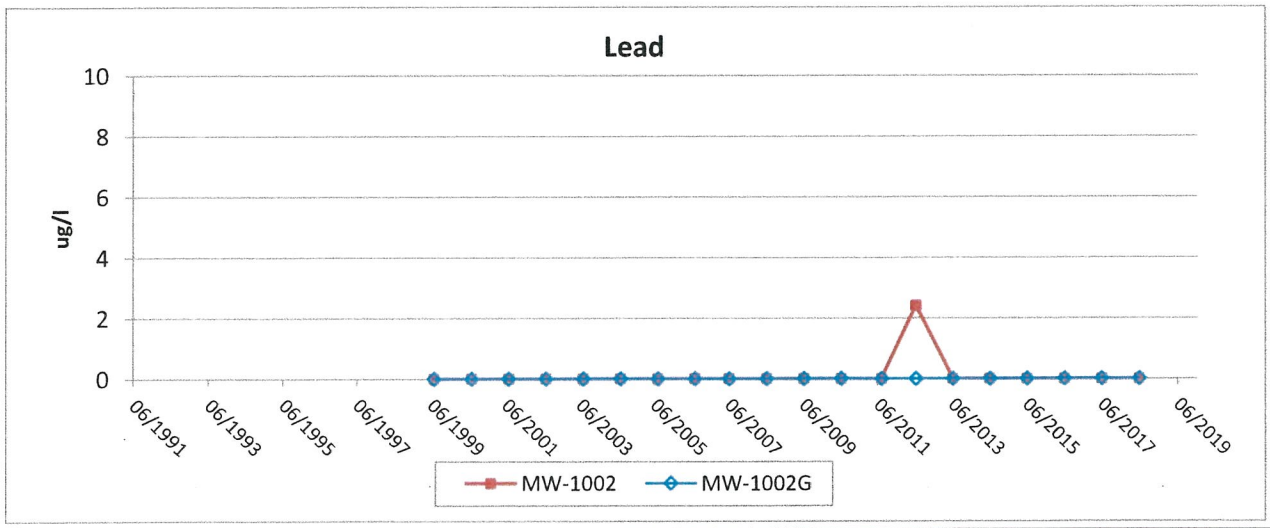

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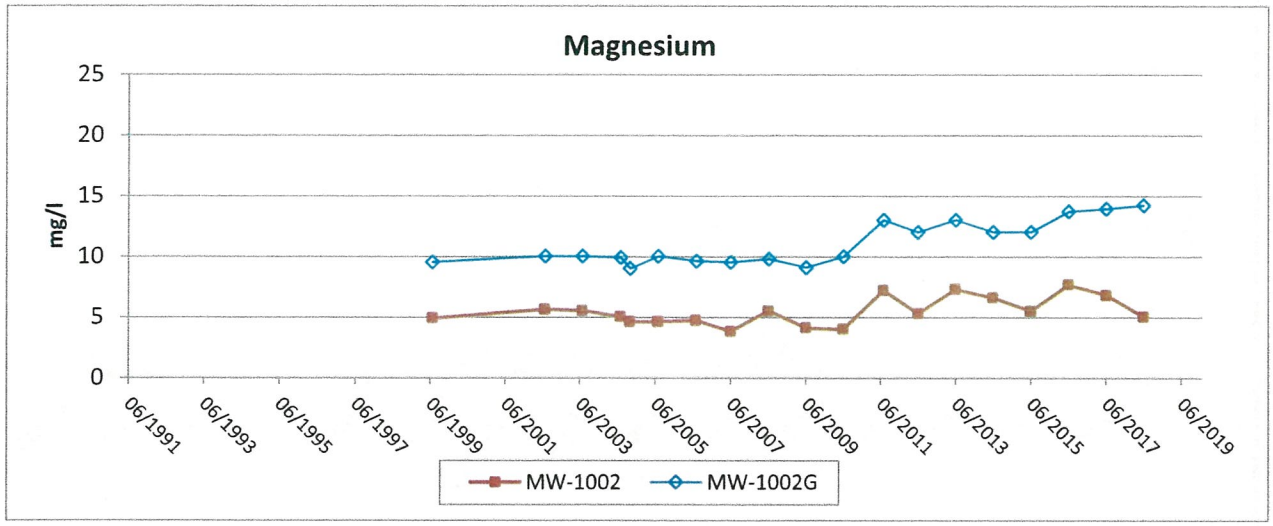
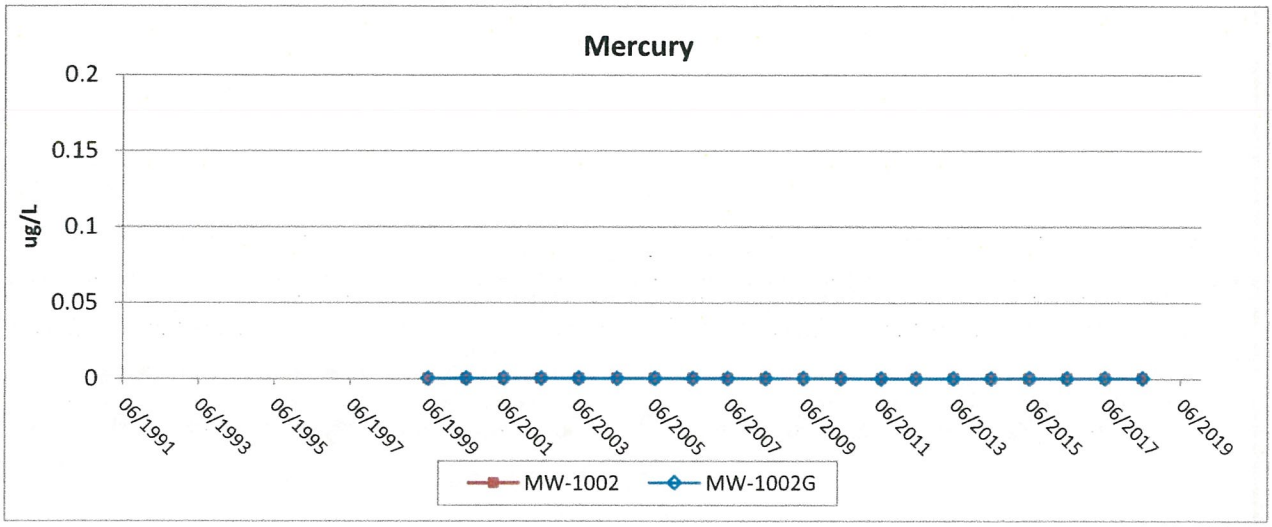
Figure B-9b

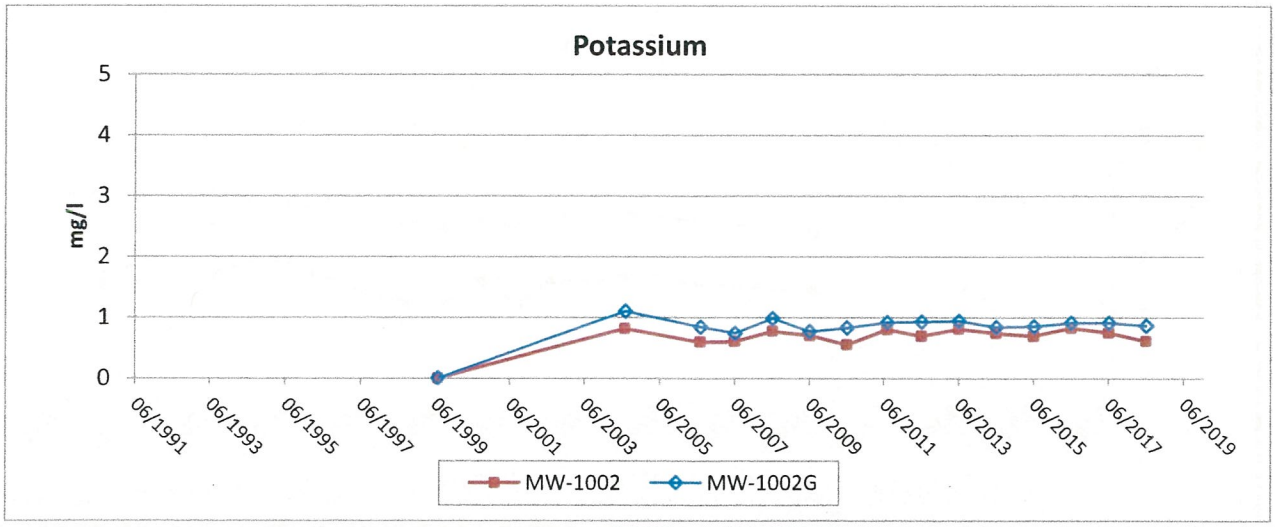
Groundwater Trend Graphs - Annual Results

MW-1002/MW-1002G

Scale: NA	Date: January 2019	
Prepared By: SGL	Checked By: SVF	Project: 17F777.18







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FLAMBEAU MINING COMPANY

Figure B-9c

Groundwater Trend Graphs - Annual Results

MW-1002/MW-1002G

Scale: NA	Date: January 2019	
Prepared By: SGL	Checked By: SVF	Project: 17F777.18

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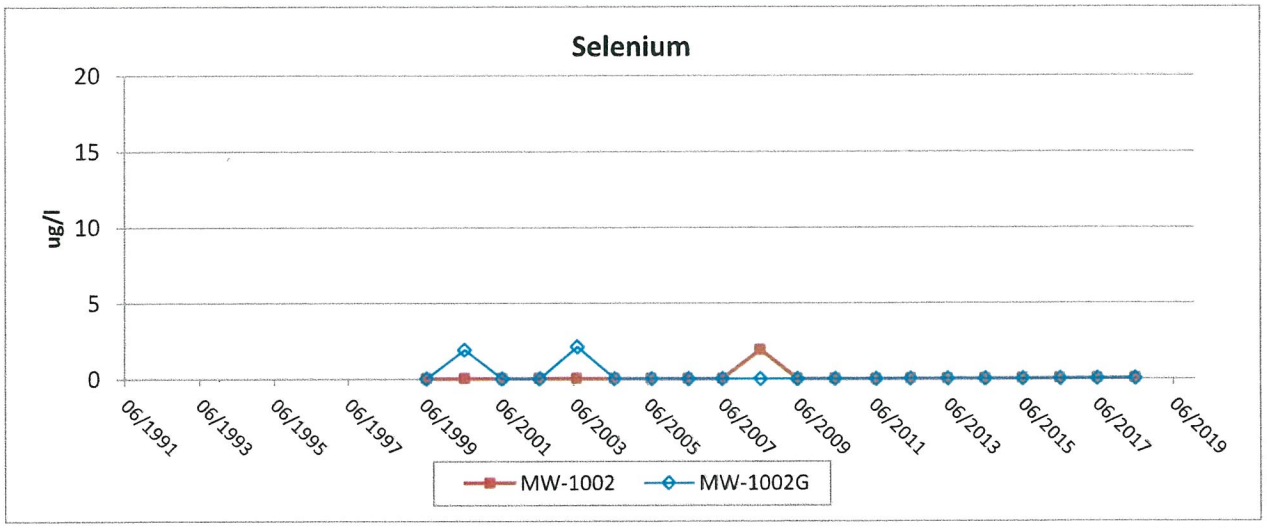

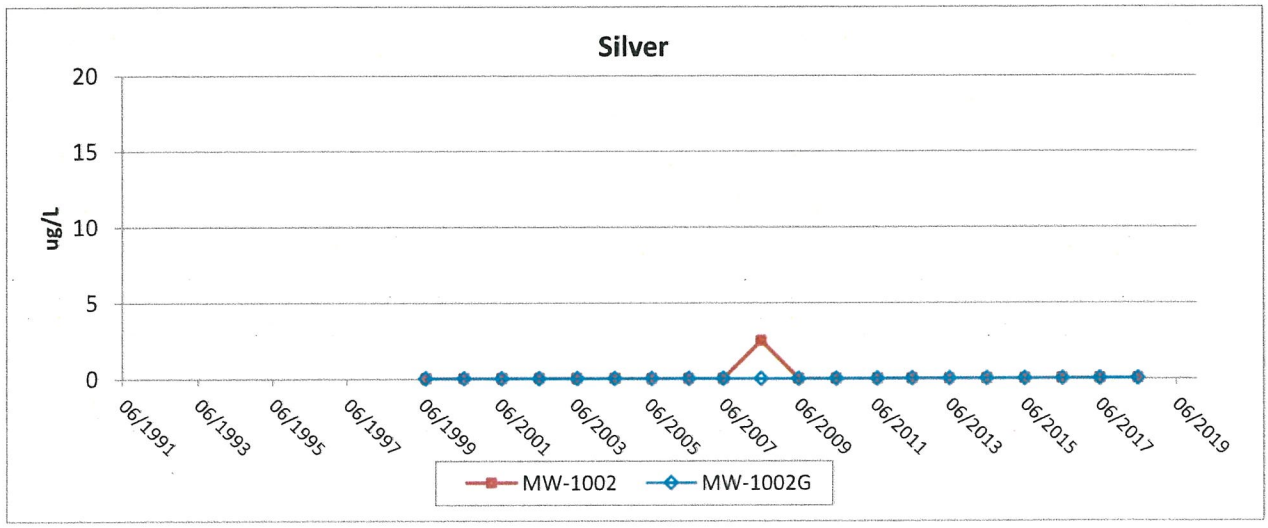

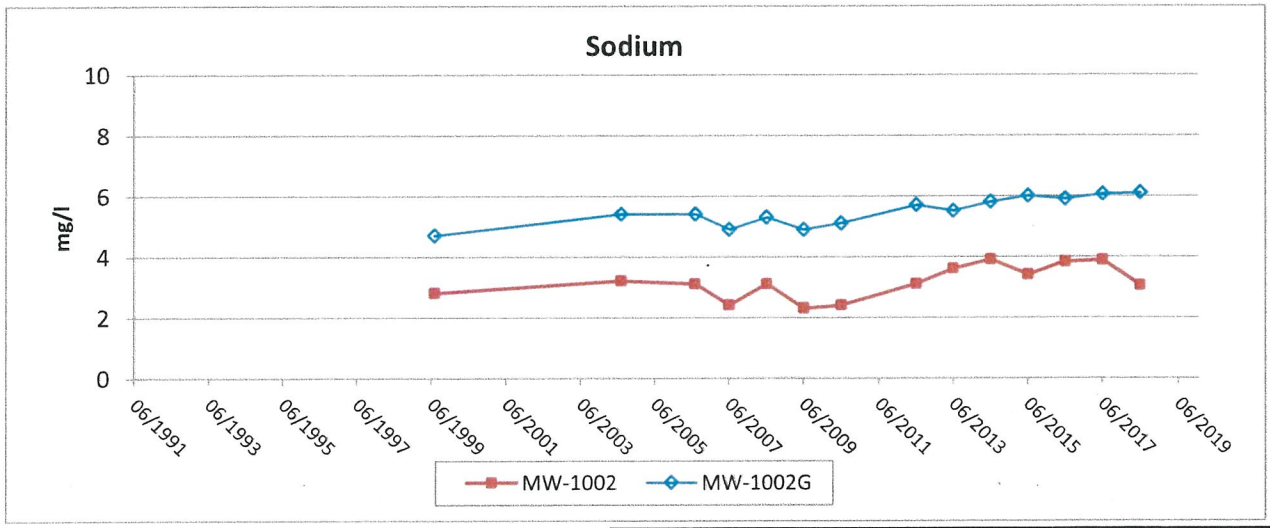

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Figure B-9d

Groundwater Trend Graphs - Annual Results

MW-1002/MW-1002G

Scale: NA	Date: January 2019	
Prepared By: SGL	Checked By: SVF	Project: 17F777.18

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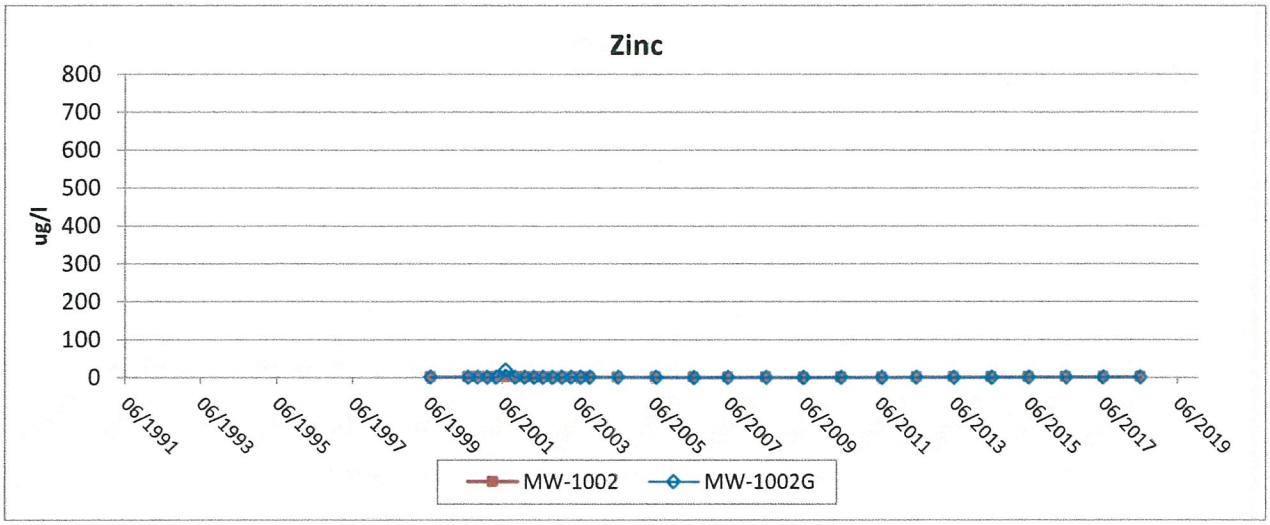

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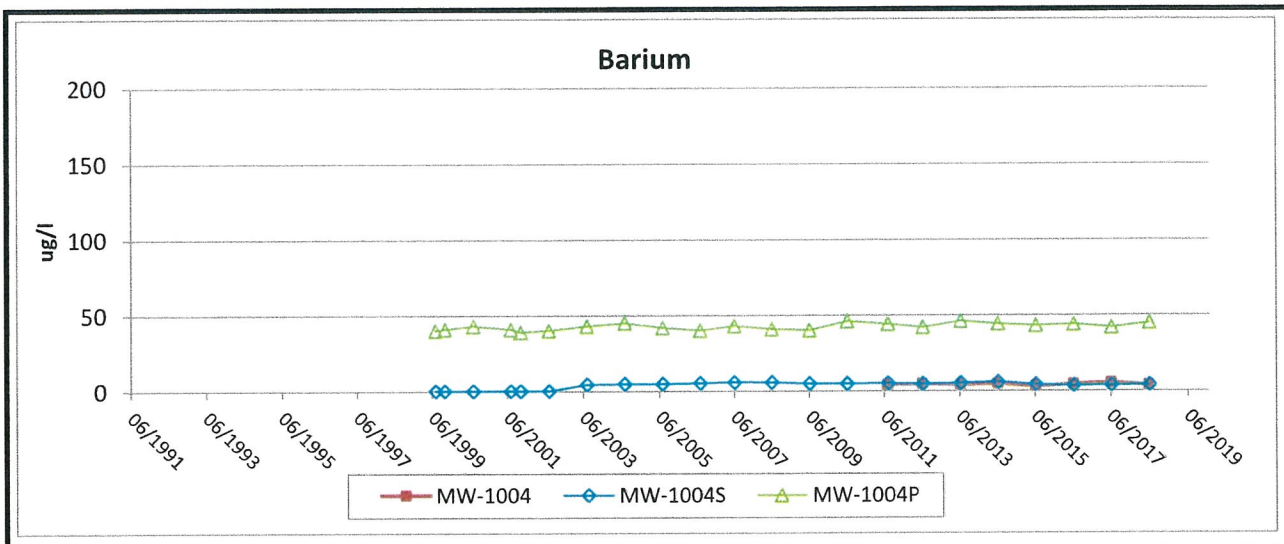
FLAMBEAU MINING COMPANY

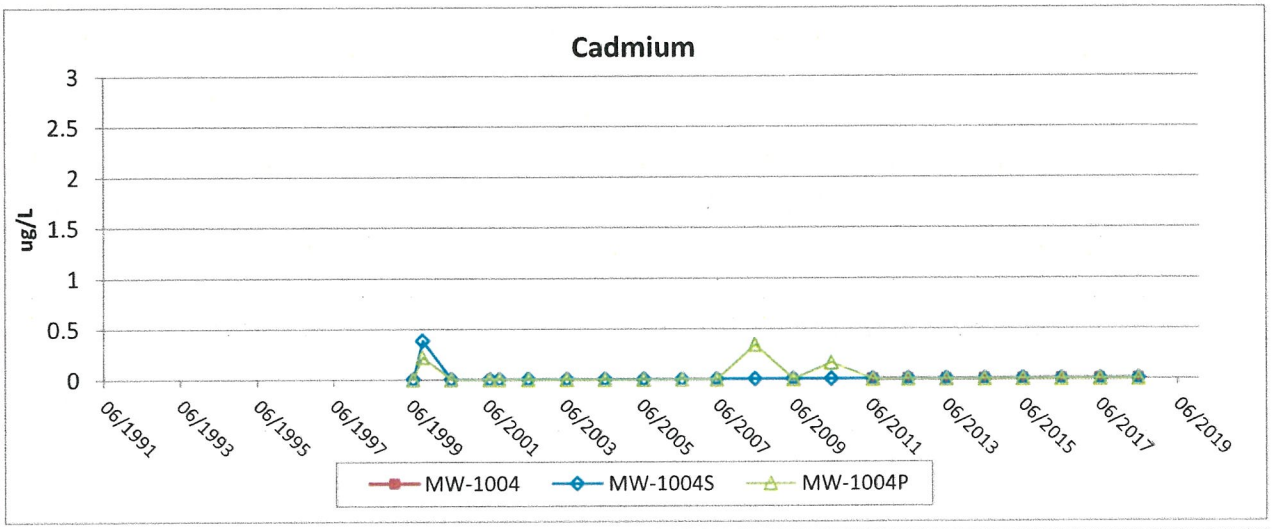
Figure B-9e

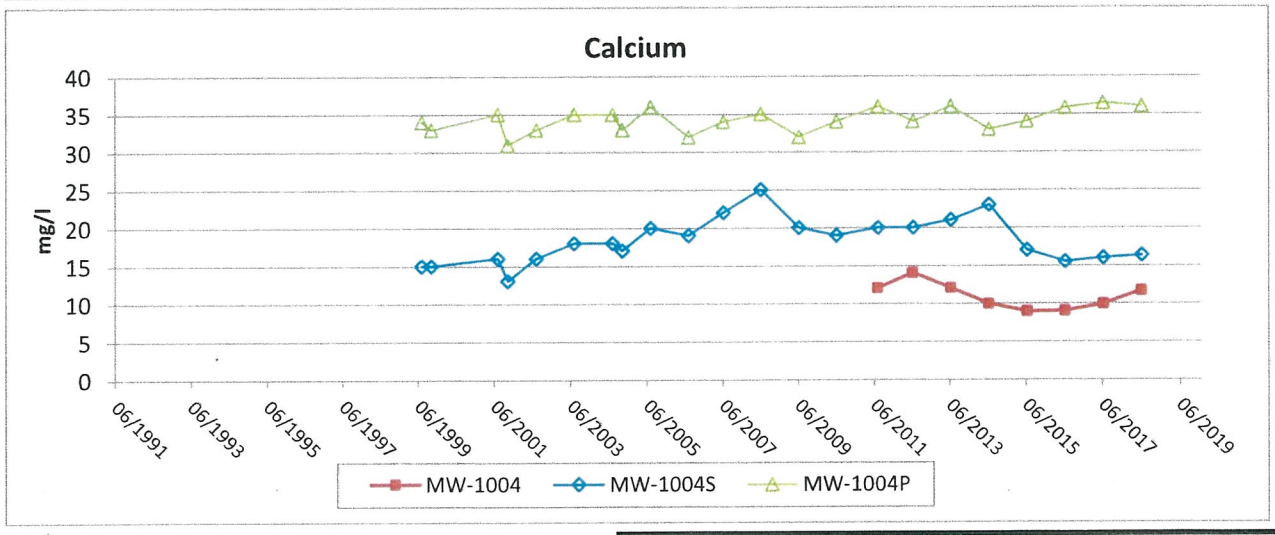
Groundwater Trend Graphs - Annual Results

MW-1002/MW-1002G

Scale: NA	Date: January 2019	
Prepared By: SGL	Checked By: SVF	Project: 17F777.18







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Foth Infrastructure & Environment, LLC

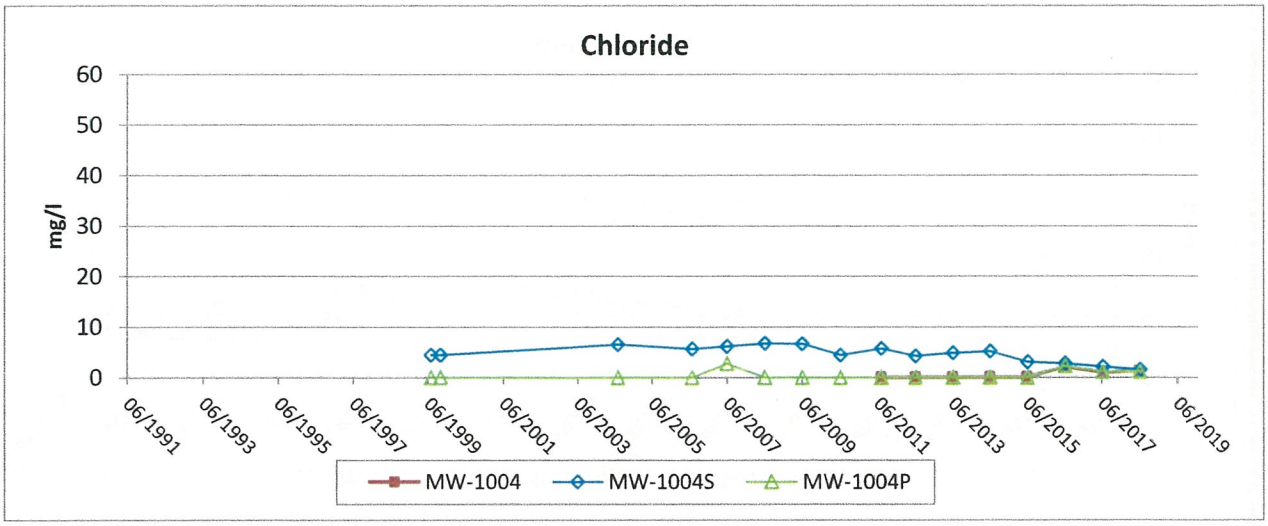
FLAMBEAU MINING COMPANY

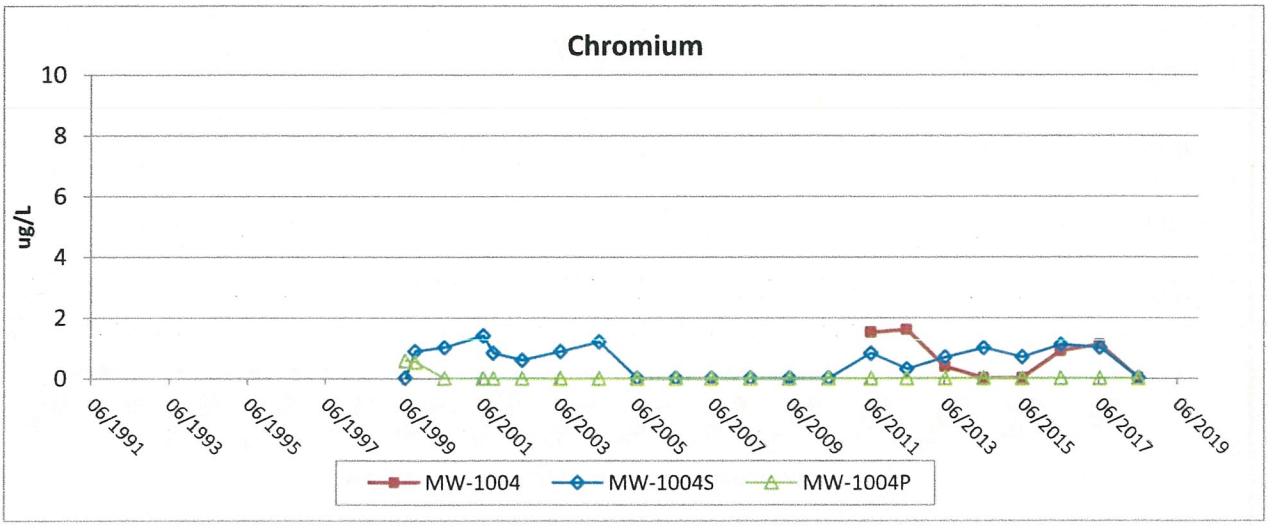
Figure B-10a

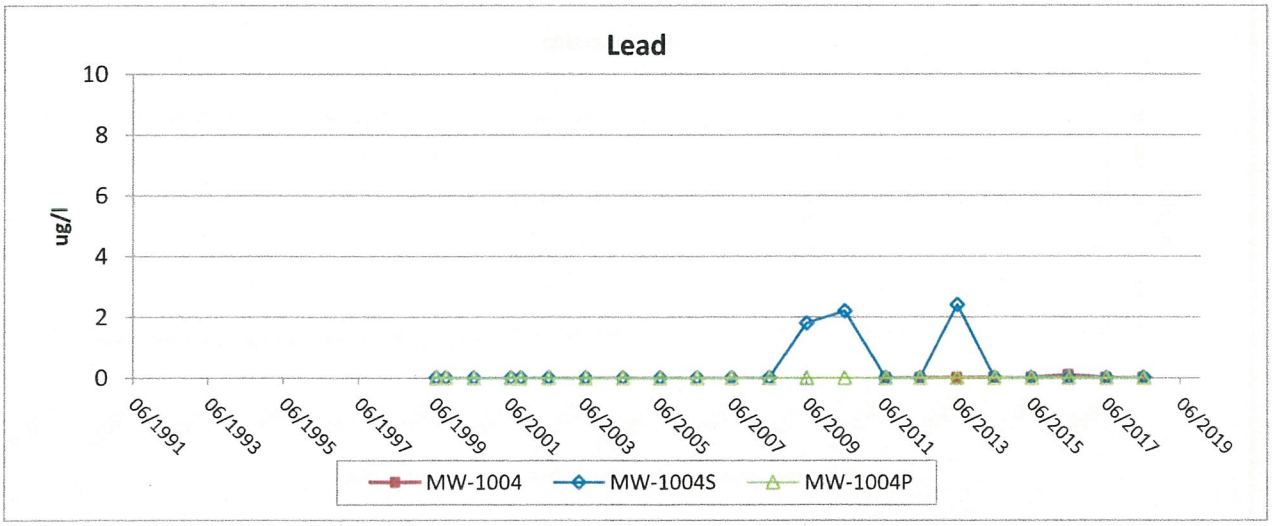
Groundwater Trend Graphs - Annual Results

MW-1004/MW-1004S/MW-1004P

Scale: NA	Date: January 2019	
Prepared By: SGL	Checked By: SVF	Project: 17F777.18







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FLAMBEAU MINING COMPANY

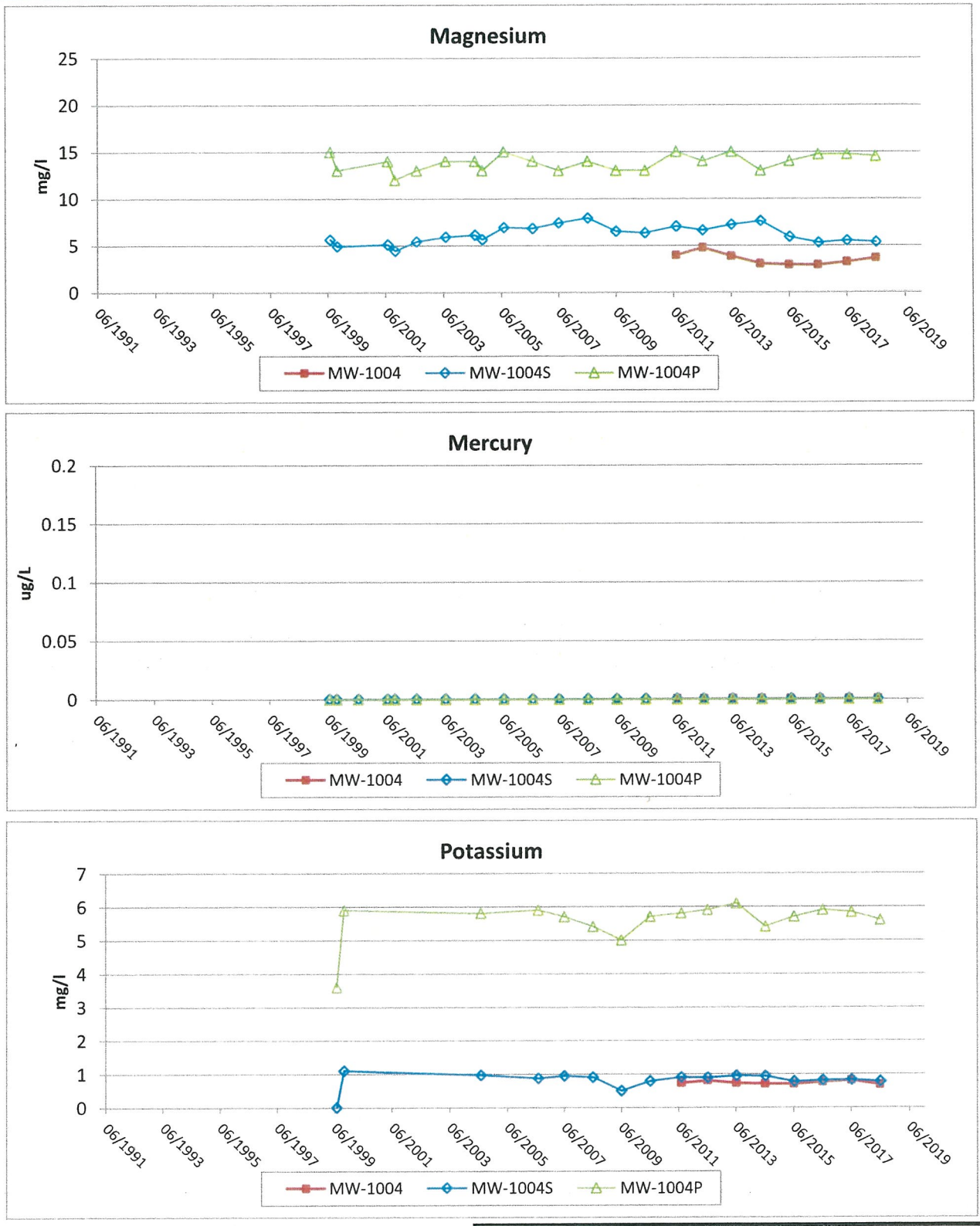
Figure B-10b

Groundwater Trend Graphs - Annual Results

MW-1004/MW-1004S/MW-1004P

Scale: NA	Date: January 2019	
Prepared By: SGL	Checked By: SVF	Project: 17F777.18

pw:\Flambeau Mining\0017F777.00\10500 Reference Information\Stats\2018 Annual Report\GWGraphs_Ann.xlsm



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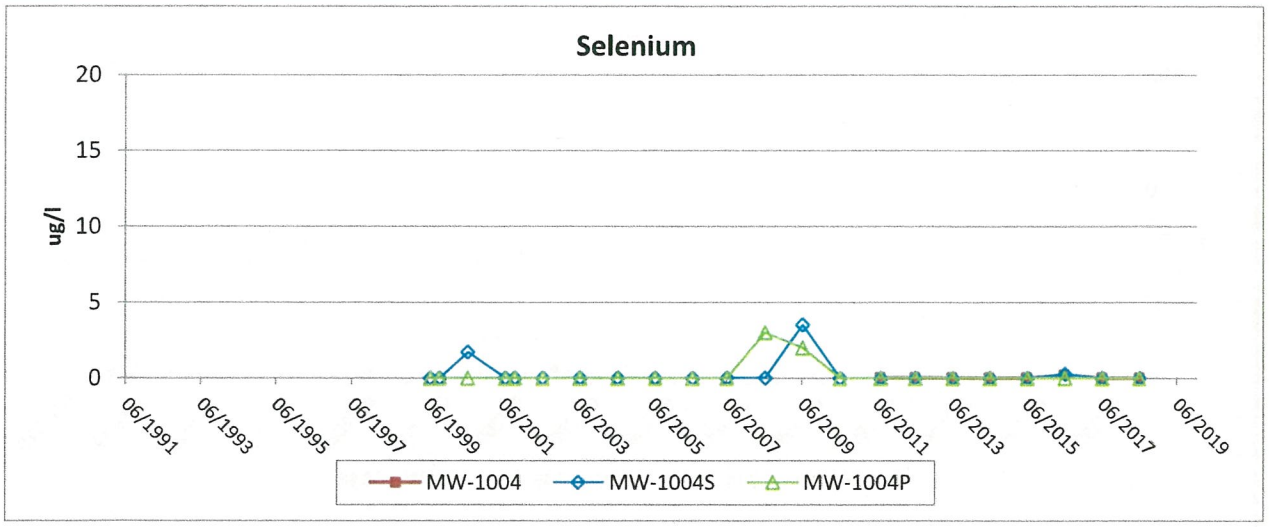
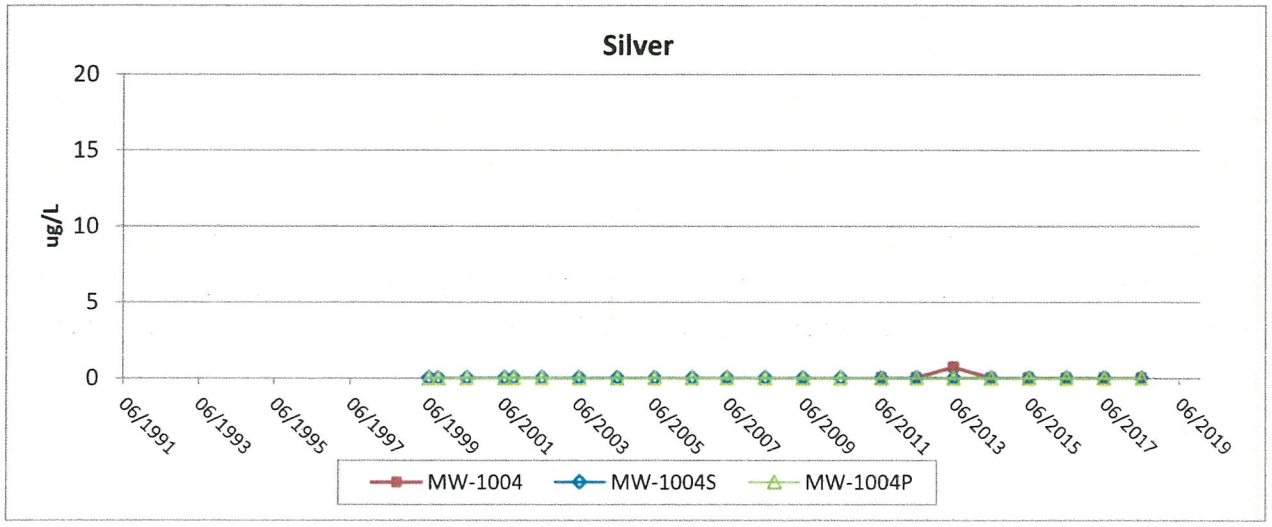
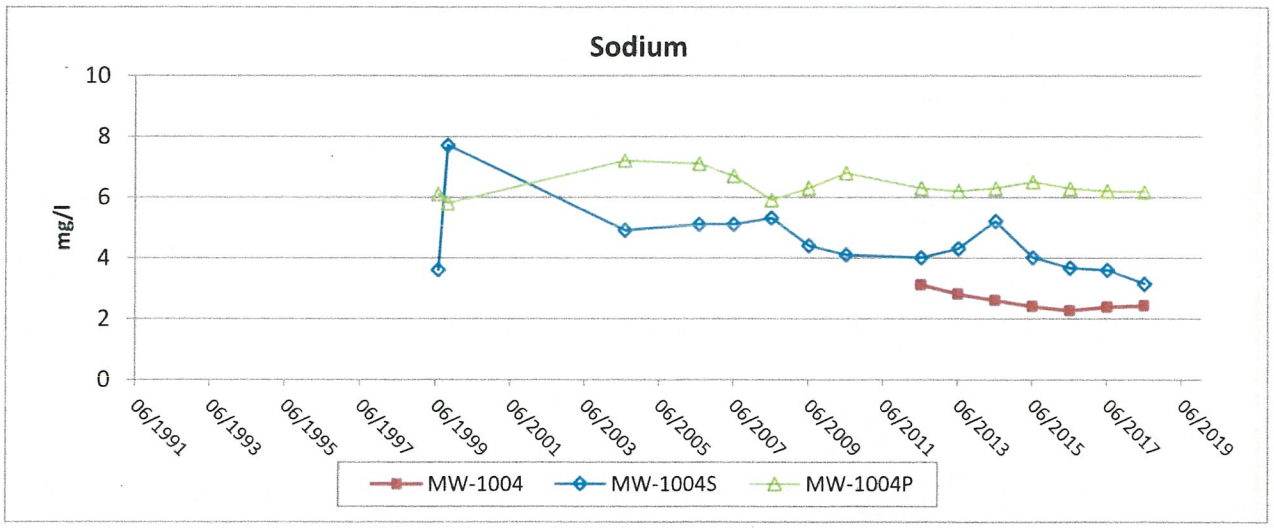
FLAMBEAU MINING COMPANY		
Figure B-10c Groundwater Trend Graphs - Annual Results MW-1004/MW-1004S/MW-1004P		
Scale: NA	Date: January 2019	
Prepared By: SGL	Checked By: SVF	Project: 17F777.18







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FLAMBEAU MINING COMPANY

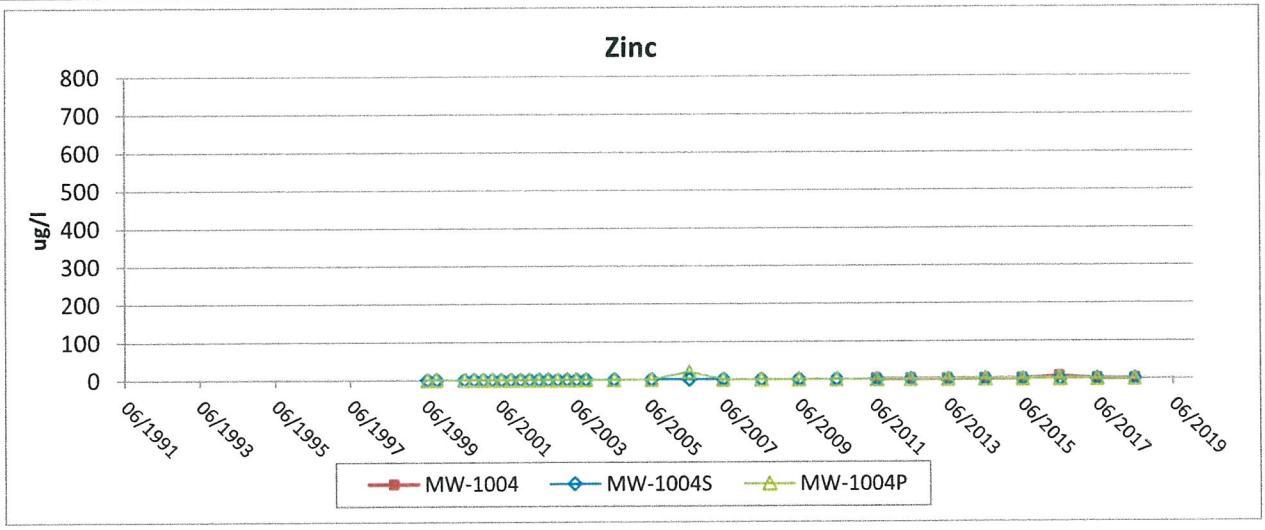
Figure B-10d

Groundwater Trend Graphs - Annual Results

MW-1004/MW-1004S/MW-1004P

Scale: NA	Date: January 2019	
Prepared By: SGL	Checked By: SVF	Project: 17F777.18

pw:\Flambeau Mining\0017F777.00\10500 Reference Information\Stats\2018 Annual Report\GWGraphs_Ann.xlsm



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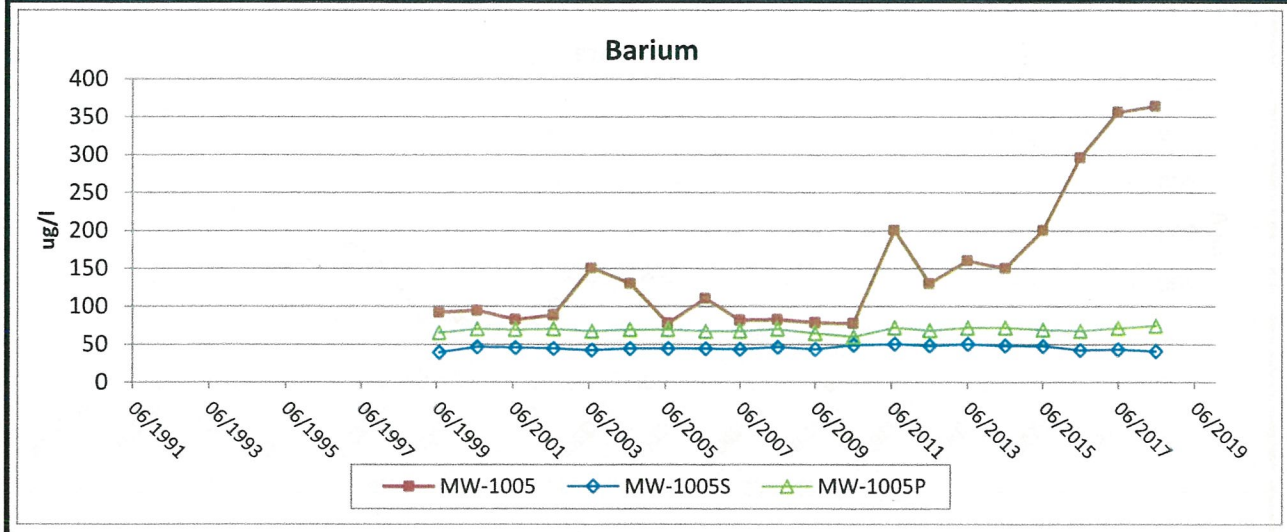
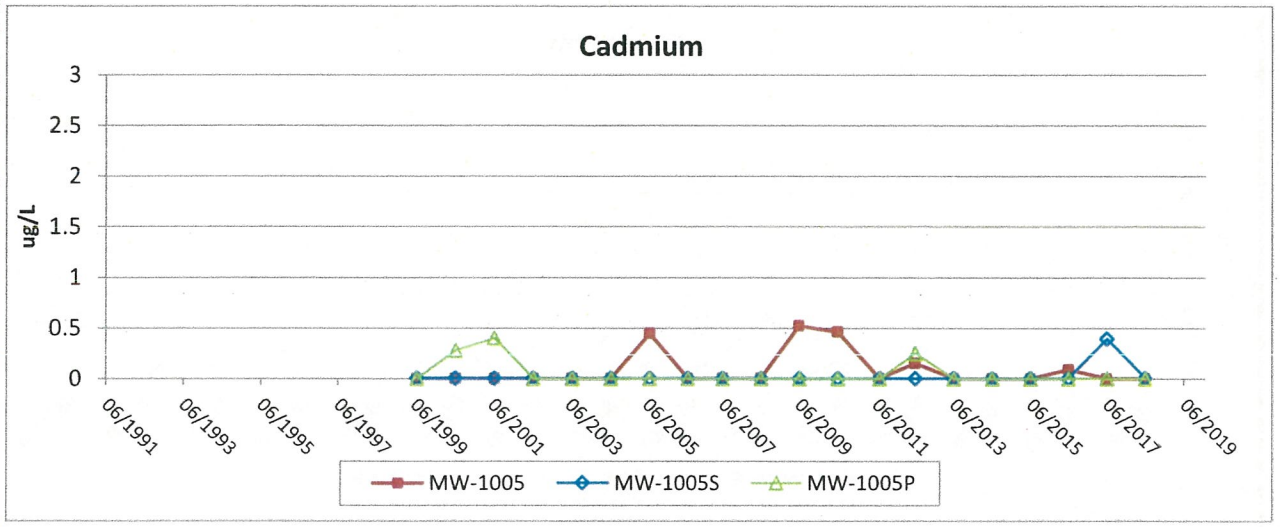
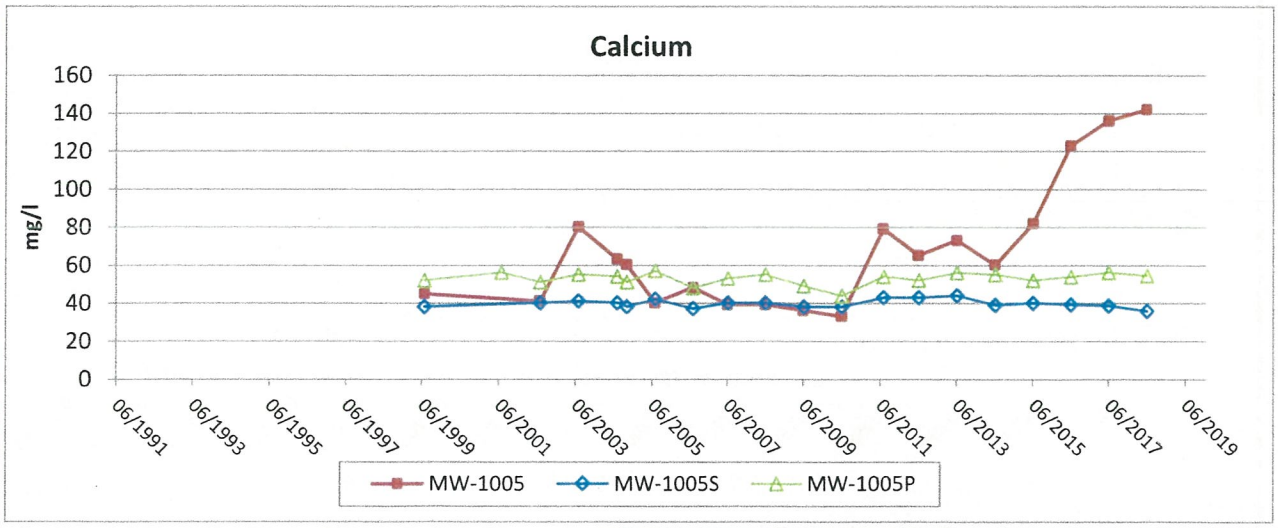
FLAMBEAU MINING COMPANY		
Figure B-10e Groundwater Trend Graphs - Annual Results MW-1004/MW-1004S/MW-1004P		
Scale: NA		Date: January 2019
Prepared By: SGL	Checked By: SVF	Project: 17F777.18







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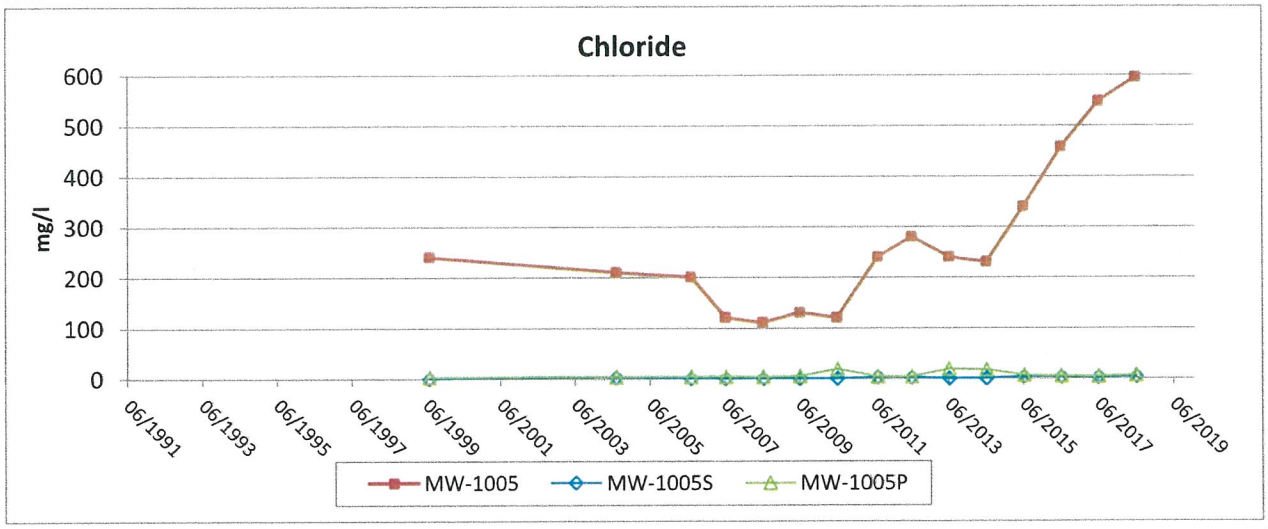
FLAMBEAU MINING COMPANY

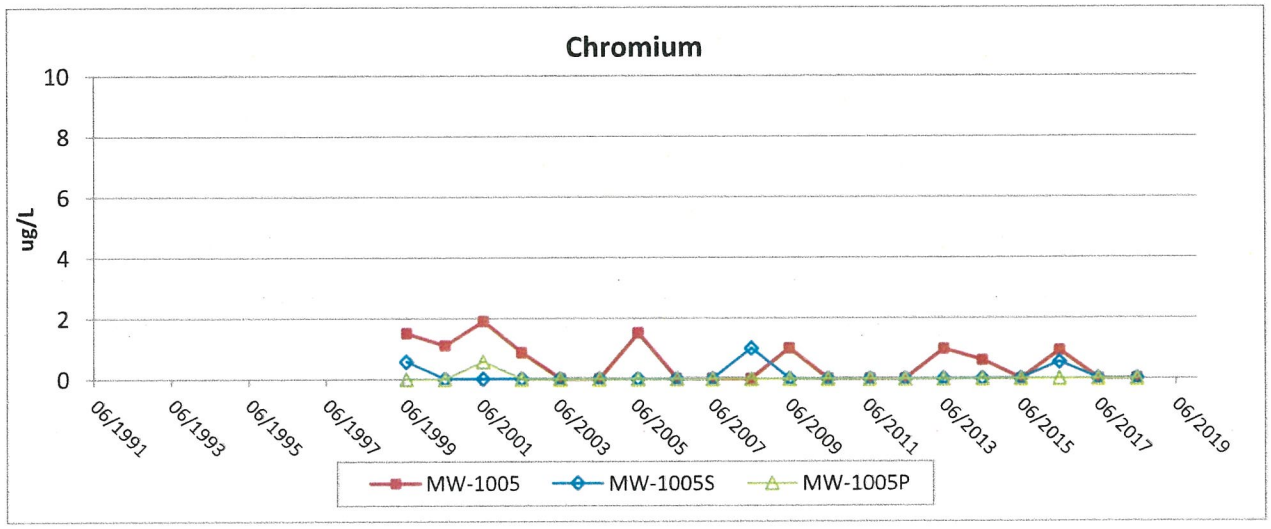
Figure B-11a

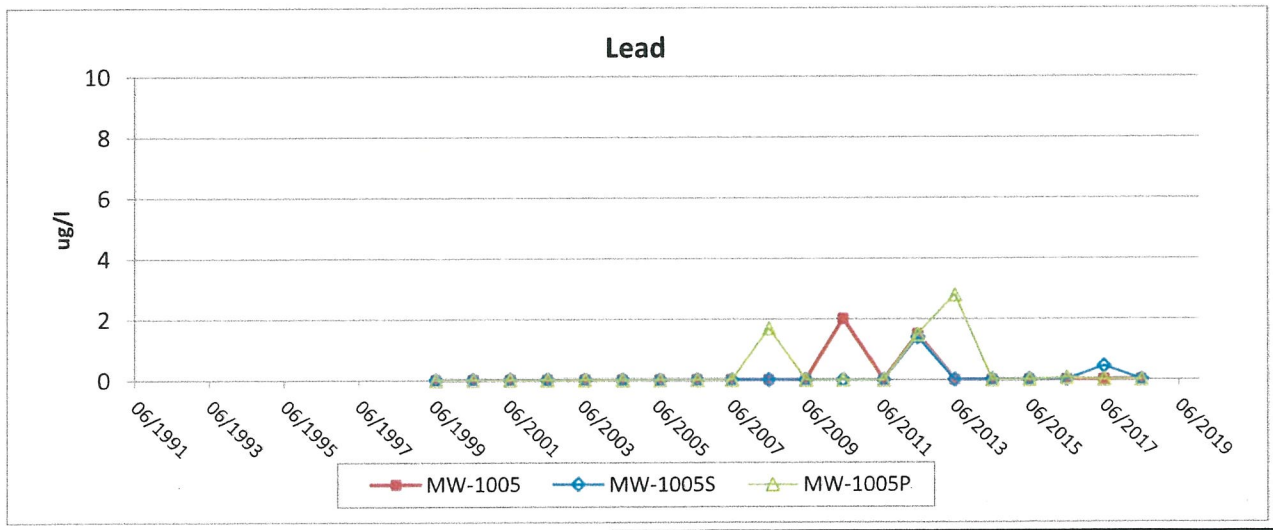
Groundwater Trend Graphs - Annual Results

MW-1005/MW-1005S/MW-1005P

Scale: NA	Date: January 2019	
Prepared By: SGL	Checked By: SVF	Project: 17F777.18







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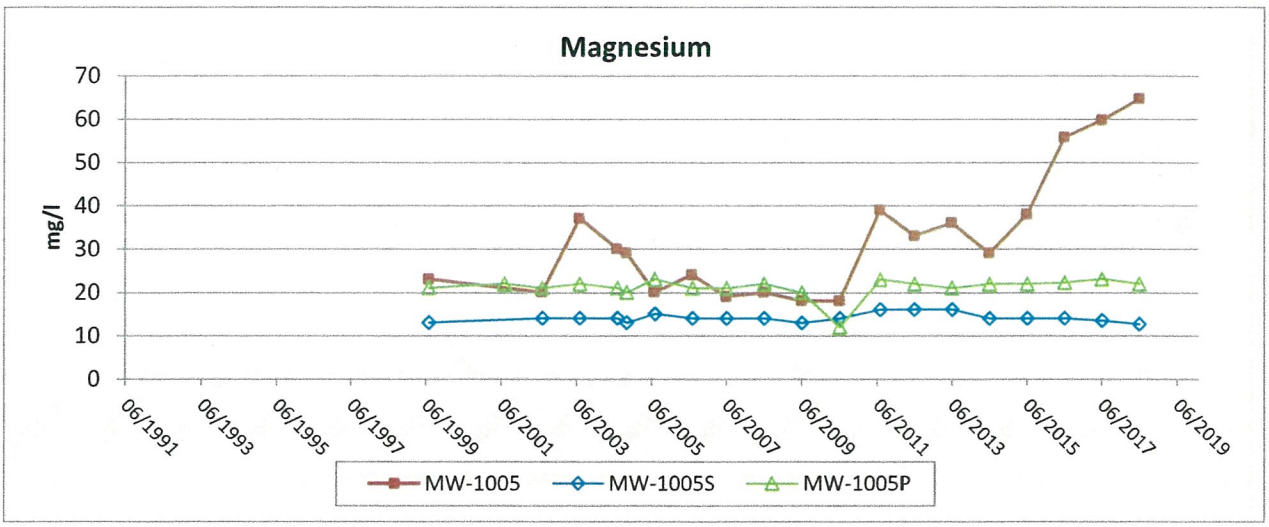
FLAMBEAU MINING COMPANY

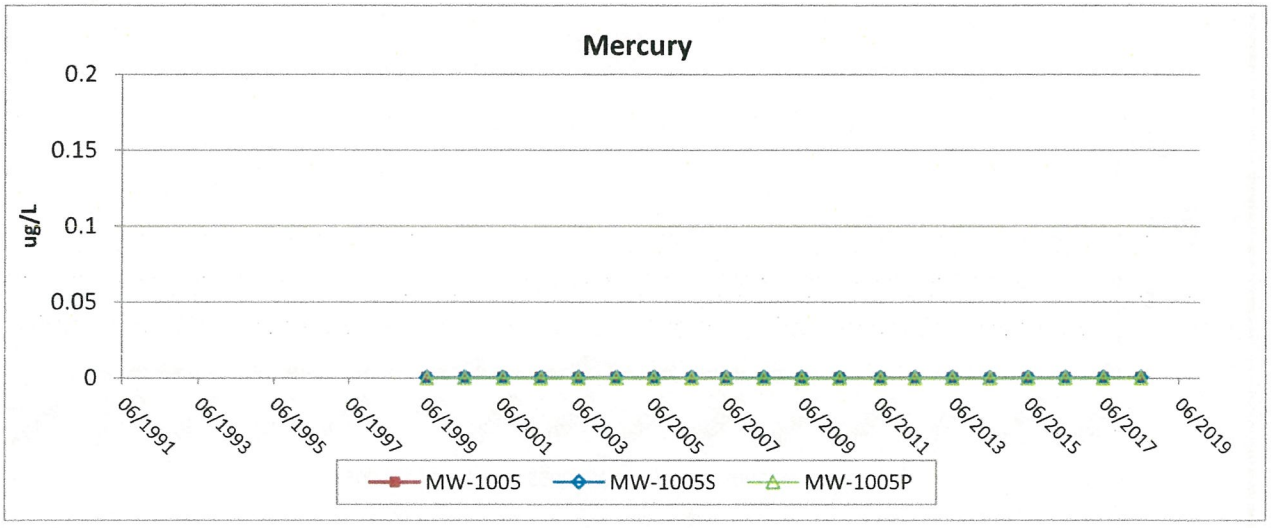
Figure B-11b

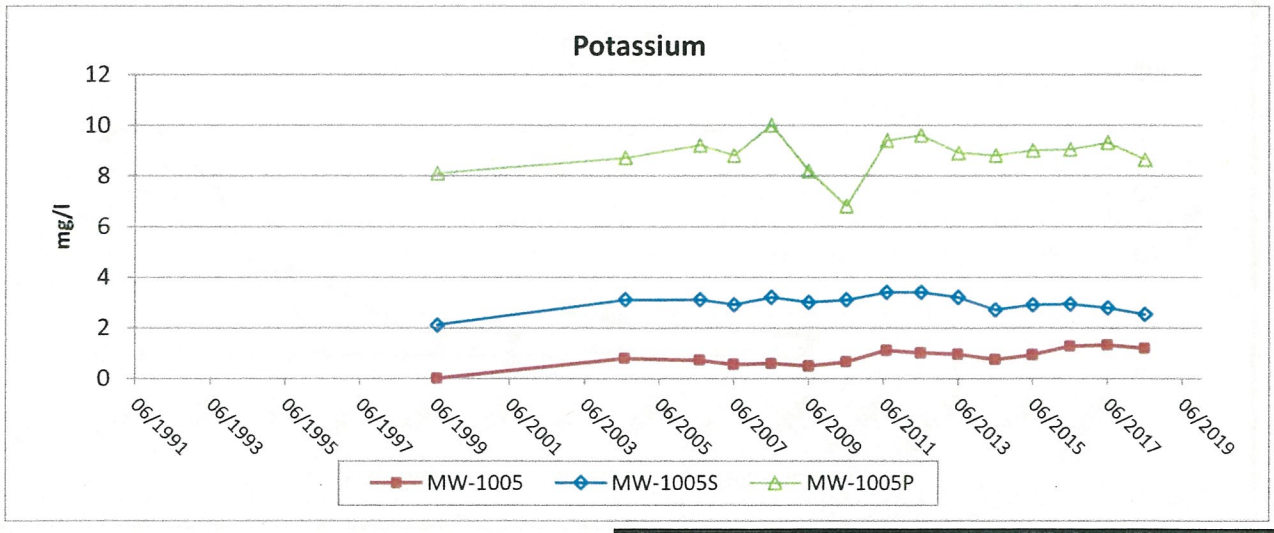
Groundwater Trend Graphs - Annual Results

MW-1005/MW-1005S/MW-1005P

Scale: NA	Date: January 2019	
Prepared By: SGL	Checked By: SVF	Project: 17F777.18







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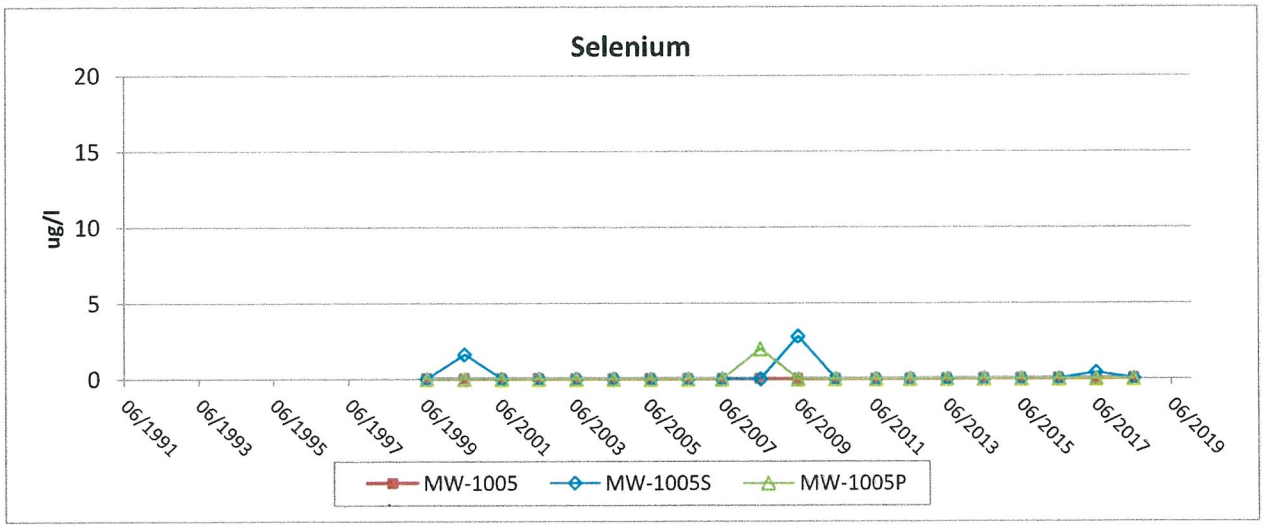
FLAMBEAU MINING COMPANY

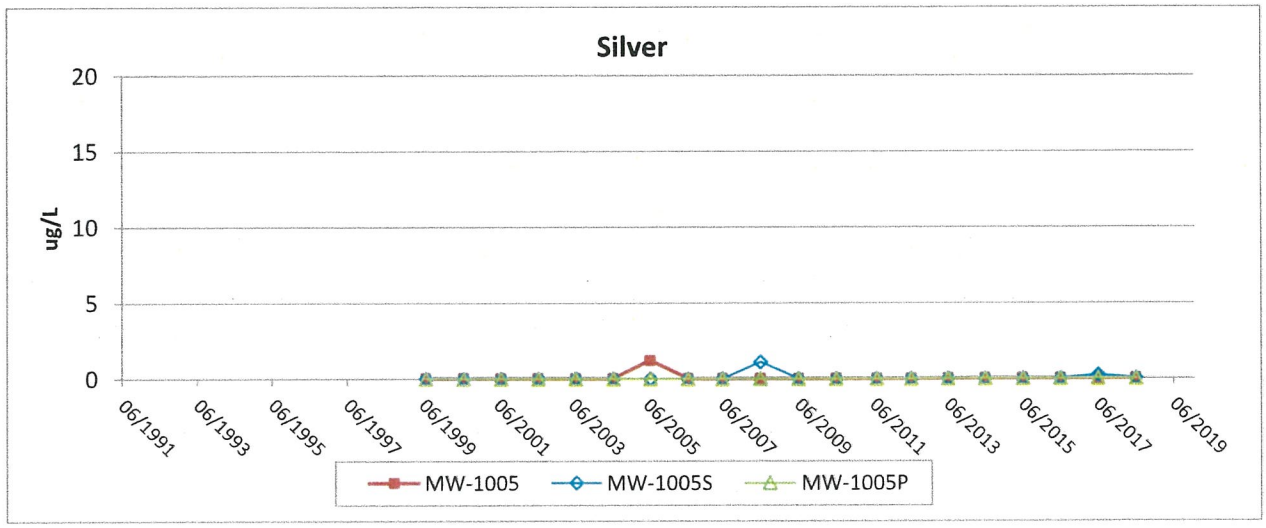
Figure B-11c

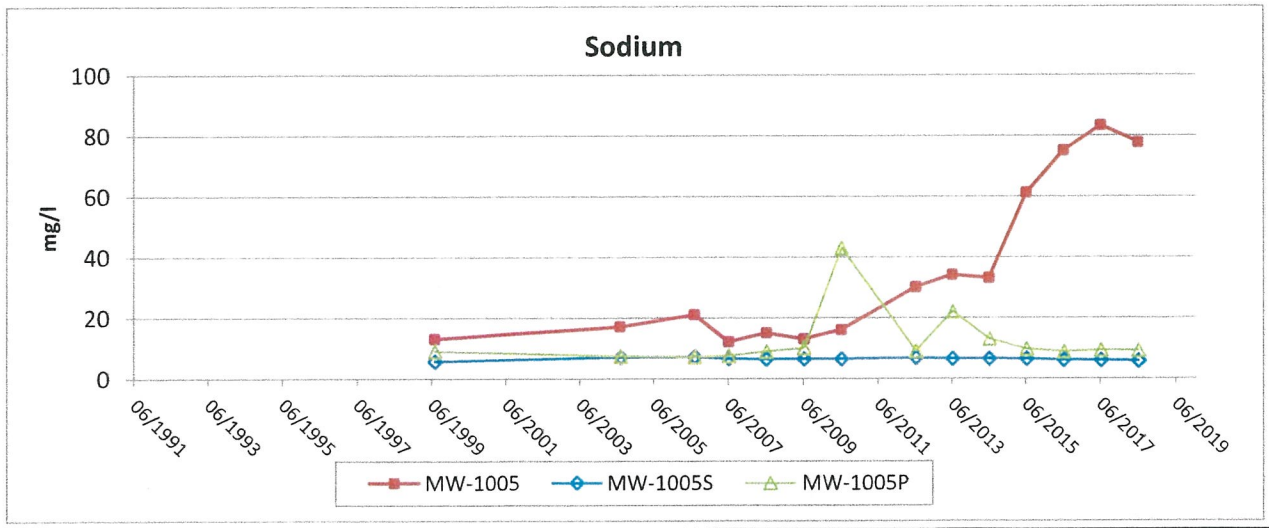
Groundwater Trend Graphs - Quarterly Results

MW-1005/MW-1005S/MW-1005P

Scale: NA	Date: January 2019	
Prepared By: SGL	Checked By: SVF	Project: 17F777.18







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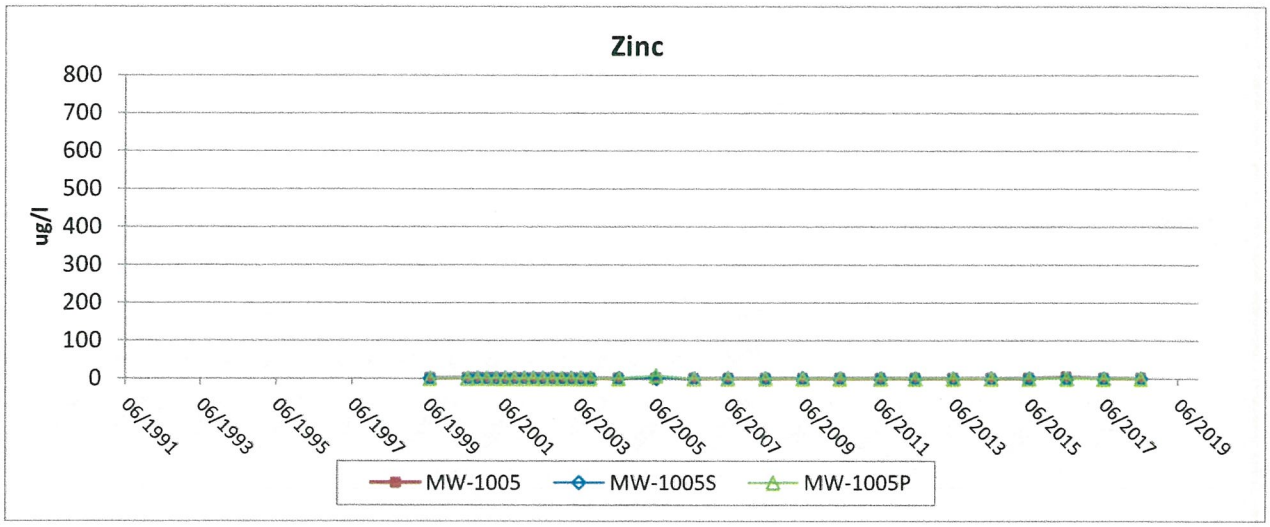
FLAMBEAU MINING COMPANY

Figure B-11d

Groundwater Trend Graphs - Annual Results

MW-1005/MW-1005S/MW-1005P

Scale: NA	Date: January 2019	
Prepared By: SGL	Checked By: SVF	Project: 17F777.18



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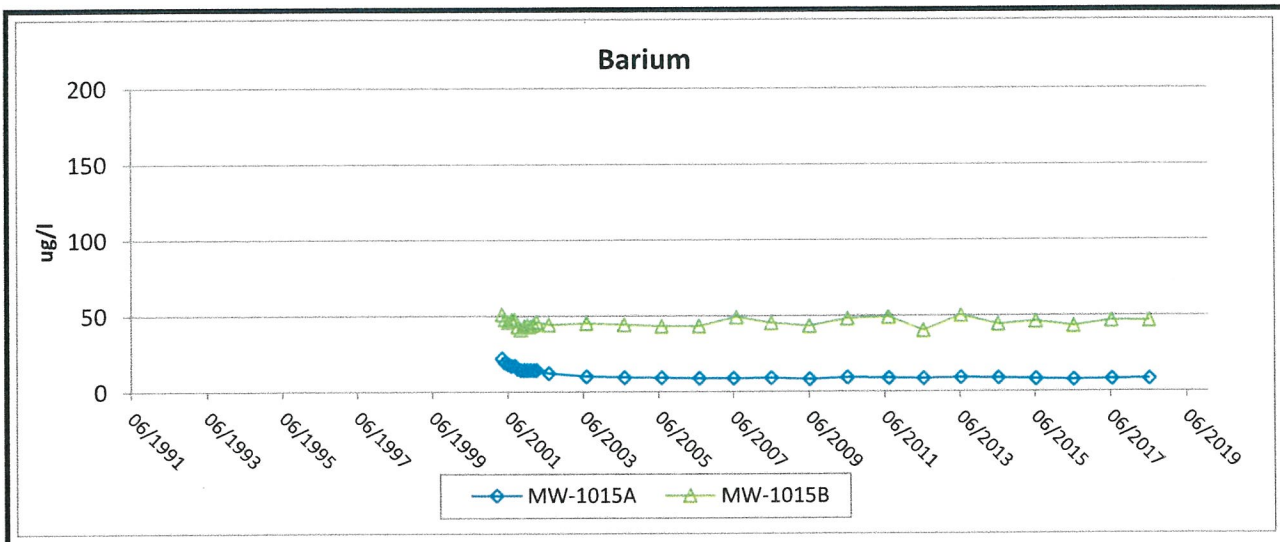
FLAMBEAU MINING COMPANY

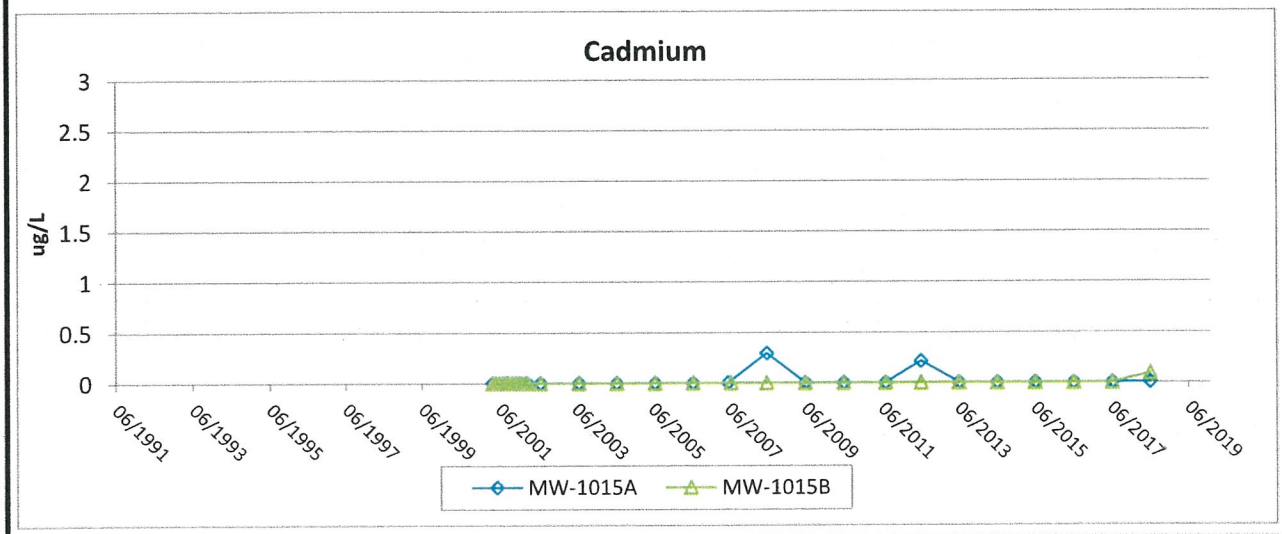
Figure B-11e

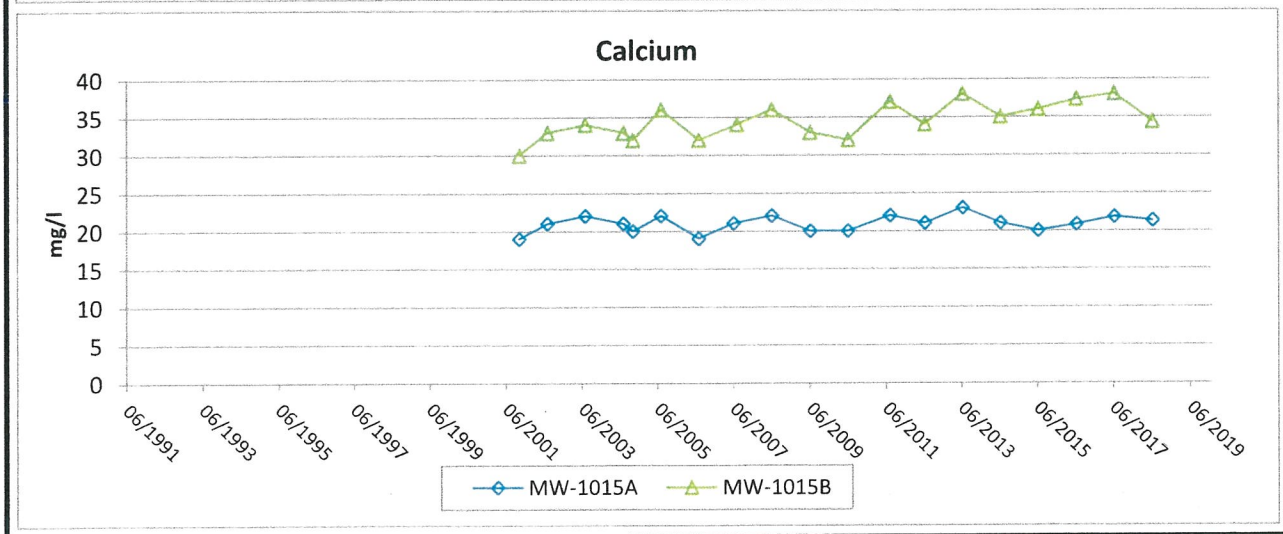
Groundwater Trend Graphs - Annual Results

MW-1005/MW-1005S/MW-1005P

Scale: NA	Date: January 2019	
Prepared By: SGL	Checked By: SVF	Project: 17F777.18







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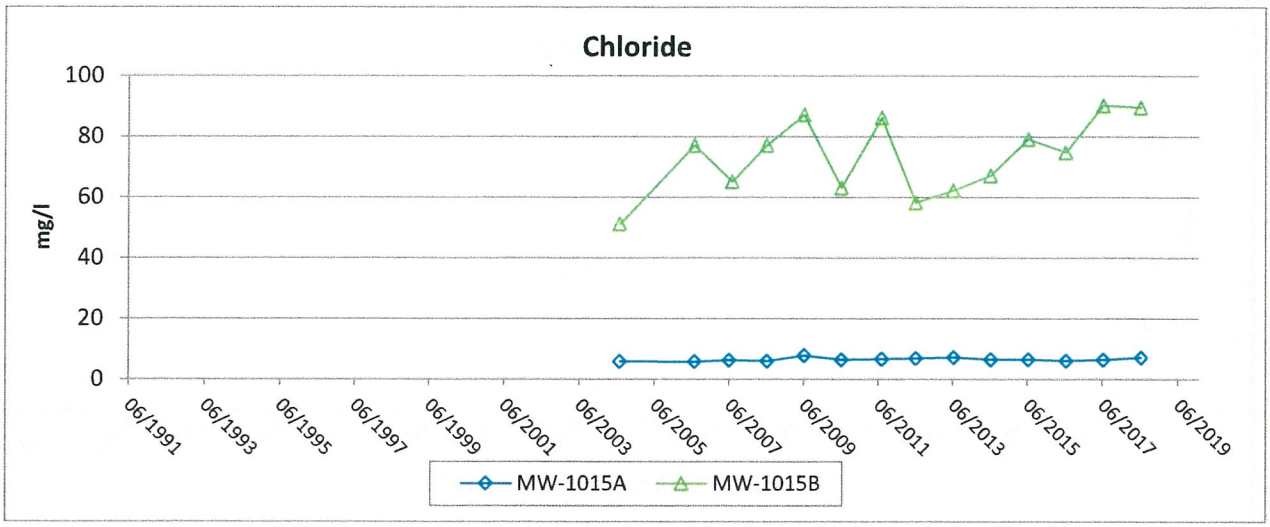
FLAMBEAU MINING COMPANY

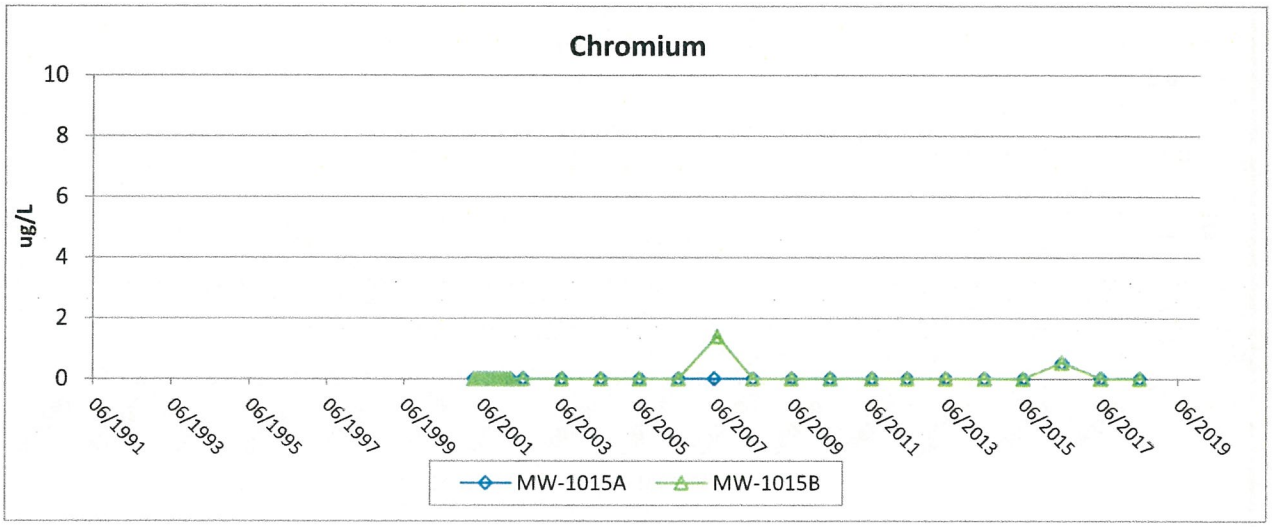
Figure B-12a

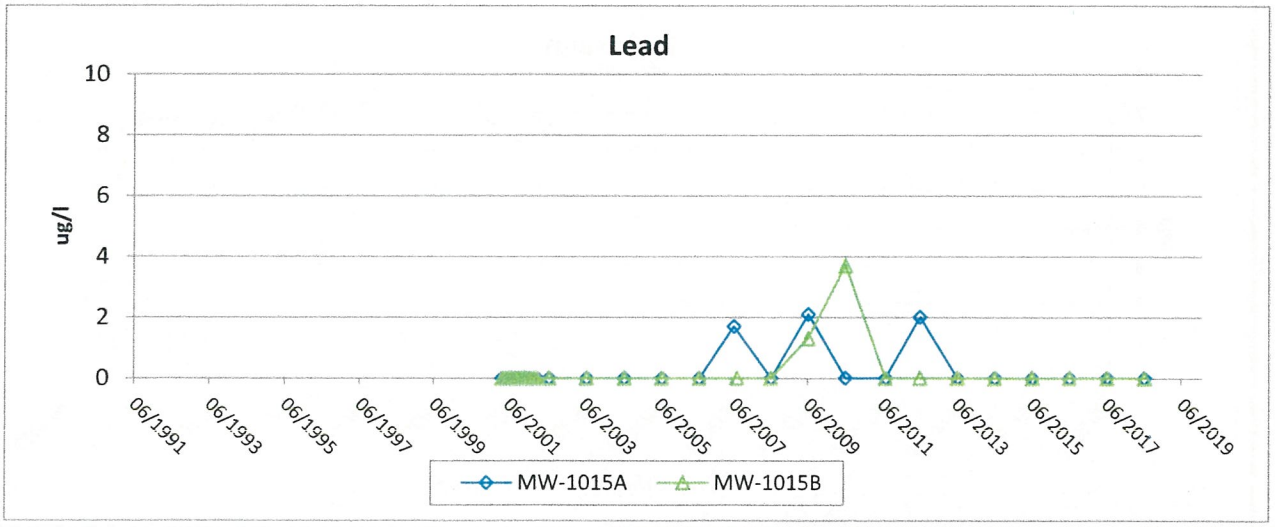
Groundwater Trend Graphs - Annual Results

MW-1015A/MW-1015B

Scale: NA	Date: January 2019	
Prepared By: SGL	Checked By: SVF	Project: 17F777.18







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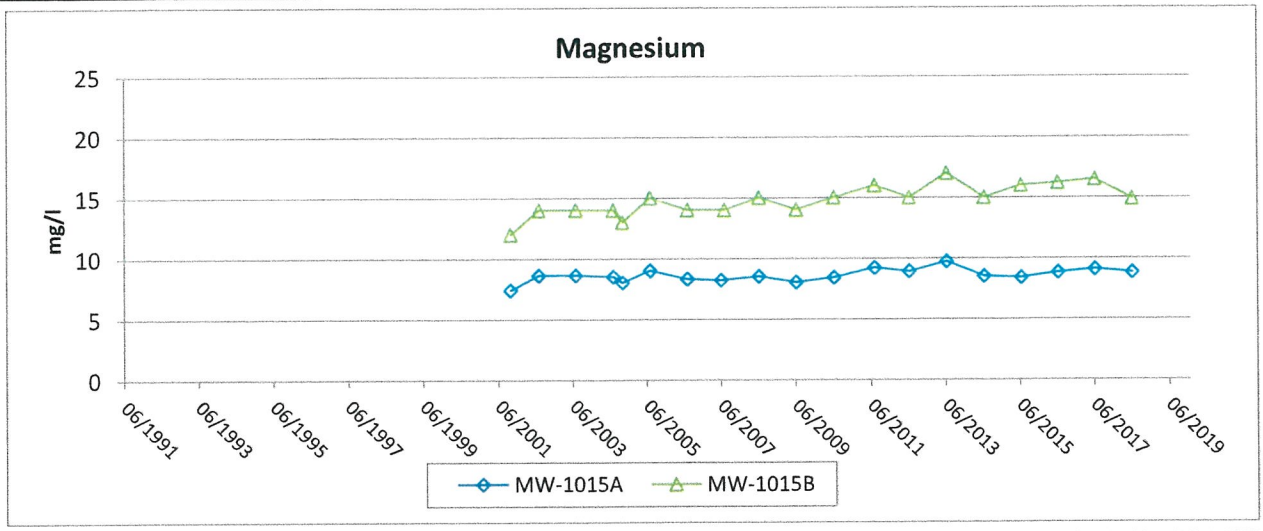
FLAMBEAU MINING COMPANY

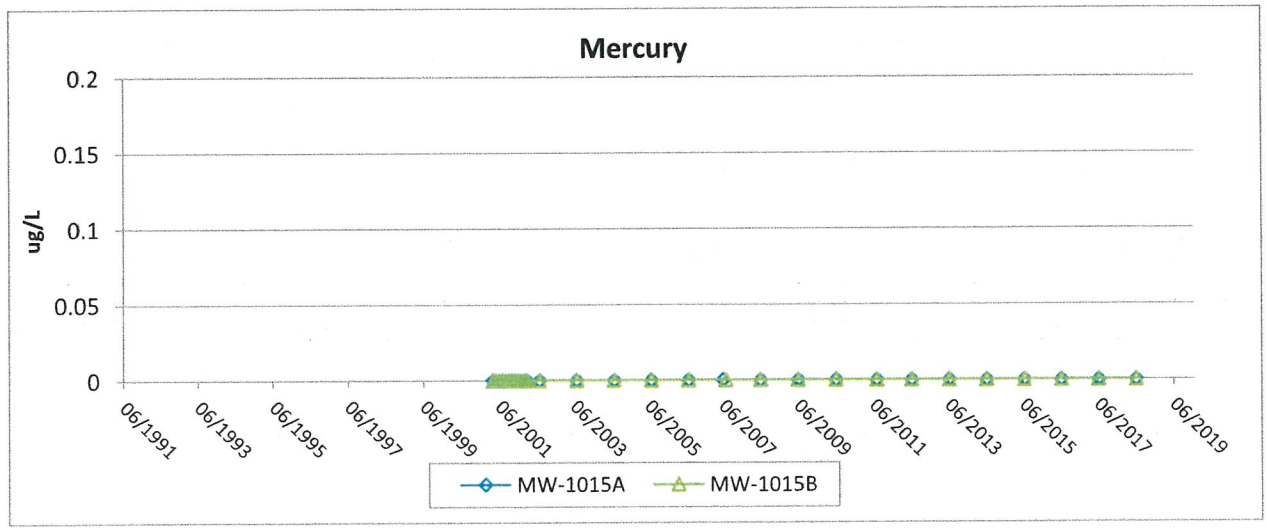
Figure B-12b

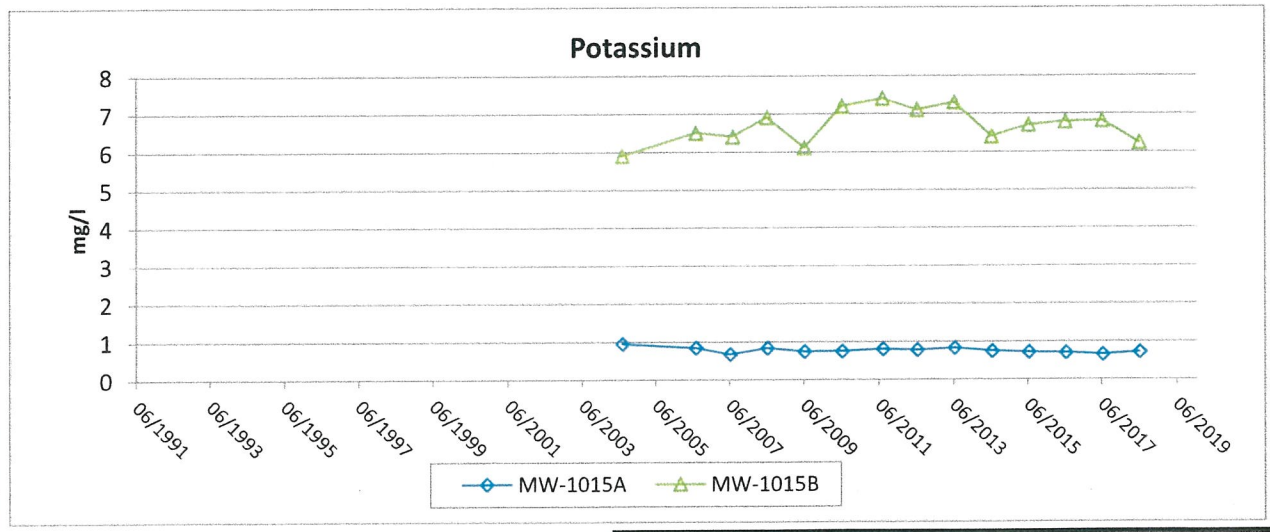
Groundwater Trend Graphs - Annual Results

MW-1015A/MW-1015B

Scale: NA	Date: January 2019	
Prepared By: SGL	Checked By: SVF	Project: 17F777.18







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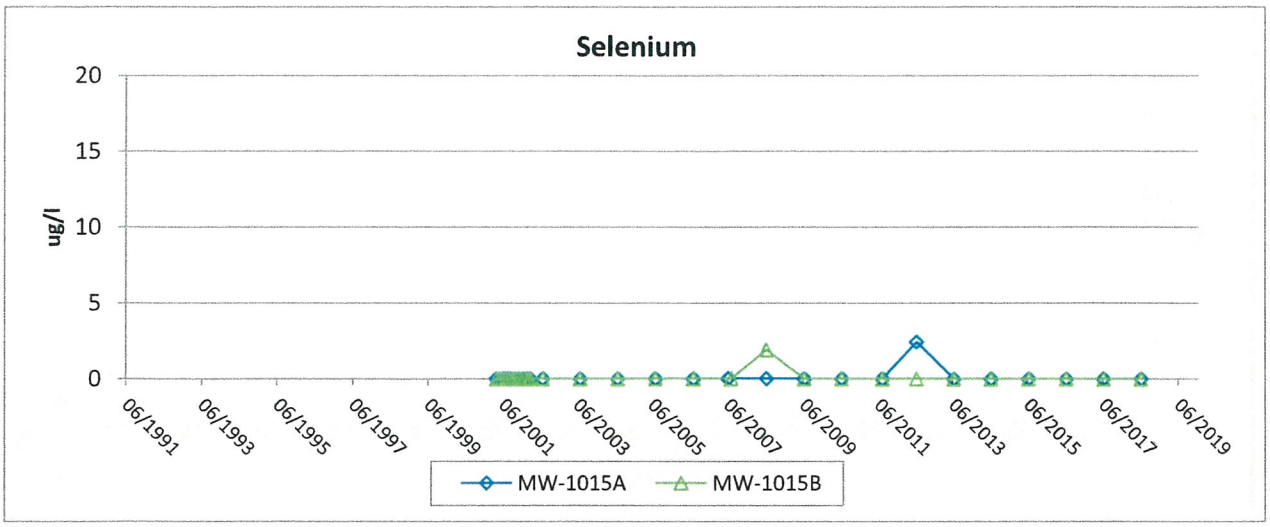
FLAMBEAU MINING COMPANY

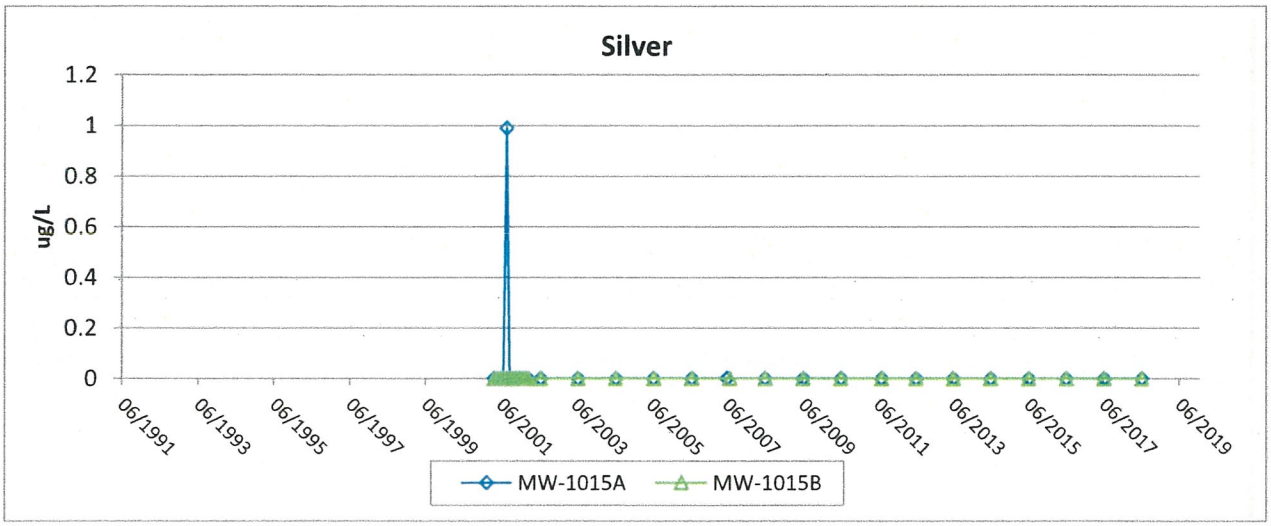
Figure B-12c

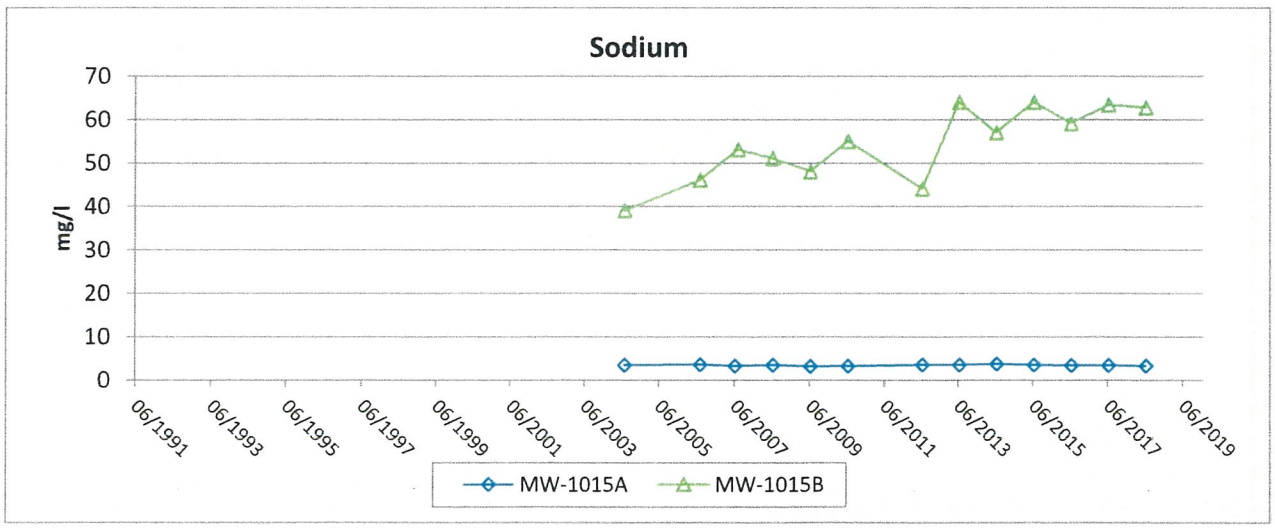
Groundwater Trend Graphs - Annual Results

MW-1015A/MW-1015B

Scale: NA	Date: January 2019	
Prepared By: SGL	Checked By: SVF	Project: 17F777.18







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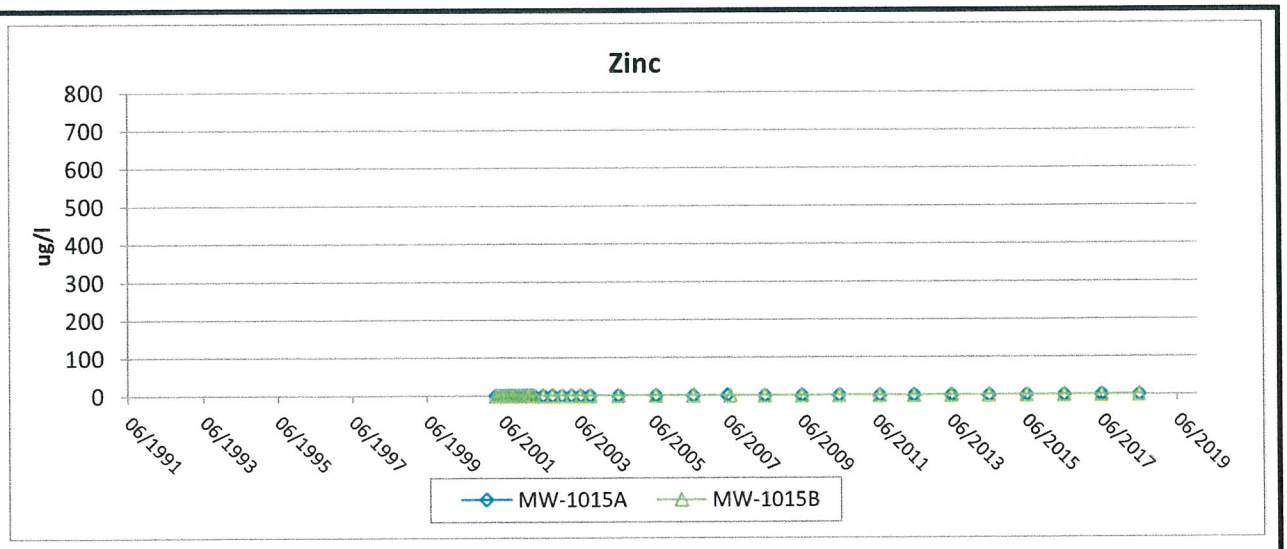
FLAMBEAU MINING COMPANY

Figure B-12d

Groundwater Trend Graphs - Annual Results

MW-1015A/MW-1015B

Scale: NA	Date: January 2019	
Prepared By: SGL	Checked By: SVF	Project: 17F777.18



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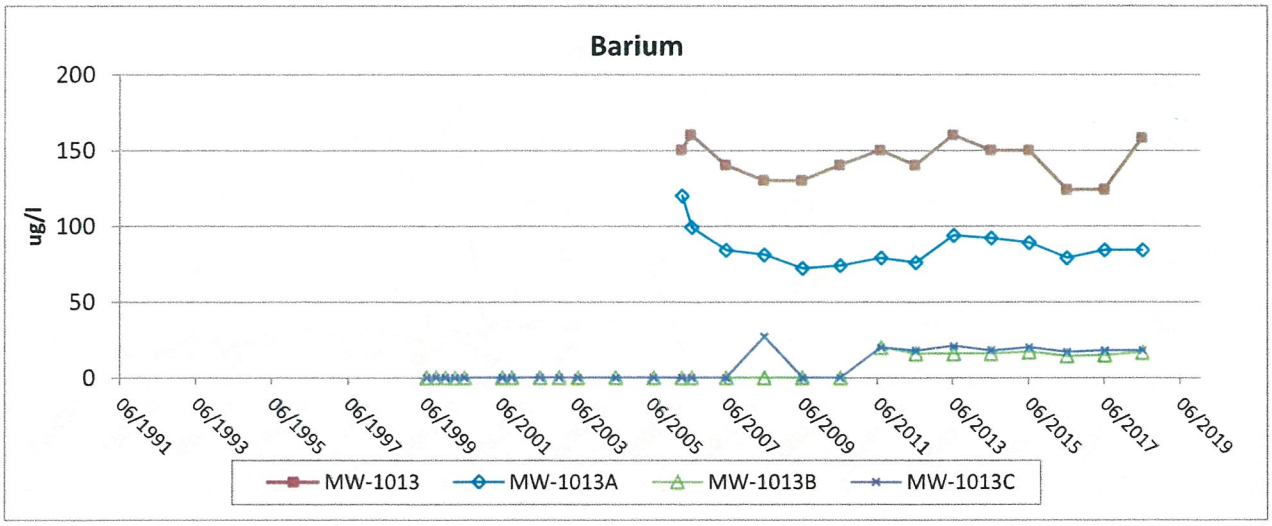
FLAMBEAU MINING COMPANY

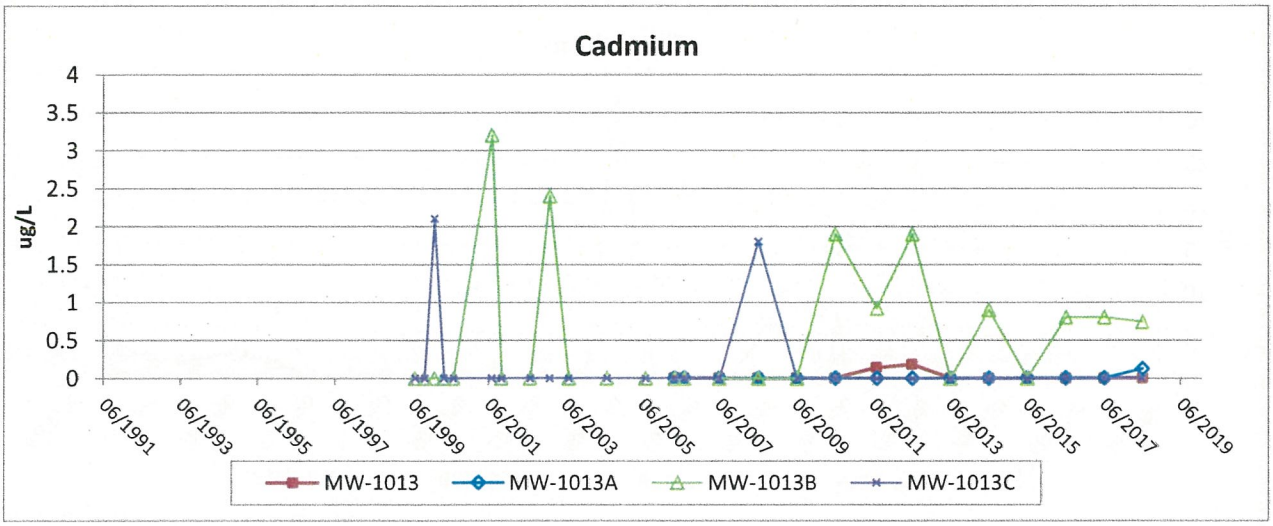
Figure B-12e

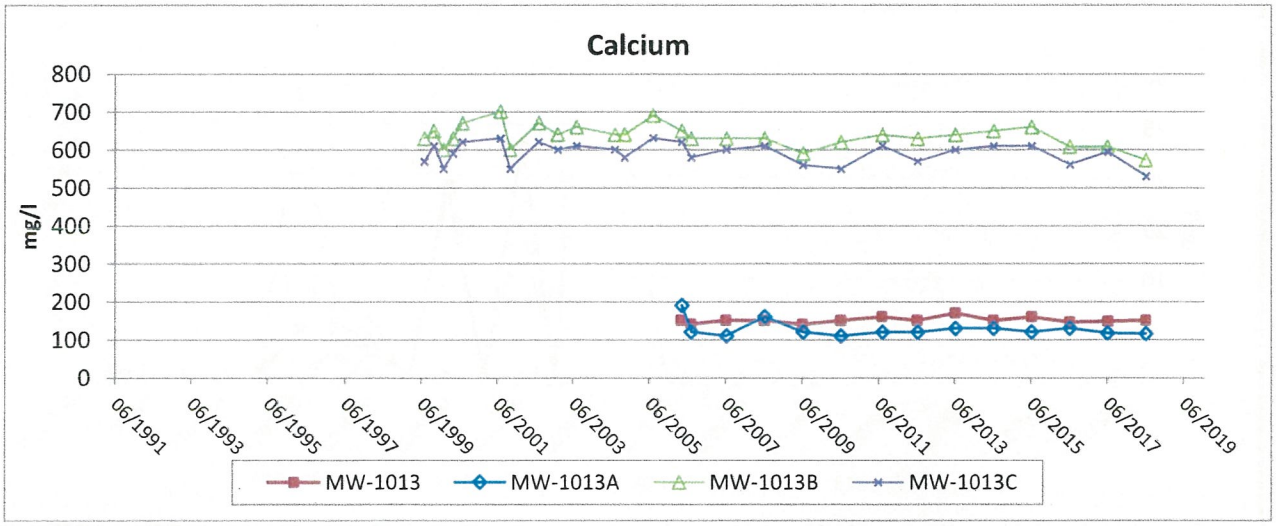
Groundwater Trend Graphs - Annual Results

MW-1015A/MW-1015B

Scale: NA	Date: January 2019	
Prepared By: SGL	Checked By: SVF	Project: 17F777.18







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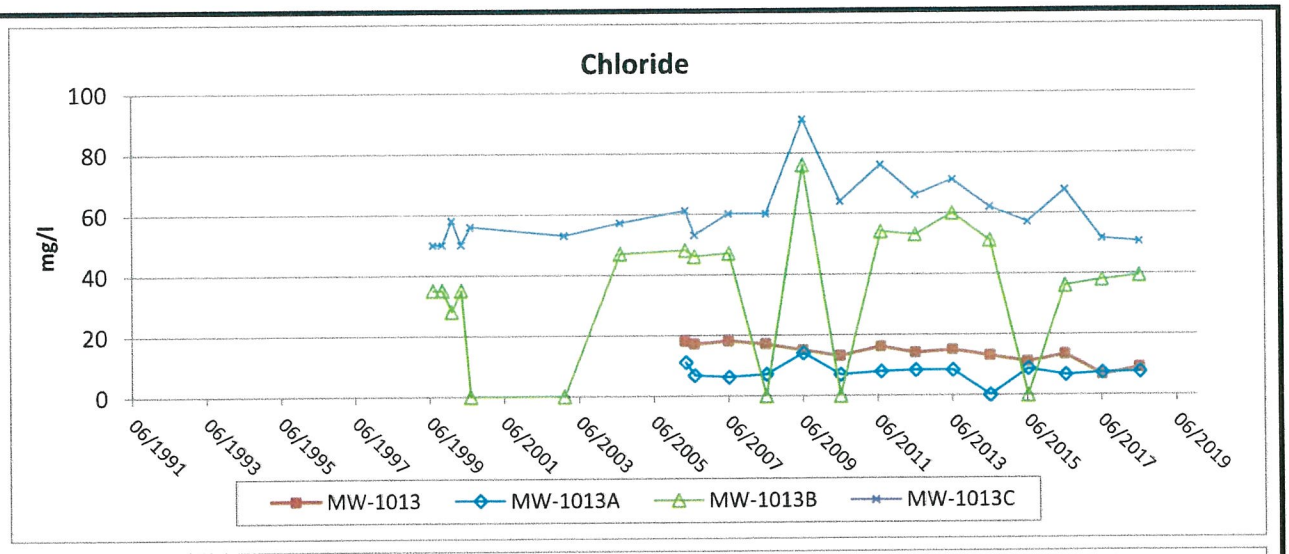
FLAMBEAU MINING COMPANY

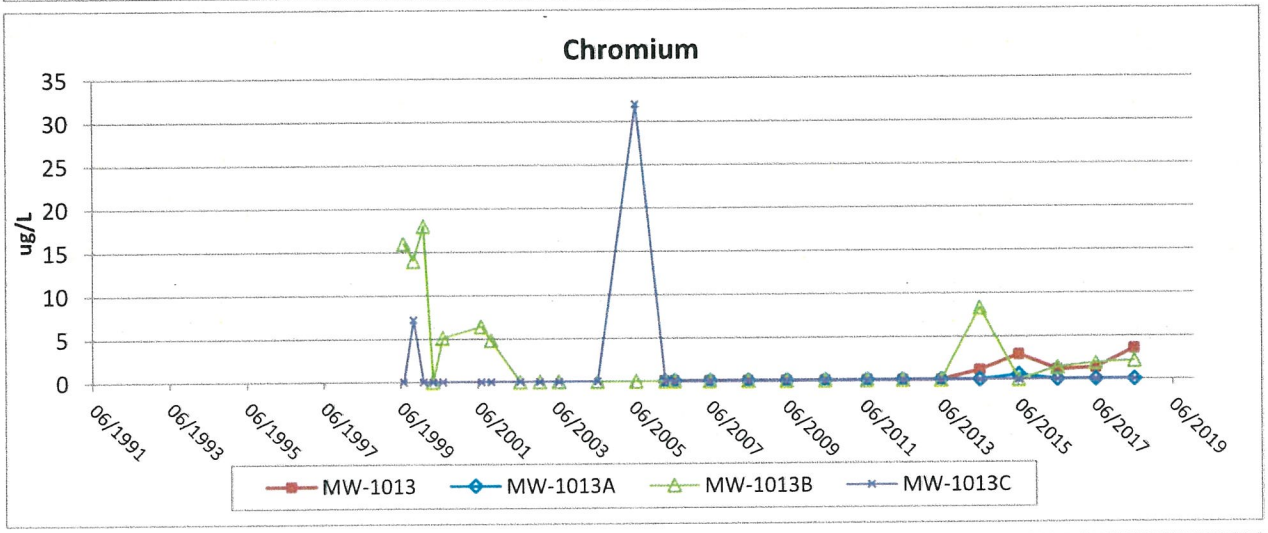
Figure B-13a

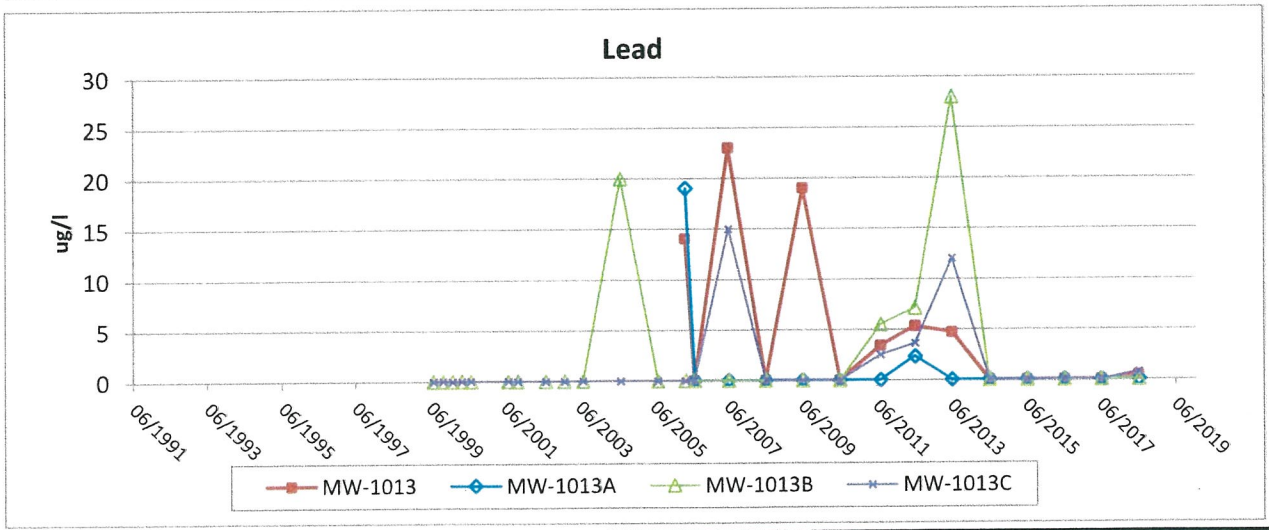
Groundwater Trend Graphs - Annual Results (In-Pit Wells)

MW-1013/MW-1013A/MW-1013B/MW-1013C

Scale: NA	Date: January 2019	
Prepared By: SGL	Checked By: SVF	Project: 17F777.18







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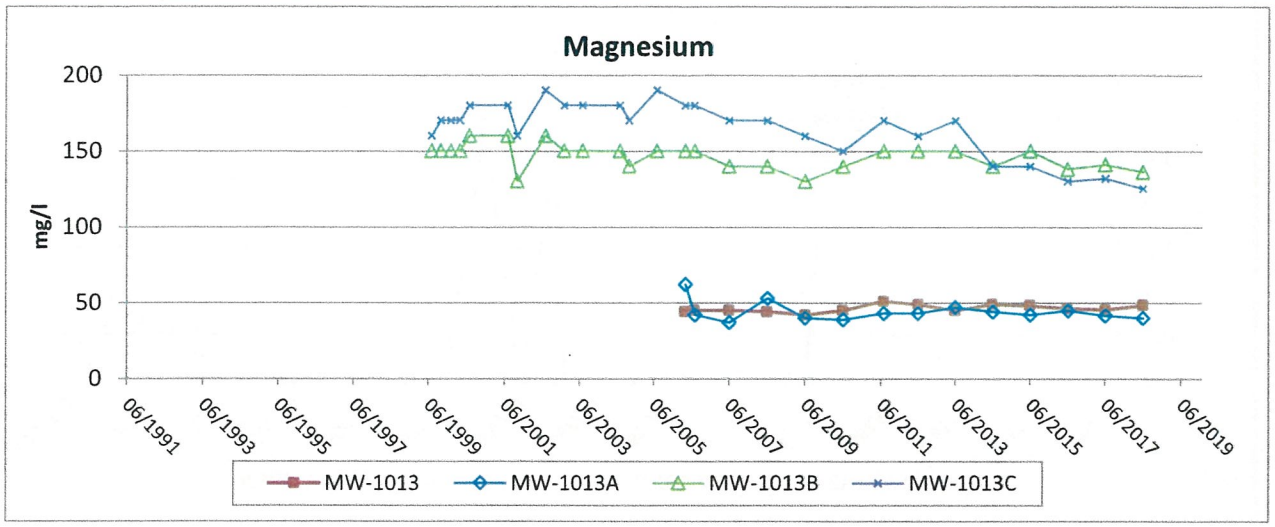
FLAMBEAU MINING COMPANY

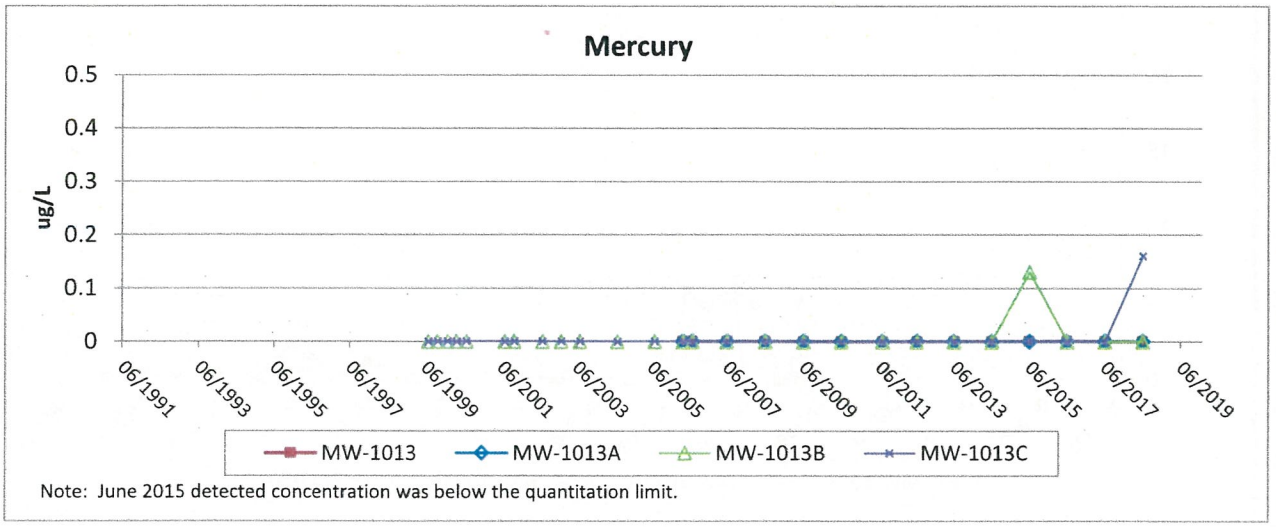
Figure B-13b

Groundwater Trend Graphs - Annual Results (In-Pit Wells)

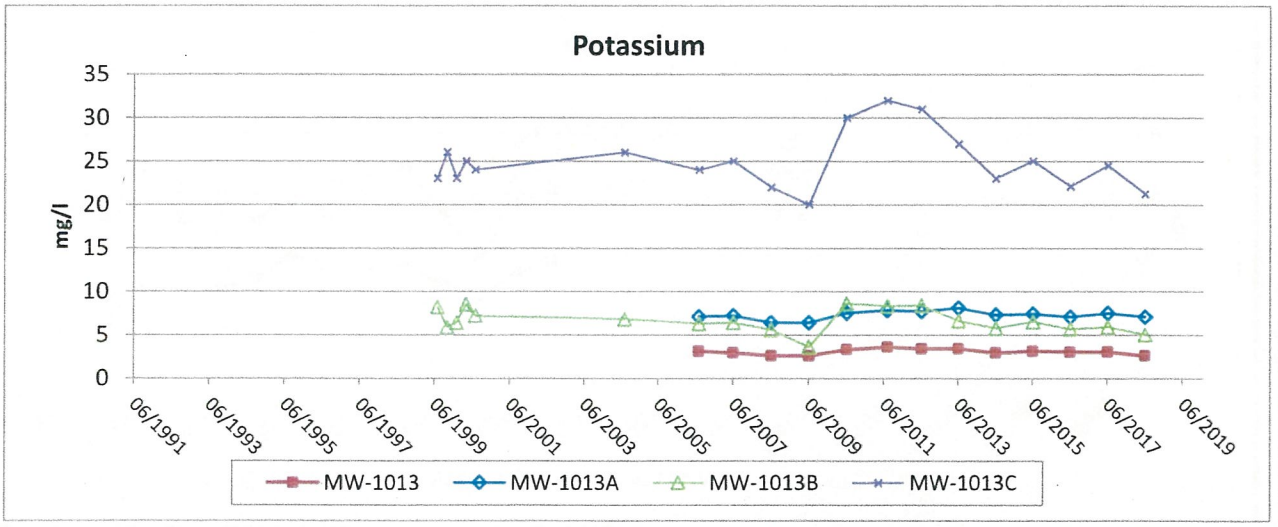
MW-1013/MW-1013A/MW-1013B/MW-1013C

Scale: NA	Date: January 2019	
Prepared By: SGL	Checked By: SVF	Project: 17F777.18





Note: June 2015 detected concentration was below the quantitation limit.



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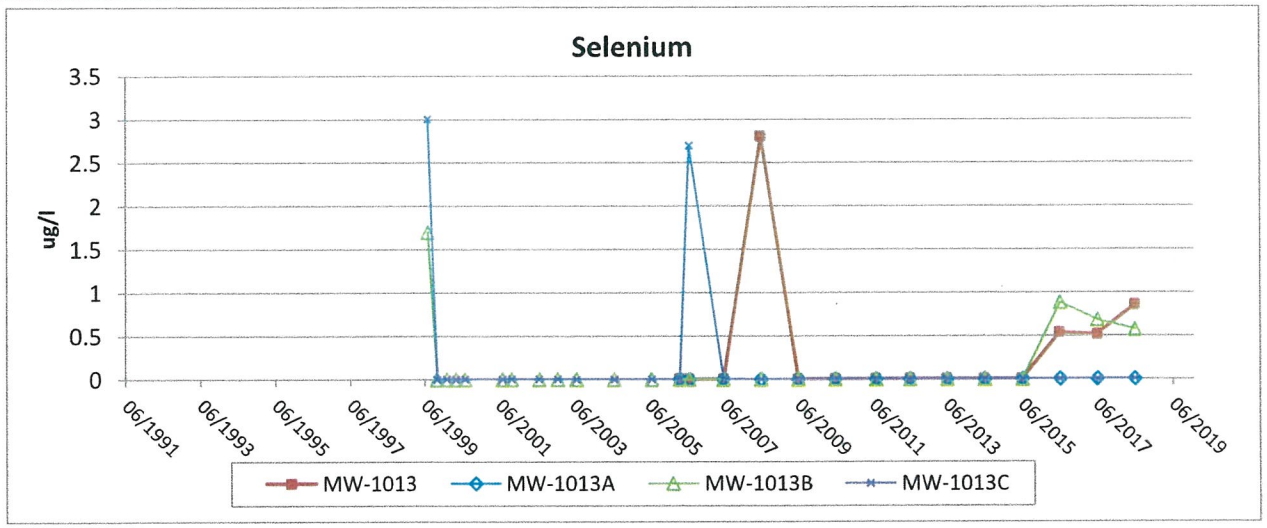
FLAMBEAU MINING COMPANY

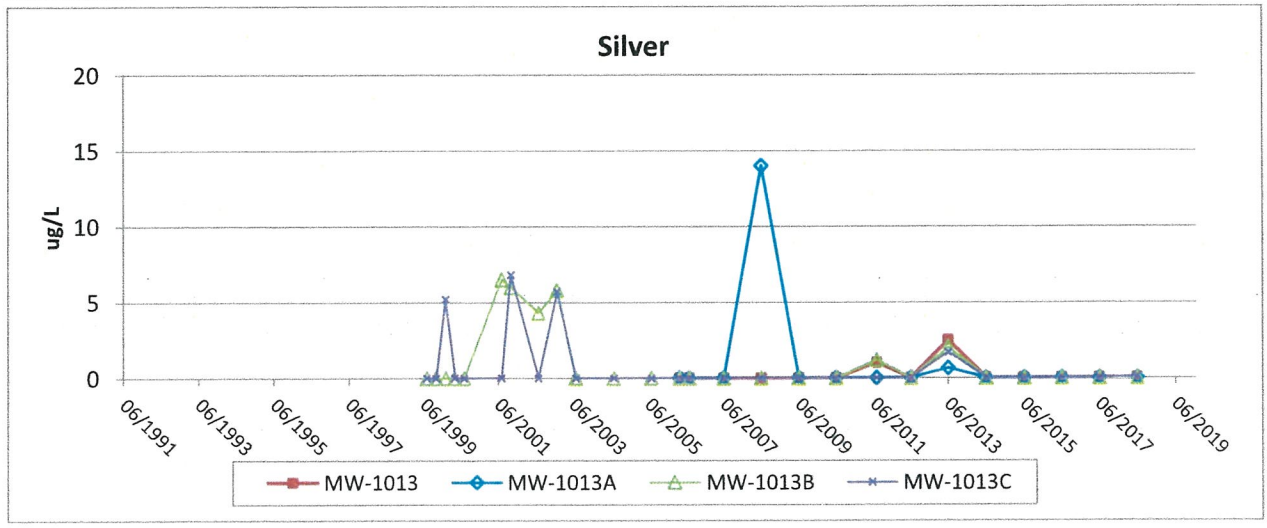
Figure B-13c

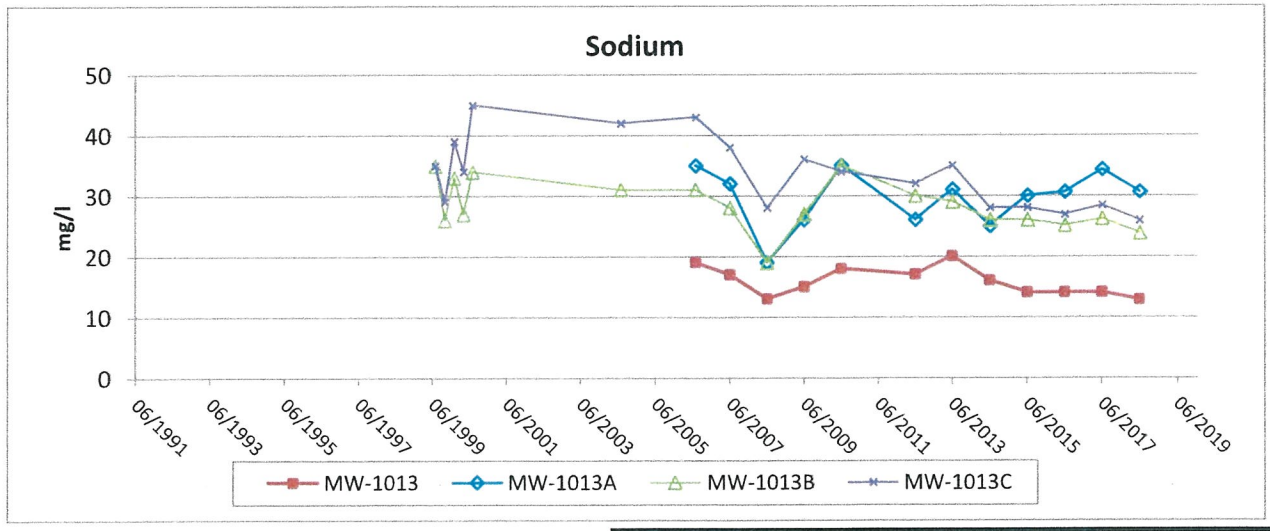
Groundwater Trend Graphs - Annual Results (In-Pit Wells)

MW-1013/MW-1013A/MW-1013B/MW-1013C

Scale: NA	Date: January 2019	
Prepared By: SGL	Checked By: SVF	Project: 17F777.18







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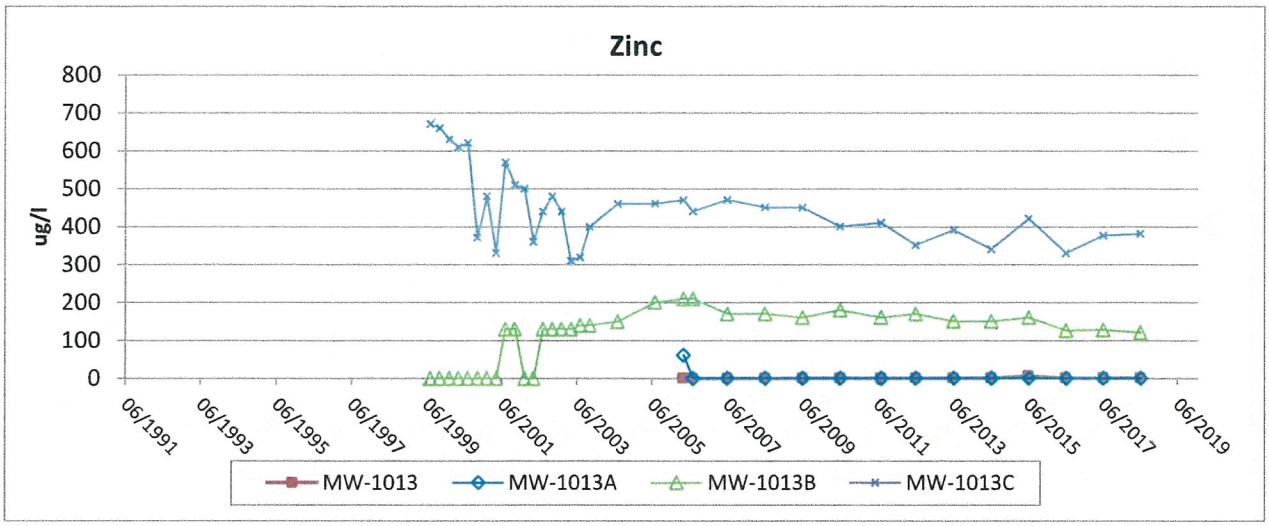
FLAMBEAU MINING COMPANY

Figure B-13d

Groundwater Trend Graphs - Annual Results (In-Pit Wells)

MW-1013/MW-1013A/MW-1013B/MW-1013C

Scale: NA	Date: January 2019	
Prepared By: SGL	Checked By: SVF	Project: 17F777.18



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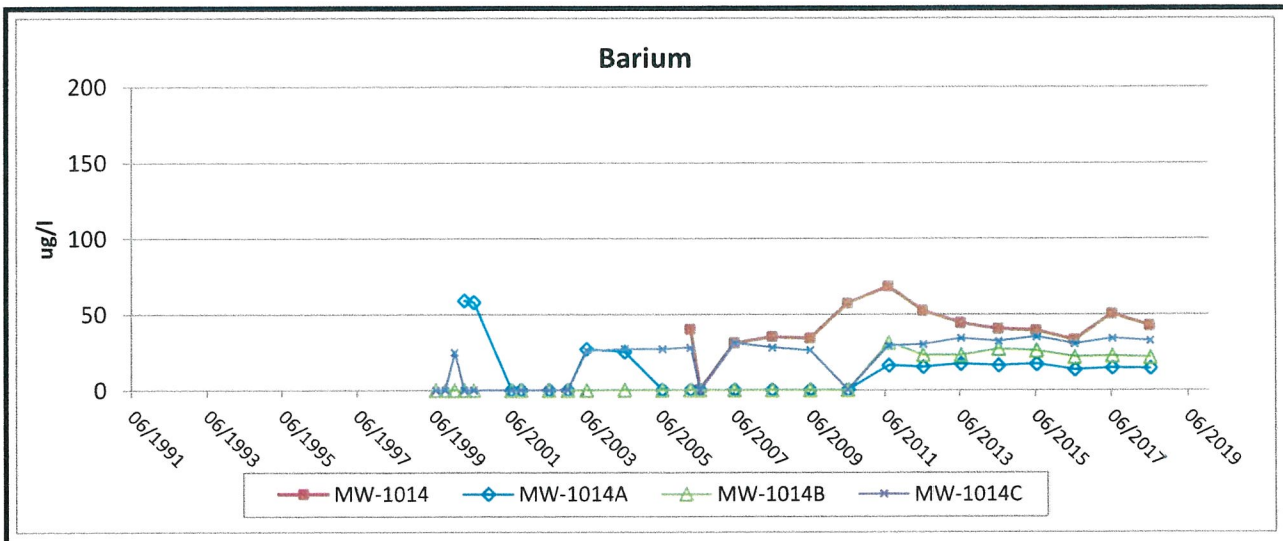
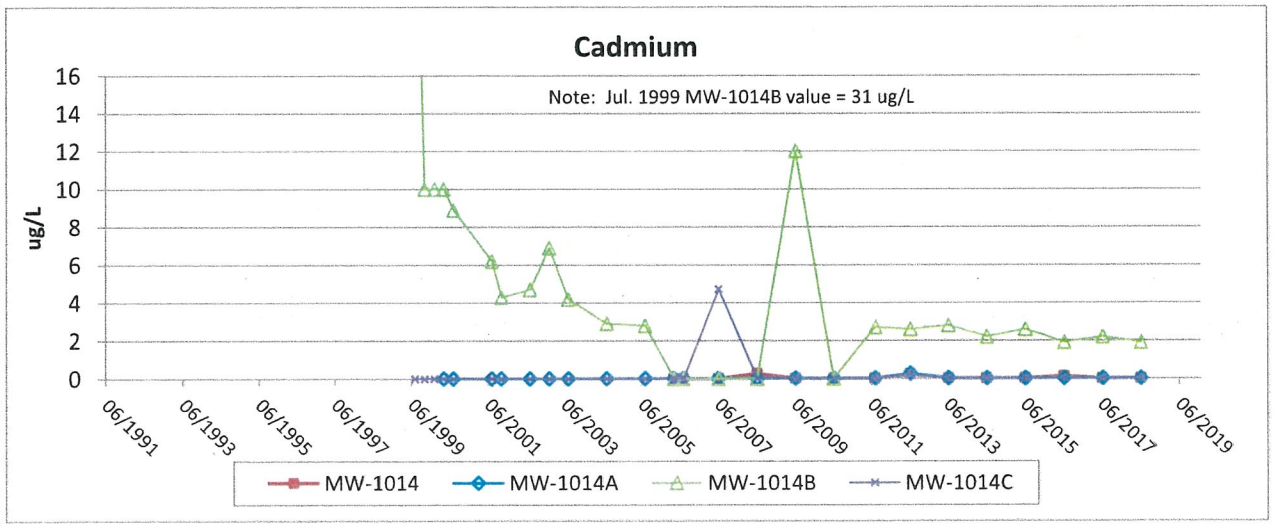
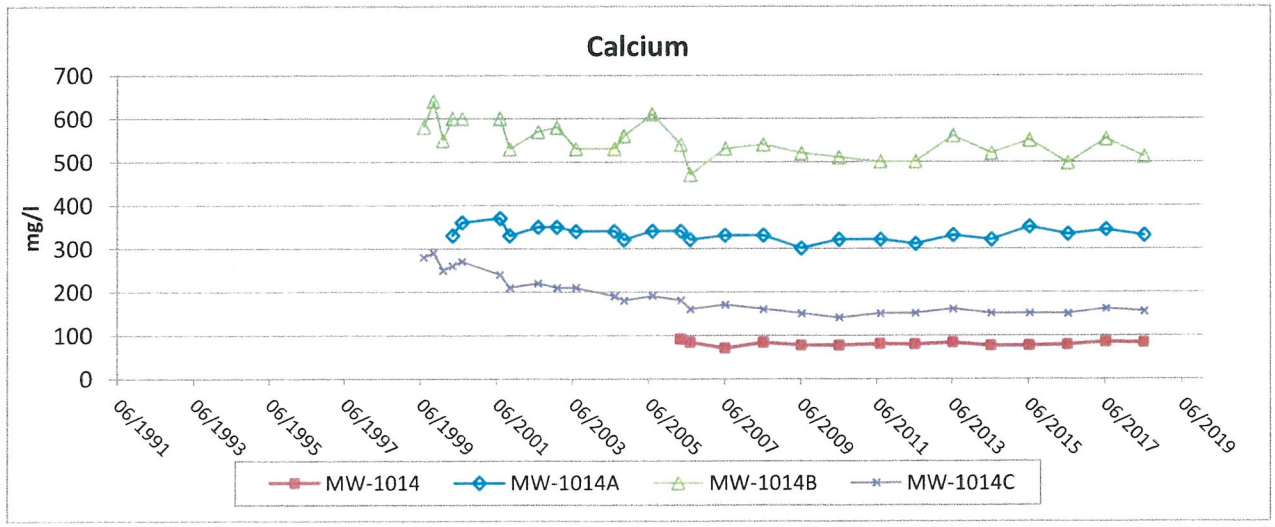
FLAMBEAU MINING COMPANY		
Figure B-13e Groundwater Trend Graphs - Annual Results (In-Pit Wells) MW-1013/MW-1013A/MW-1013B/MW-1013C		
Scale: NA		Date: January 2019
Prepared By: SGL	Checked By: SVF	Project: 17F777.18







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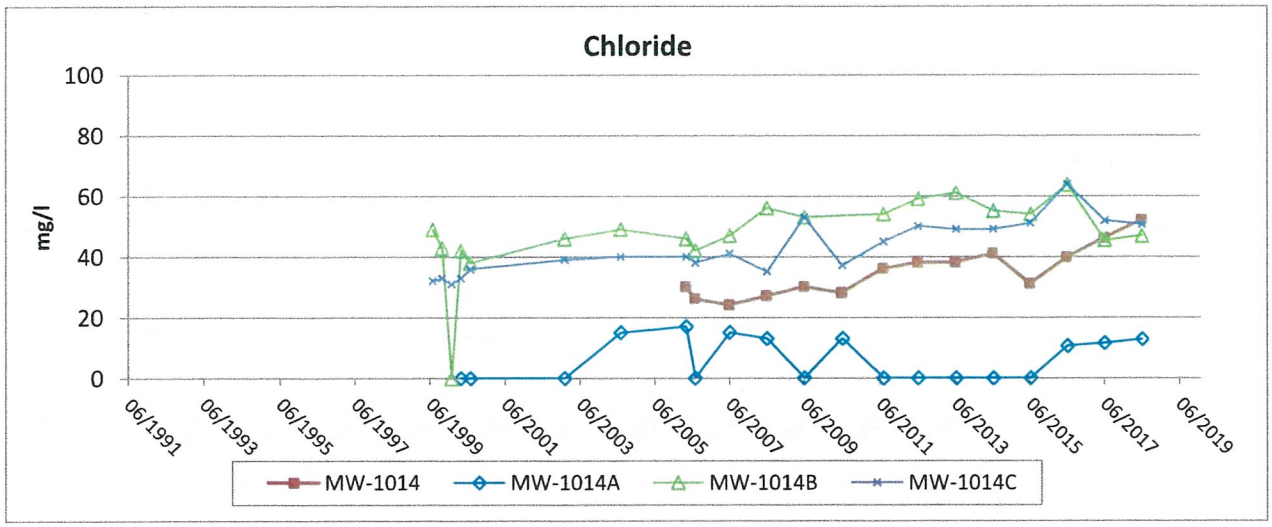
FLAMBEAU MINING COMPANY

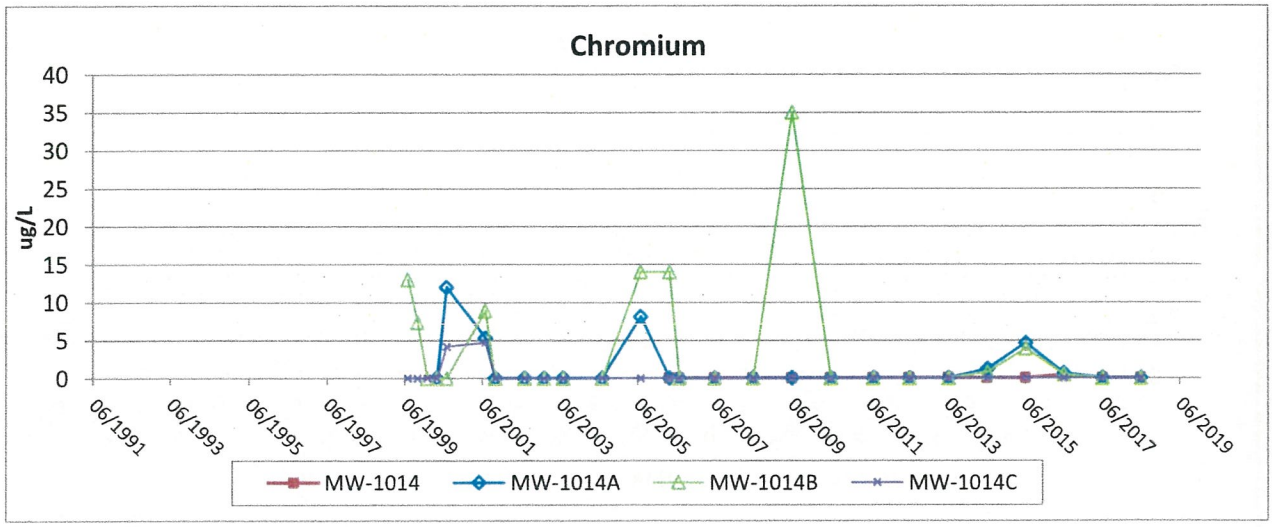
Figure B-14a

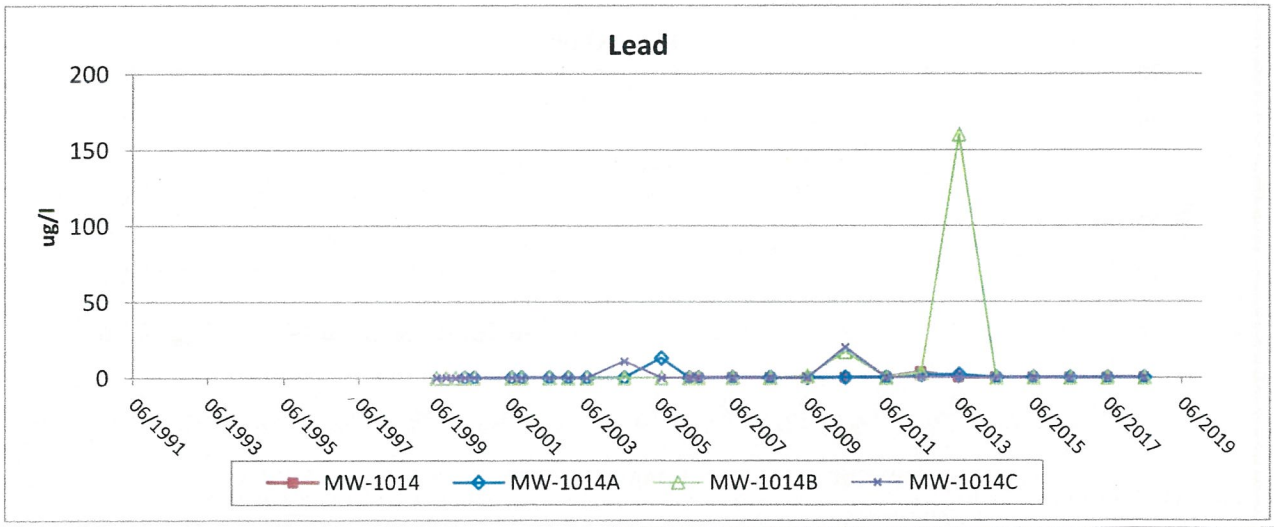
Groundwater Trend Graphs - Annual Results (In-Pit Wells)

MW-1014/MW-1014A/MW-1014B/MW-1014C

Scale: NA	Date: January 2019	
Prepared By: SGL	Checked By: SVF	Project: 17F777.18







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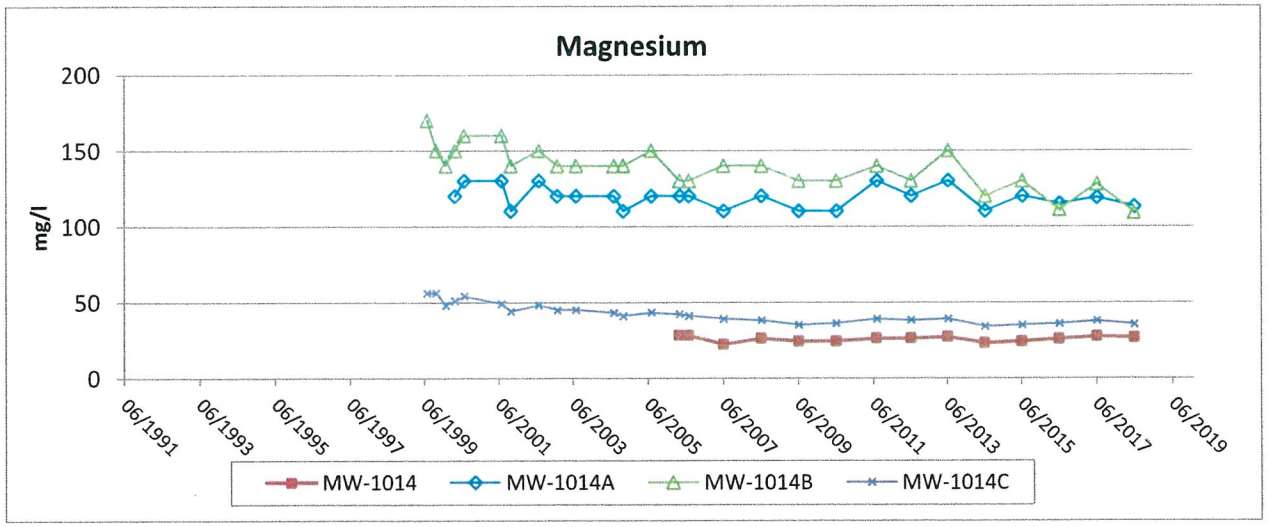
FLAMBEAU MINING COMPANY

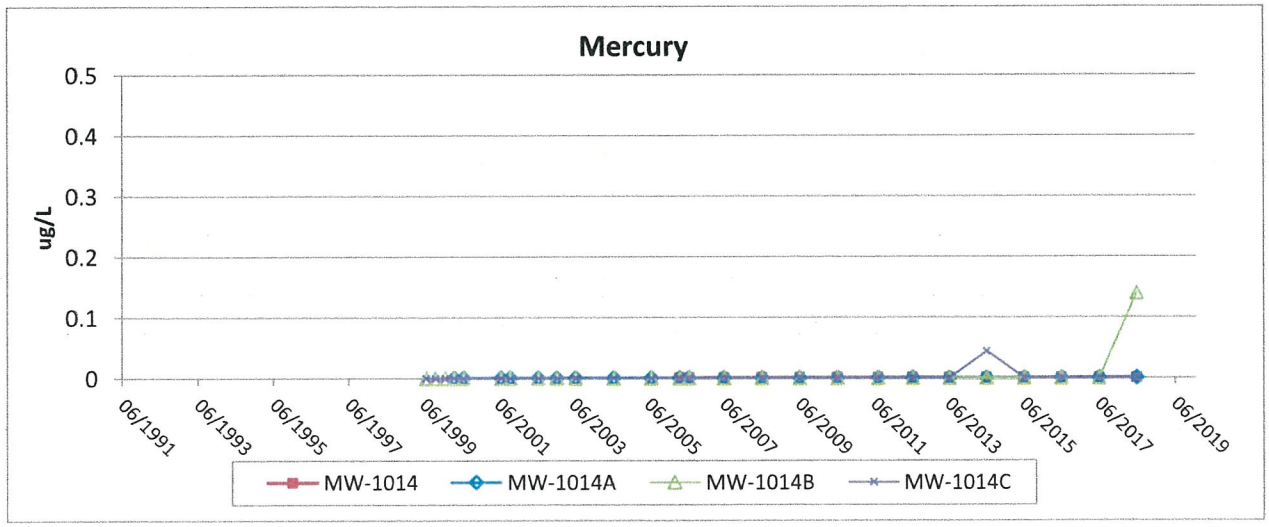
Figure B-14b

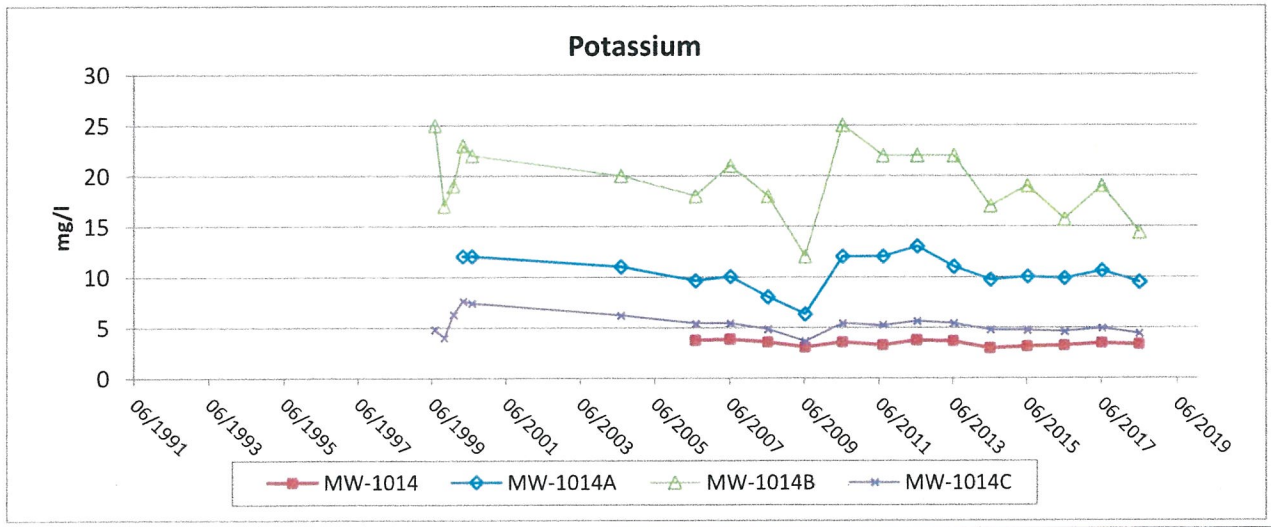
Groundwater Trend Graphs - Annual Results (In-Pit Wells)

MW-1014/MW-1014A/MW-1014B/MW-1014C

Scale: NA	Date: January 2019	
Prepared By: SGL	Checked By: SVF	Project: 17F777.18







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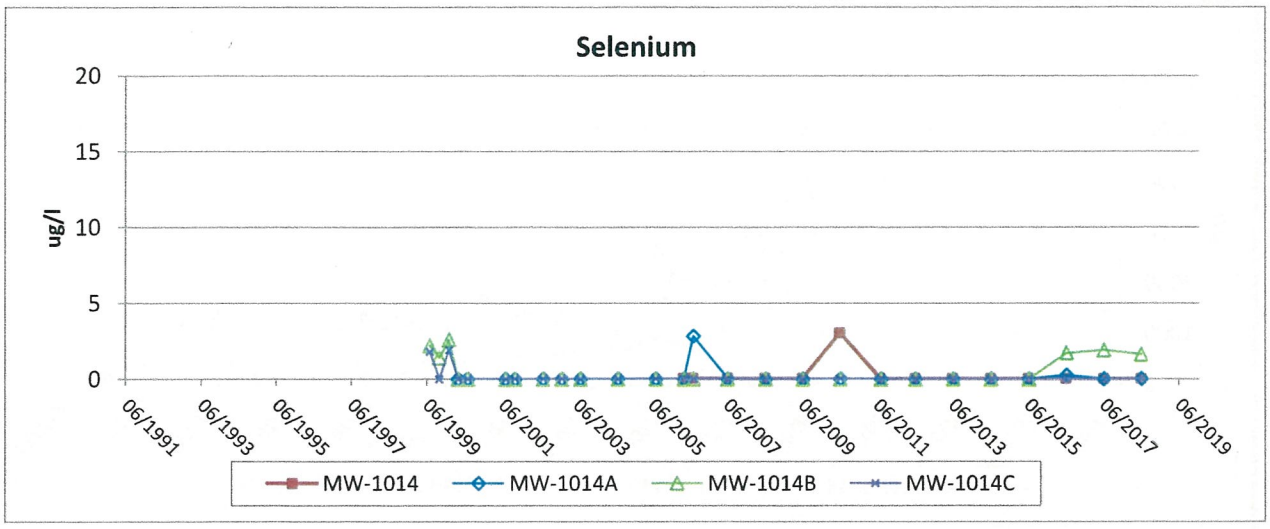
FLAMBEAU MINING COMPANY

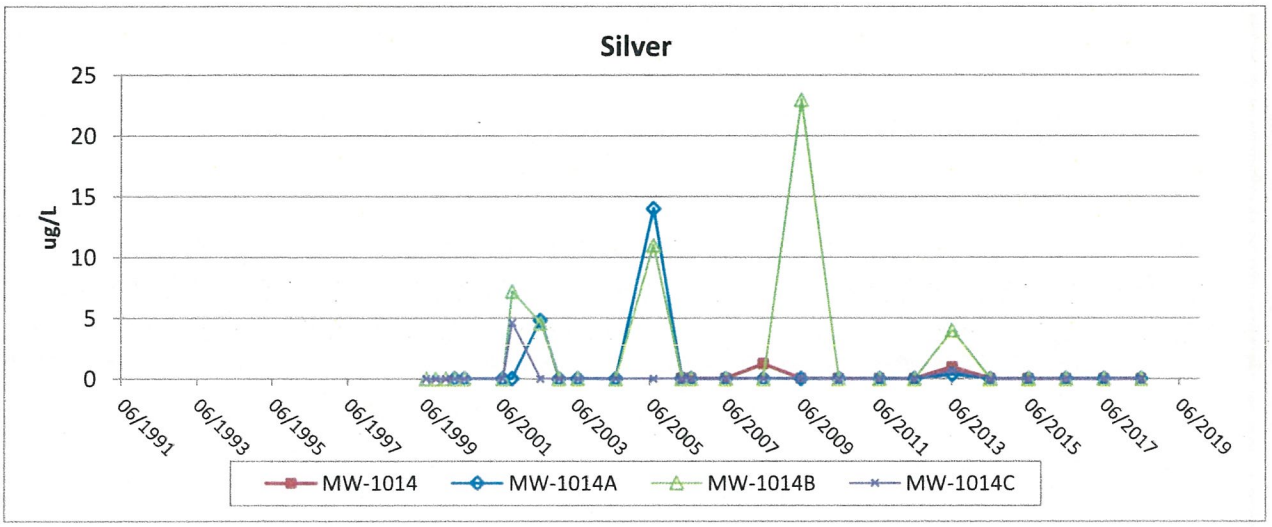
Figure B-14c

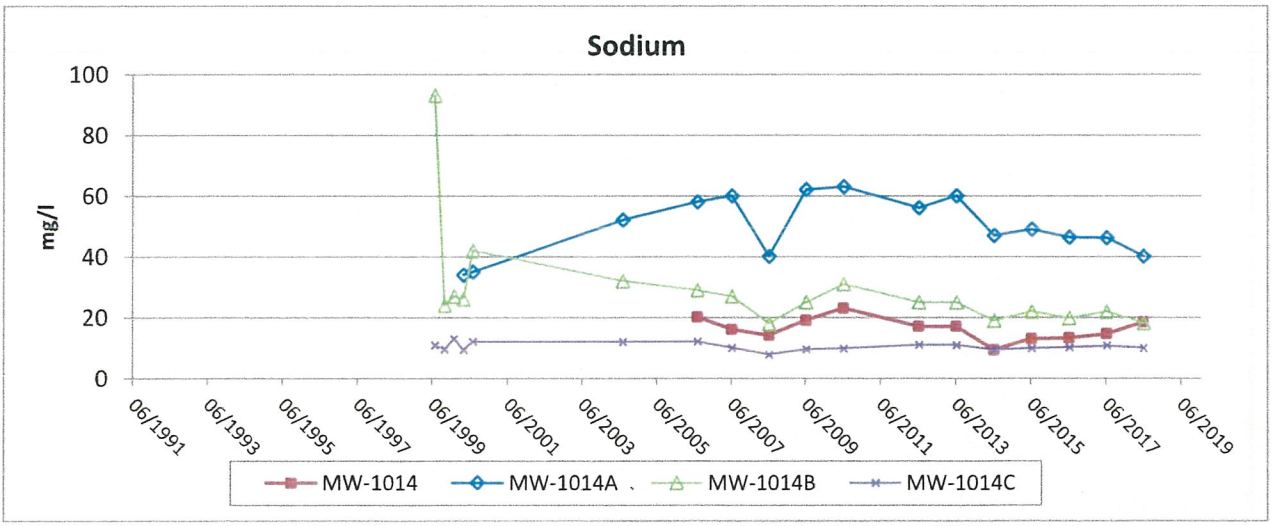
Groundwater Trend Graphs - Annual Results (In-Pit Wells)

MW-1014/MW-1014A/MW-1014B/MW-1014C

Scale: NA	Date: January 2019	
Prepared By: SGL	Checked By: SVF	Project: 17F777.18







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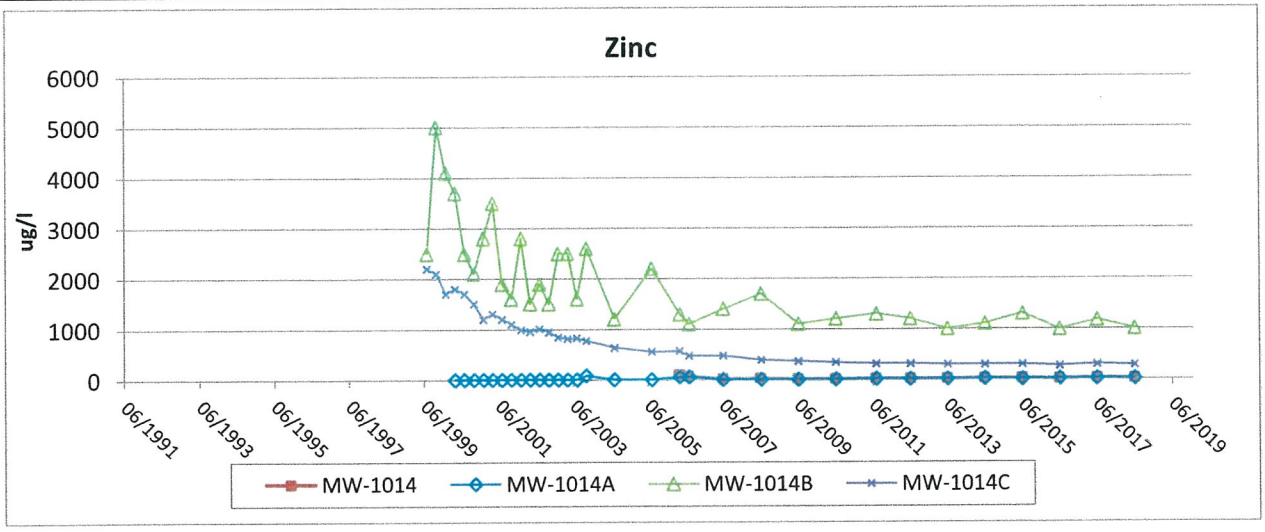
FLAMBEAU MINING COMPANY

Figure B-14d

Groundwater Trend Graphs - Annual Results (In-Pit Wells)

MW-1014/MW-1014A/MW-1014B/MW-1014C

Scale: NA	Date: January 2019	
Prepared By: SGL	Checked By: SVF	Project: 17F777.18



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FLAMBEAU MINING COMPANY		
Figure B-14e Groundwater Trend Graphs - Annual Results (In-Pit Wells) MW-1014/MW-1014A/MW-1014B/MW-1014C		
Scale: NA		Date: January 2019
Prepared By: SGL	Checked By: SVF	Project: 17F777.18

2018 Groundwater Results - Annual Parameters

Sample Date (yyyy-mm)	Location		Barium ug/l	Cadmium ug/l	Calcium mg/l	Chloride mg/l	Chromium ug/l	Lead ug/l	Magnesium mg/l	Mercury ug/l	Potassium mg/l	Selenium ug/l	Silver ug/l	Sodium mg/l	Zinc ug/l
2018-06	MW-1000PR	N	94.5	0.71	102	14.2	5.7	0.89	28.2	< 0.12	3.05	1.5	0.59	7.29	416
2018-06	MW-1000R	N	25.0	0.17	19.8	7.7	< 1.0	< 0.20	5.25	< 0.12	0.536	0.37	< 0.10	4.46	< 4.6
2018-06	MW-1002	Dup.	7.1	< 0.081	14.5	7.5	< 1.0	< 0.20	5.07	< 0.12	0.552	< 0.32	< 0.10	3.43	< 4.6
2018-06	MW-1002	N	6.5	< 0.081	14.9	7.4	< 1.0	< 0.20	5.01	< 0.12	0.607	< 0.32	< 0.10	3.03	< 4.6
2018-06	MW-1002G	N	37.8	< 0.081	36.7	29.7	< 1.0	< 0.20	14.2	< 0.12	0.864	< 0.32	< 0.10	6.09	< 4.6
2018-06	MW-1004	N	3.4	< 0.081	11.6	1.2	< 1.0	< 0.20	3.62	< 0.12	0.67	< 0.32	< 0.10	2.42	< 4.6
2018-06	MW-1004P	N	44.8	< 0.081	36	1.1	< 1.0	< 0.20	14.5	< 0.12	5.6	< 0.32	< 0.10	6.17	< 4.6
2018-06	MW-1004S	N	3.7	< 0.081	16.3	1.5	< 1.0	< 0.20	5.33	< 0.12	0.765	< 0.32	< 0.10	3.14	< 4.6
2018-06	MW-1005	N	364	< 0.081	142	594	< 1.0	< 0.20	64.6	< 0.12	1.17	< 0.32	< 0.10	77.6	< 4.6
2018-06	MW-1005P	N	73.8	< 0.081	54.3	6.5	< 1.0	< 0.20	21.9	< 0.12	8.63	< 0.32	< 0.10	9.09	< 4.6
2018-06	MW-1005S	N	40.0	< 0.081	35.7	3.1	< 1.0	< 0.20	12.6	< 0.12	2.52	< 0.32	< 0.10	5.6	< 4.6
2018-06	MW-1010P	N	45.9	< 0.081	49.4	5.1	< 1.0	< 0.20	13.4	< 0.12	2.6	< 0.32	< 0.10	4.24	< 4.6
2018-06	MW-1013	N	158	< 0.081	150	8.8	3.5	0.40	48.3	< 0.12	2.57	0.85	< 0.10	12.8	< 4.6
2018-06	MW-1013A	N	84.0	0.12	115	7.5	< 1.0	< 0.20	39.8	< 0.12	7.04	< 0.32	< 0.10	30.6	< 4.6
2018-06	MW-1013B	N	16.6	0.74	572	39.3	2.1	< 0.20	136	< 0.12	5.04	0.57	< 0.10	23.8	120
2018-06	MW-1013C	N	17.9	< 0.081	530	50.4	< 1.0	0.73	125	0.16	21.2	< 0.32	0.10	25.9	380
2018-06	MW-1014	N	42.3	< 0.081	81.9	52.0	< 1.0	< 0.20	26.5	< 0.12	3.3	< 0.32	< 0.10	18.5	6.0
2018-06	MW-1014A	N	14.2	< 0.081	330	12.8	< 1.0	< 0.20	113	< 0.12	9.45	< 0.32	< 0.10	40	7.2
2018-06	MW-1014B	N	21.6	1.9	512	46.9	< 1.0	< 0.20	109	0.14	14.4	1.6	< 0.10	18.2	1000
2018-06	MW-1014C	Dup.	32.3	< 0.081	140	51.0	< 1.0	< 0.20	32.8	< 0.12	4	< 0.32	< 0.10	10.3	252
2018-06	MW-1014C	N	32.5	< 0.081	155	50.6	< 1.0	< 0.20	35.5	< 0.12	4.36	< 0.32	< 0.10	9.98	272
2018-06	MW-1015A	N	8.0	< 0.081	21.3	7.0	< 1.0	< 0.20	8.81	< 0.12	0.71	< 0.32	< 0.10	3.26	< 4.6
2018-06	MW-1015B	N	46.4	0.089	34.3	89.5	< 1.0	< 0.20	14.9	< 0.12	6.23	< 0.32	< 0.10	62.8	< 4.6

Attachment 3

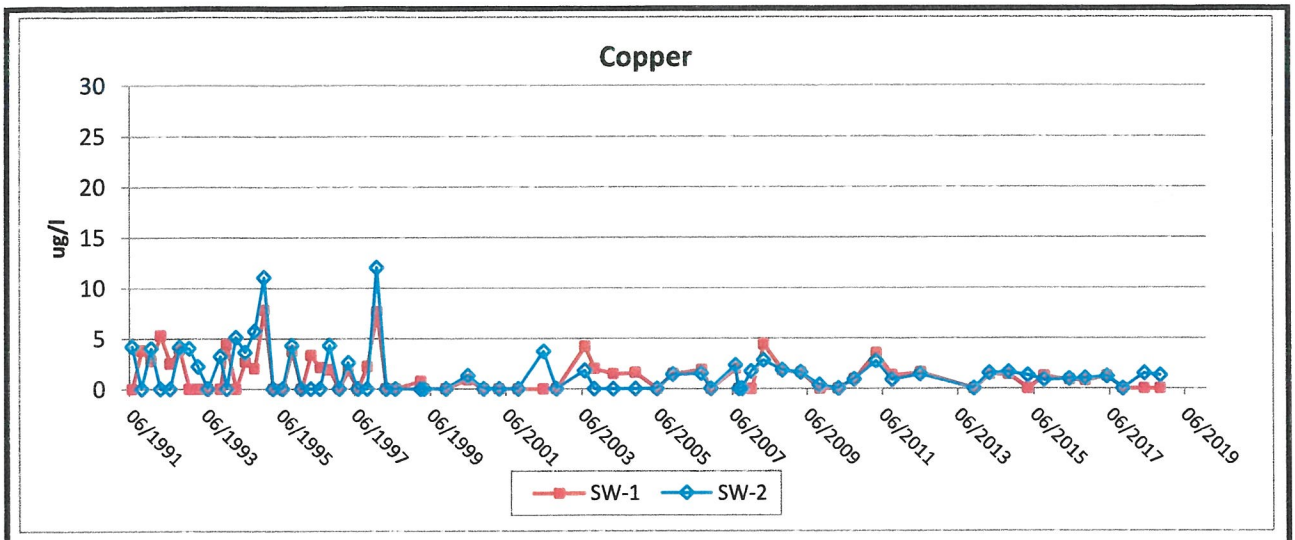
Surface Water

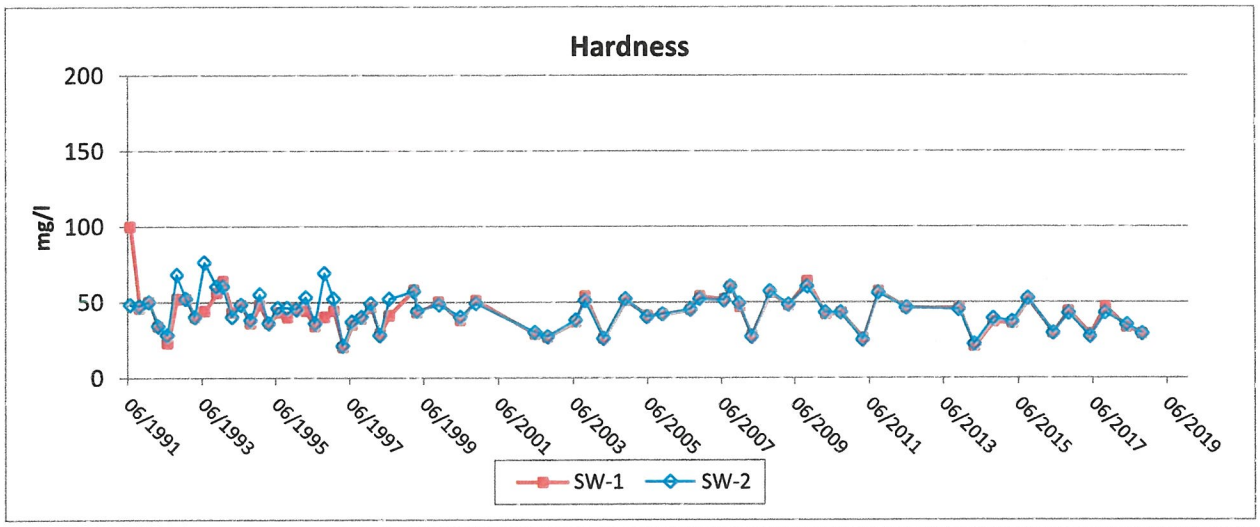
Statistical Results
Trend Graphs
2018 Data

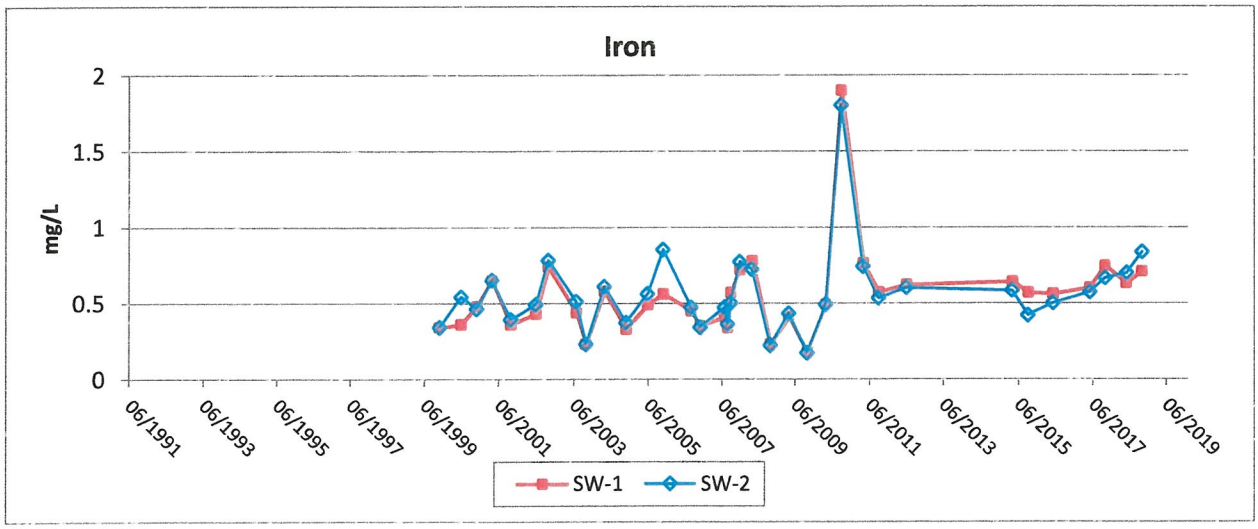
Trend Analysis Results - Surface Water
Year Ending 2018

	Copper	Hardness	Iron	Manganese	Zinc	Total Suspended Solids
SW-1						
Trend Results for Most Recent 5 Years						
Sample Size	10	10	7	4	8	10
Mann-Kendall S	-25	-1	7	-2	-5	8
p-Level	0.028	1.000	0.382	0.750	0.634	0.542
Trend						
Trend Results for All Data Since Oct. 1997						
Sample Size	45	42	35	32	43	19
Mann-Kendall S	-34	-58	179	70	0	-17
p-Level	0.733	0.536	0.010	0.266	1.000	0.580
Trend			+			
SW-2						
Trend Results for Most Recent 5 Years						
Sample Size	10	10	7	4	8	10
Mann-Kendall S	-7	-1	15	2	-6	3
p-Level	0.600	1.000	0.030	0.750	0.548	0.862
Trend						
Trend Results for All Data Since Oct. 1997						
Sample Size	45	42	35	32	43	19
Mann-Kendall S	191	-115	113	37	86	-31
p-Level	0.051	0.216	0.112	0.563	0.312	0.298
Trend						

Notes: Overall increasing trend denoted by "+".
Overall decreasing trend denoted by "-"
All trend tests performed at a Type I (two-tailed) error rate of 0.01.







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FLAMBEAU MINING COMPANY

Figure B-15a
Surface Water Trend Graphs
SW-1/SW-2

Scale: NA		Date: January 2019
Prepared By: SGL	Checked By: SVF	Project: 17F777.18

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2018 Annual Summary Memorandum

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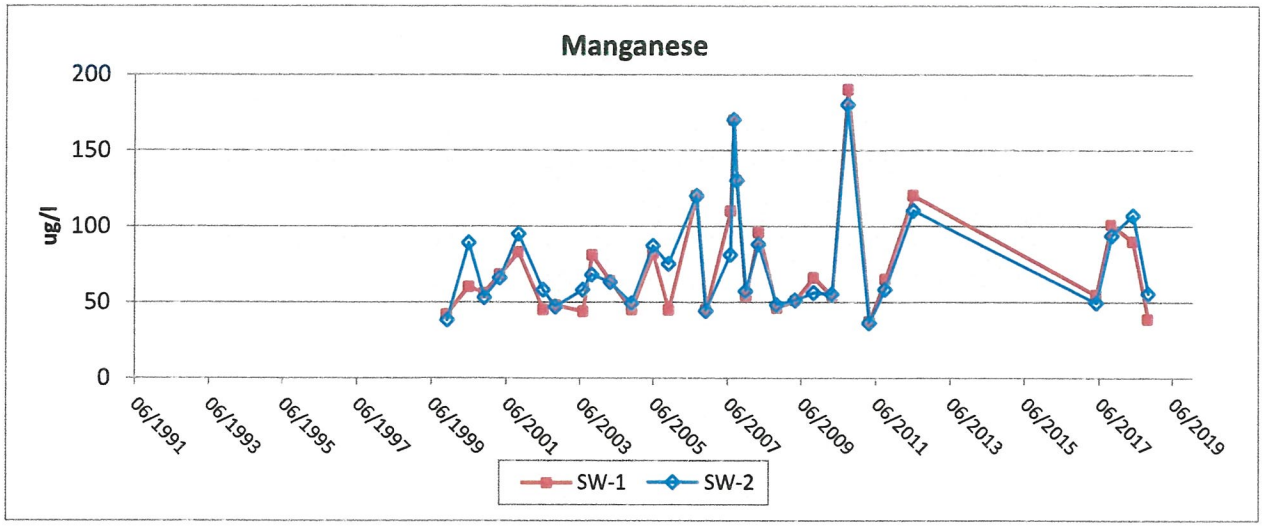

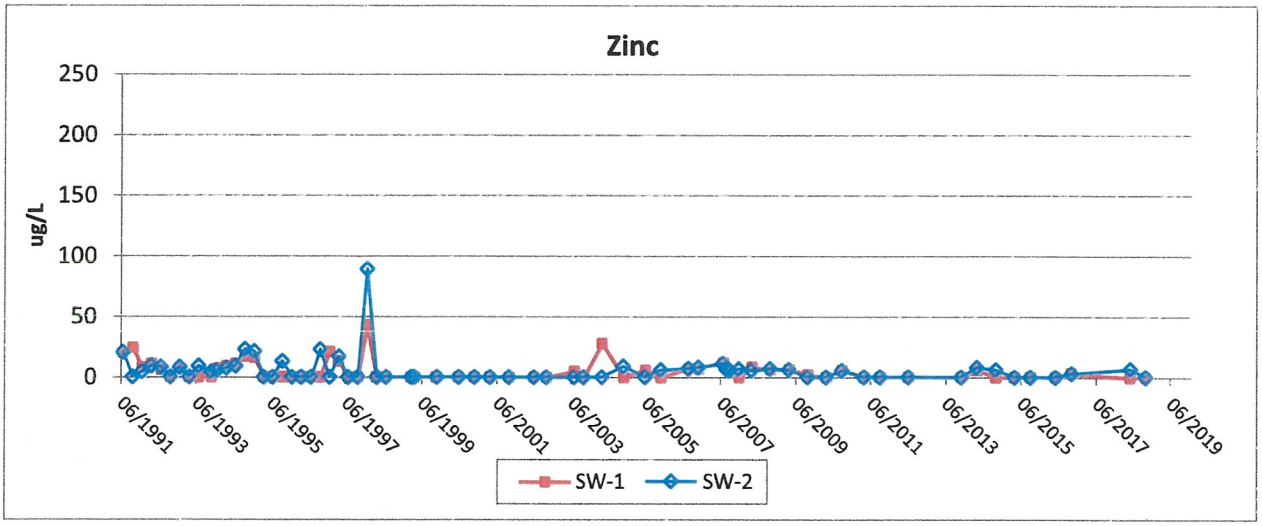

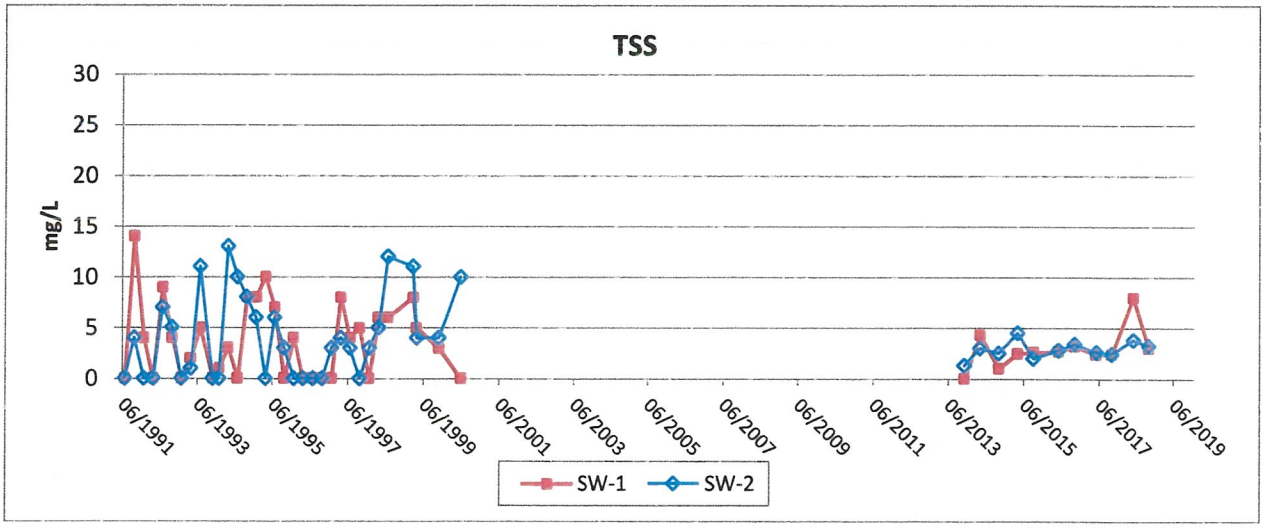

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FLAMBEAU MINING COMPANY

Figure B-15b

Surface Water Trend Graphs

SW-1/SW-2

Scale: NA	Date: January 2019	
Prepared By: SGL	Checked By: SVF	Project: 17F777.18

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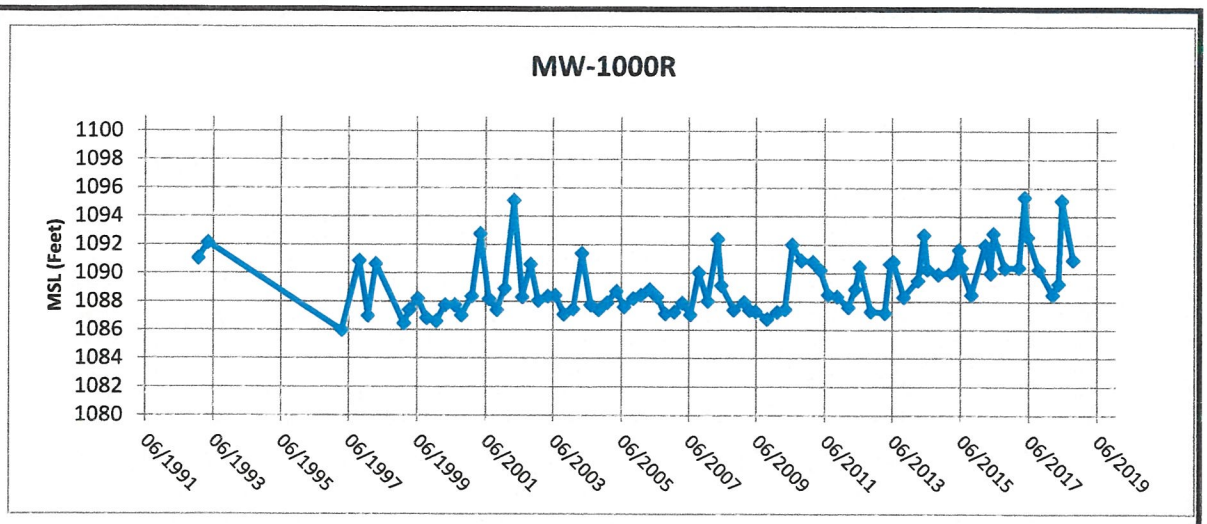
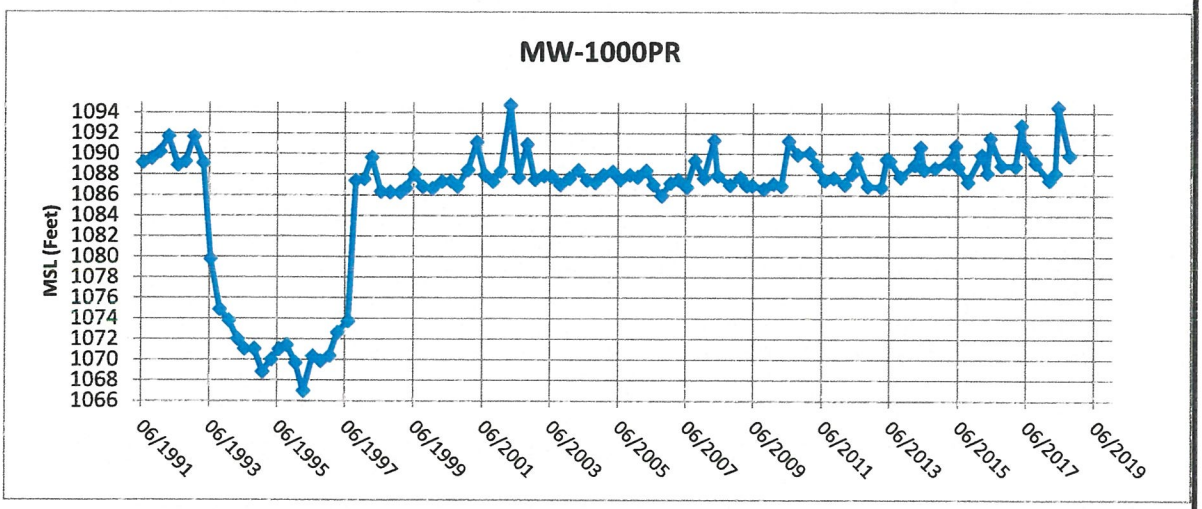
2018 Surface Water Results

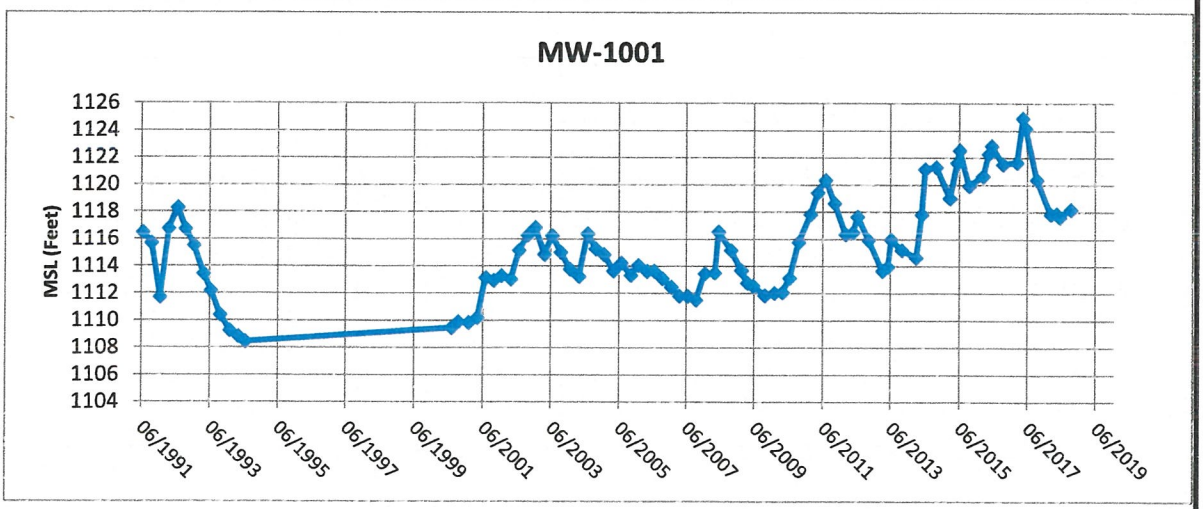
Sample Date (yyyy-mm)	Location		Copper ug/l	Hardness mg/l	Iron mg/l	Manganese ug/l	Zinc ug/l	Total Suspended Solids mg/l
2018-05	SW-1	N	< 1.1	33.3	0.631	90.0	< 4.6	8.0
2018-05	SW-1	Dup.	< 1.1	32.7	0.621	90.4	< 4.6	3.4
2018-05	SW-2	N	1.5	34.8	0.697	107	6.5	3.8
2018-10	SW-1	N	< 1.1	29.0	0.708	38.9	< 4.6	3.0
2018-10	SW-2	N	1.3	28.9	0.835	55.4	< 4.6	3.2

Attachment 4

Hydrographs







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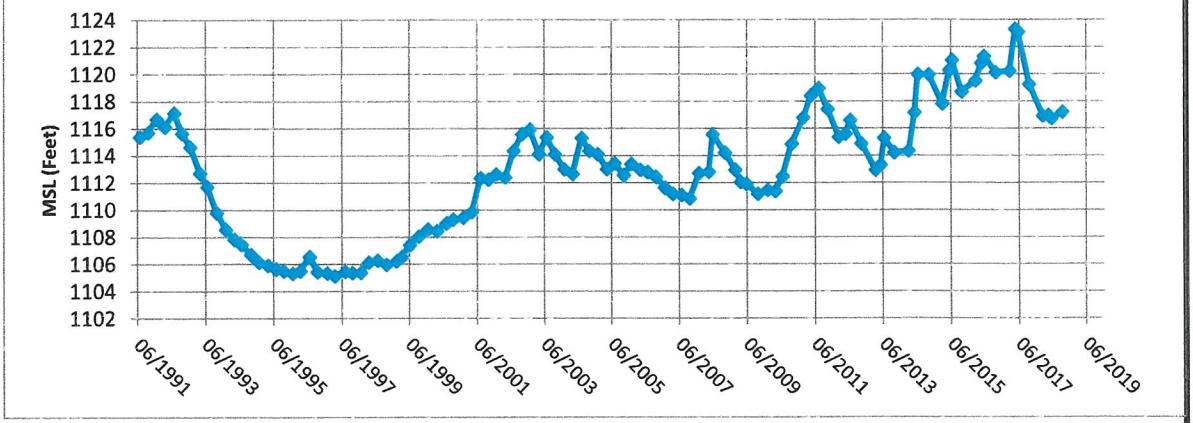
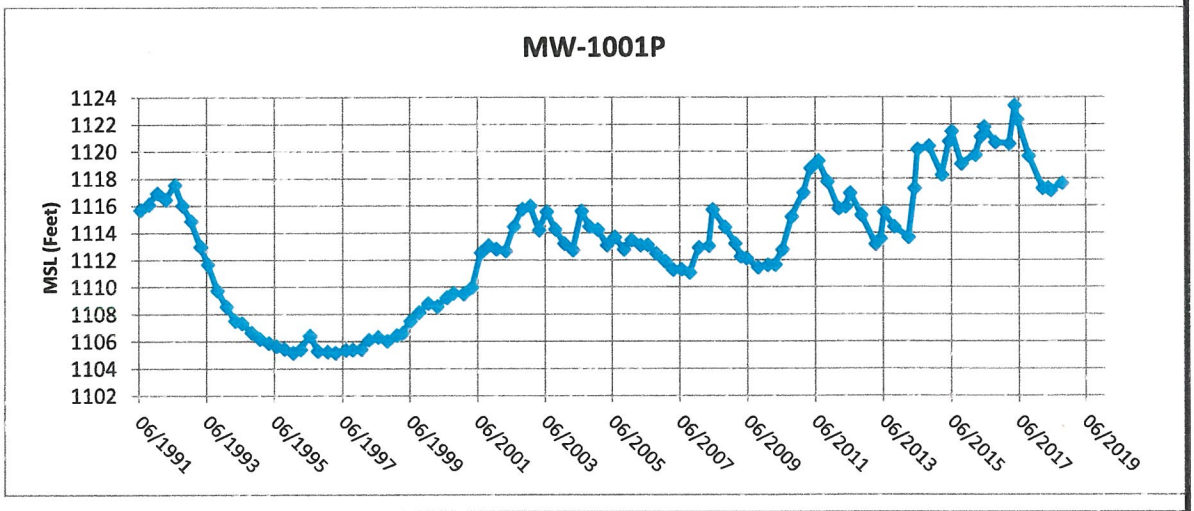
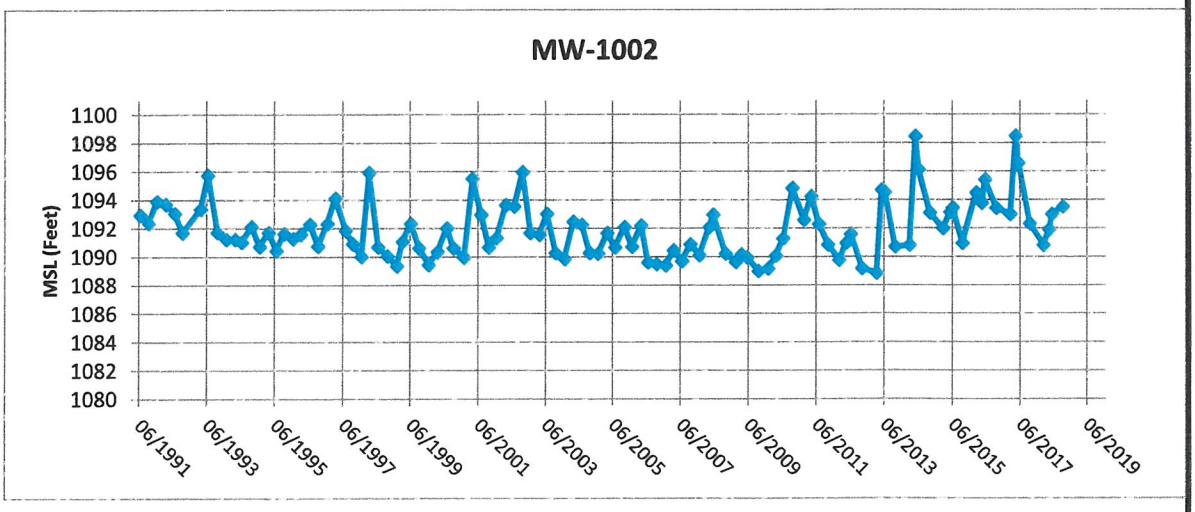
FLAMBEAU MINING COMPANY

Figure B-16a
Hydrographs

Scale: NA	Date: January 2019
Prepared By: SGL	Checked By: SVF	Project: 17F777.18







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FLAMBEAU MINING COMPANY

Figure B-16b
Hydrographs

Scale: NA	Date: January 2019	
Prepared By: SGL	Checked By: SVF	Project: 17F777.18

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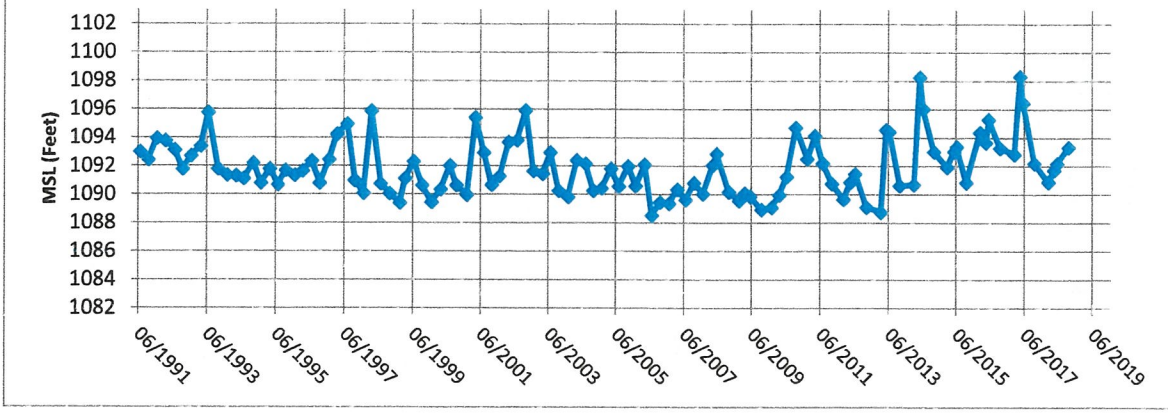

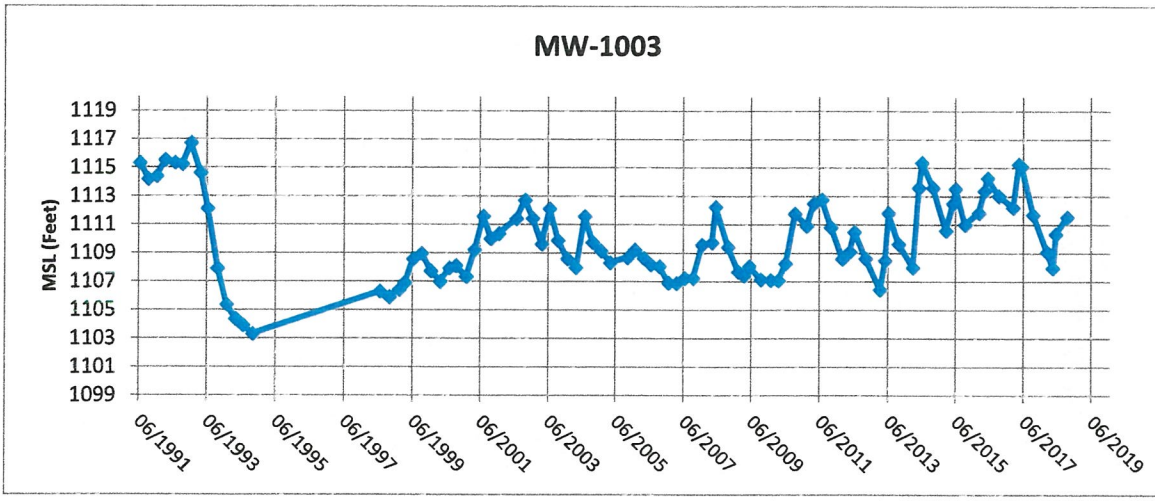

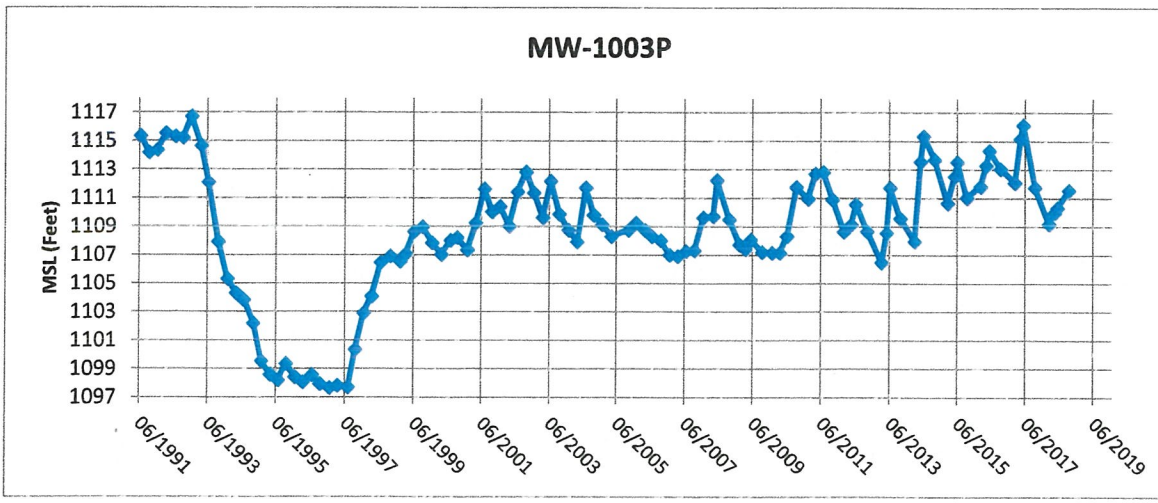

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FLAMBEAU MINING COMPANY

Figure B-16c
Hydrographs

Scale: NA	Date: January 2019	
Prepared By: SGL	Checked By: SVF	Project: 17F777.18

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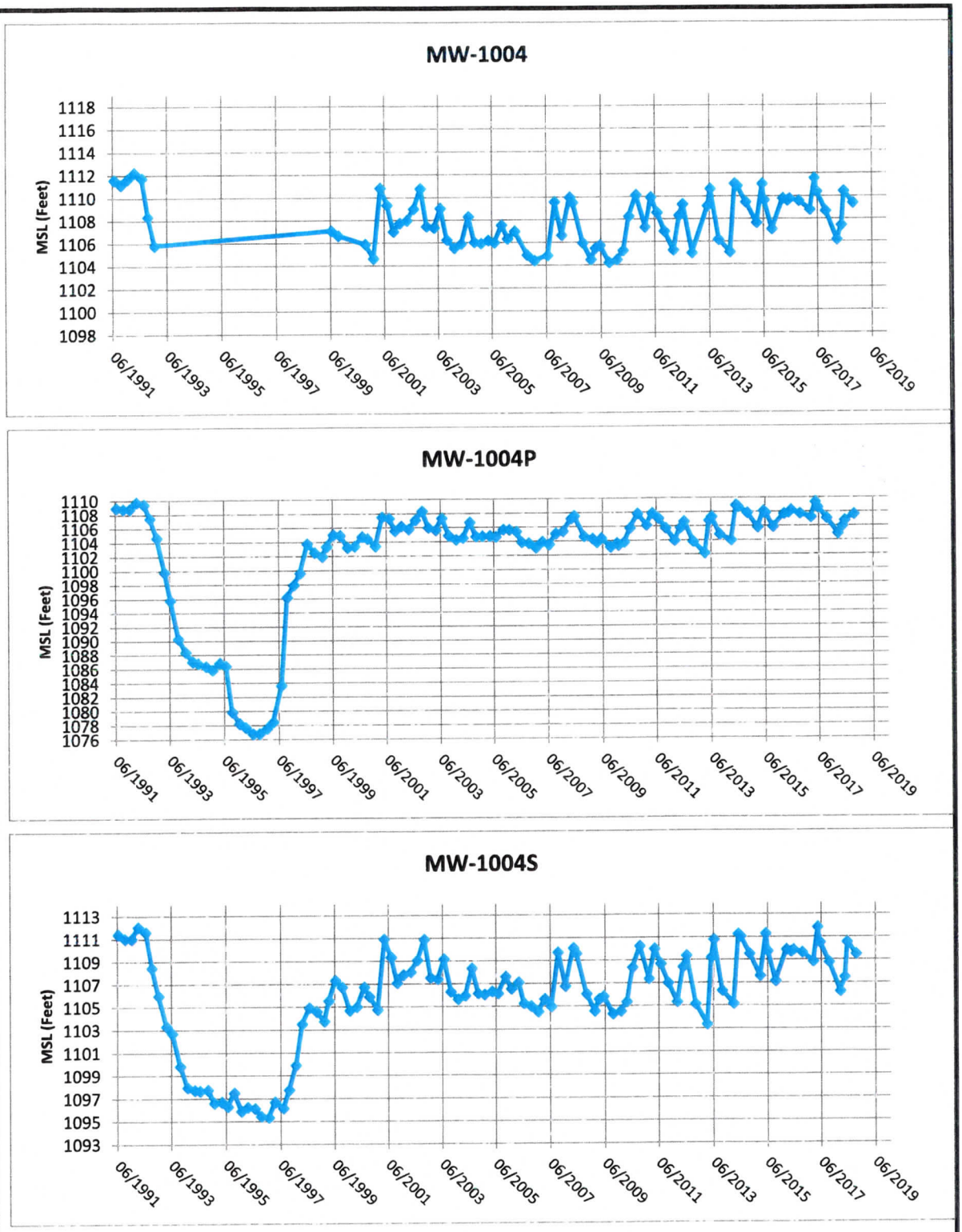

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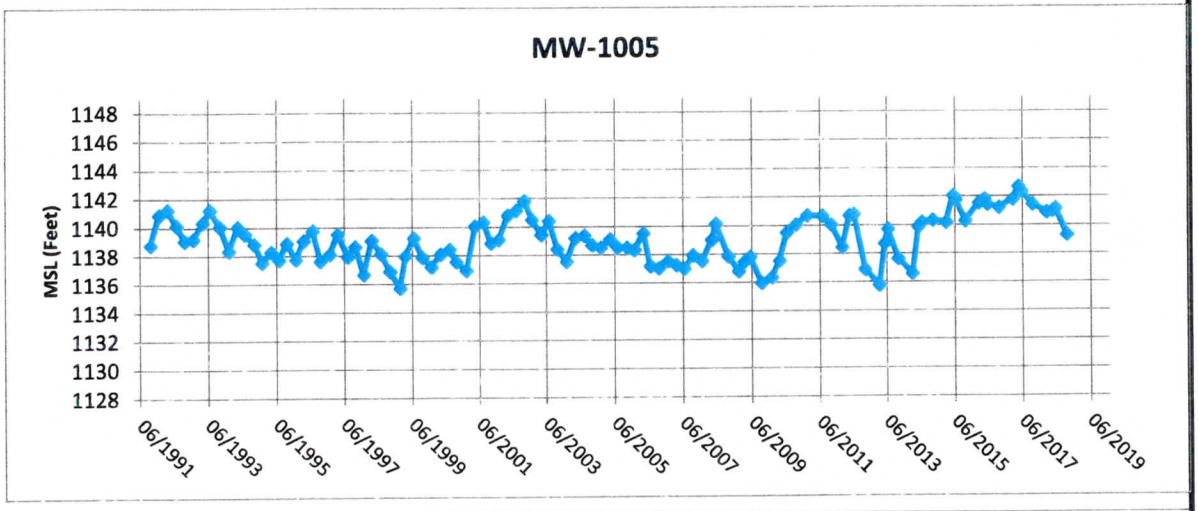
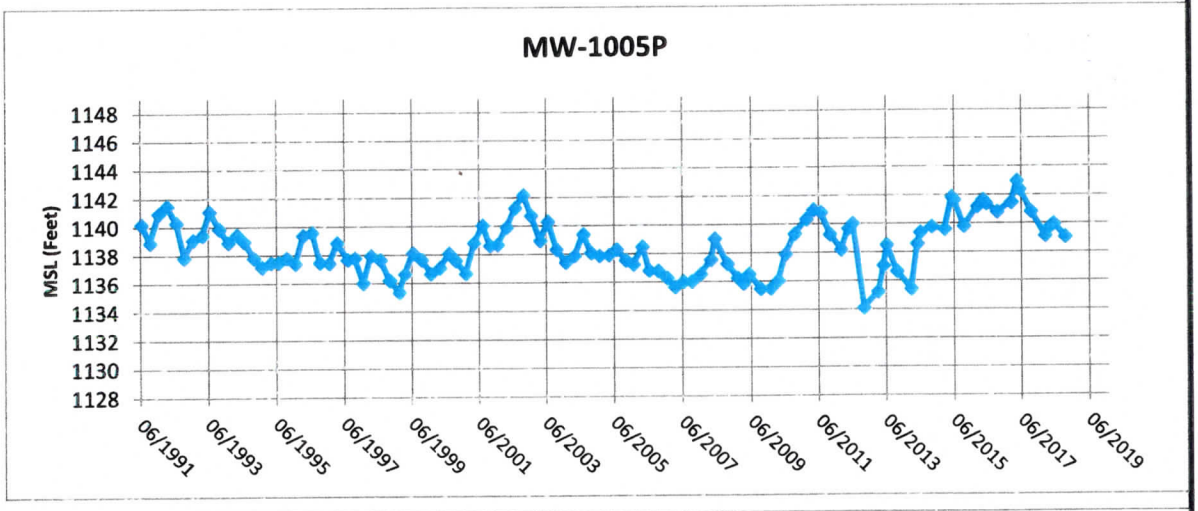
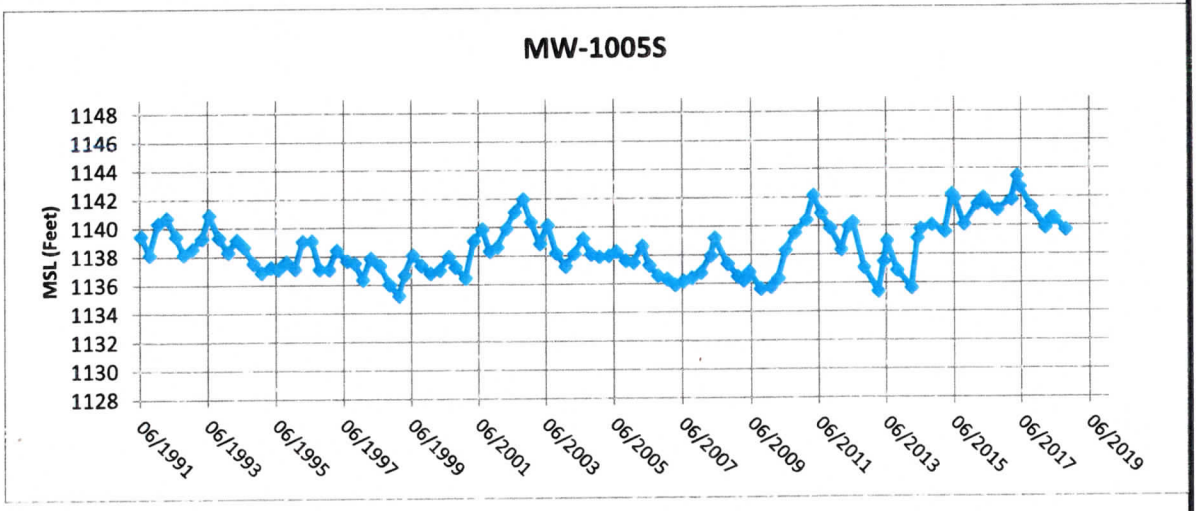
FLAMBEAU MINING COMPANY

Figure B-16d
Hydrographs

Scale: NA	Date: January 2019
Prepared By: SGL	Checked By: SVF	Project: 17F777.18







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FLAMBEAU MINING COMPANY

Figure B-16e
Hydrographs

Scale: NA	Date: January 2019
Prepared By: SGL	Checked By: SVF	Project: 17F777.18

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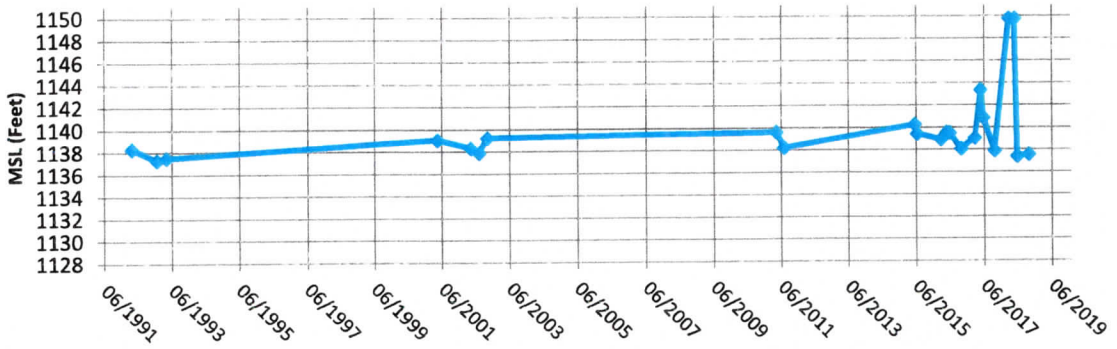
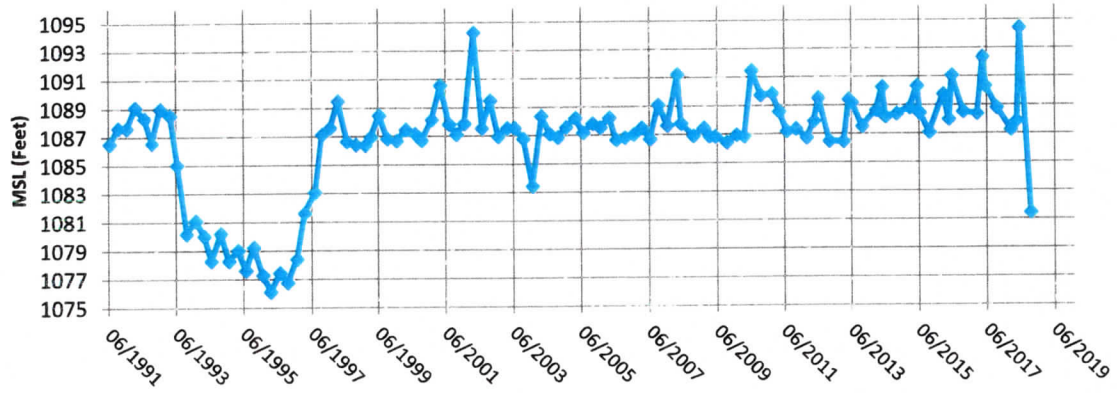
MW-1006



Note: Gaps between collected data are due to dry well.

MW-1010P



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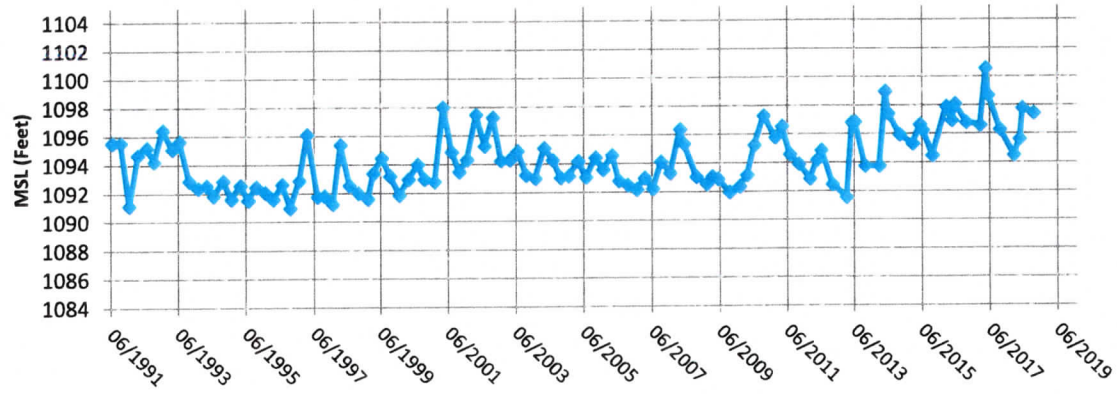

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FLAMBEAU MINING COMPANY

Figure B-16f
Hydrographs

Scale: NA	Date: January 2019
Prepared By: SGL	Checked By: SVF	Project: 17F777.18

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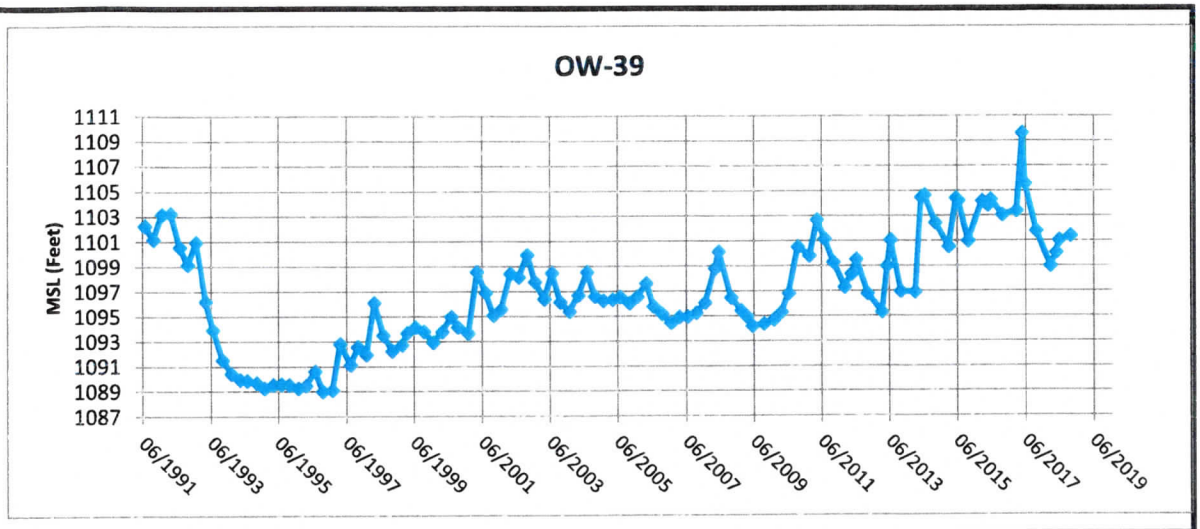

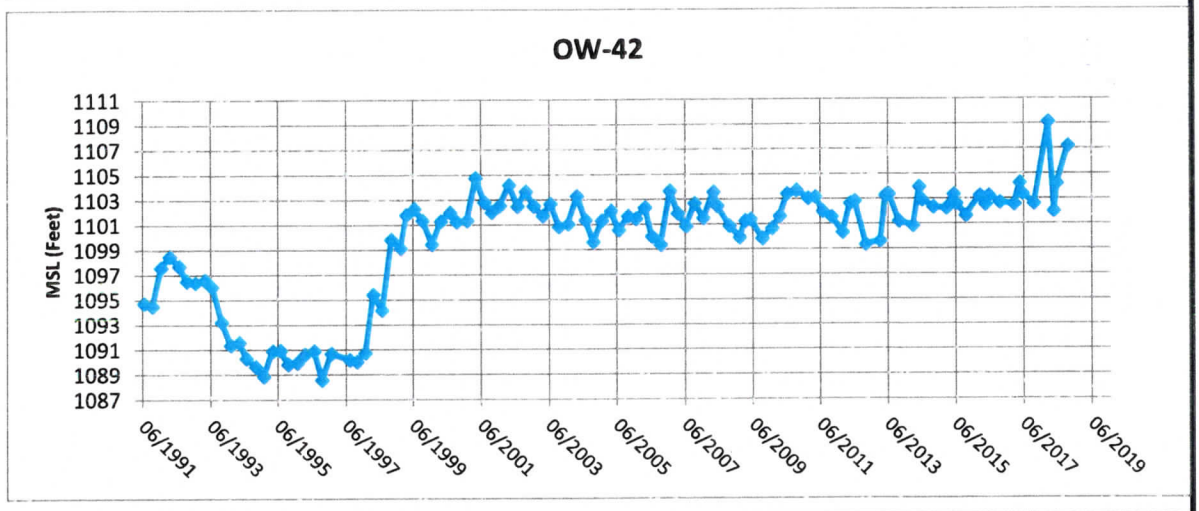

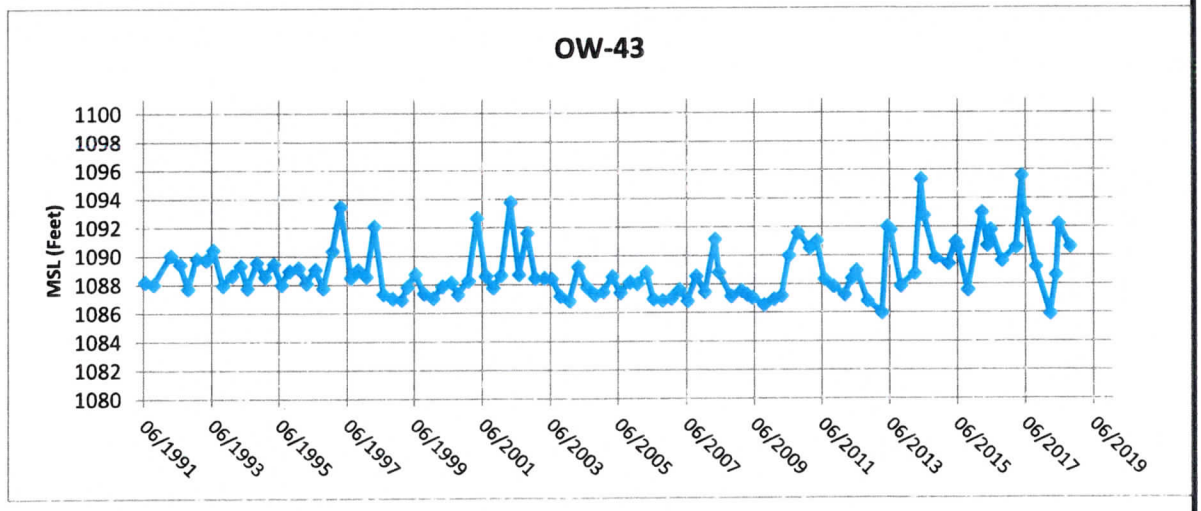

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Figure B-16g
Hydrographs

Scale: NA	Date: January 2019
Prepared By: SGL	Checked By: SVF	Project: 17F777.18

Flambeau Mining Co.
2018 Annual Summary Memorandum

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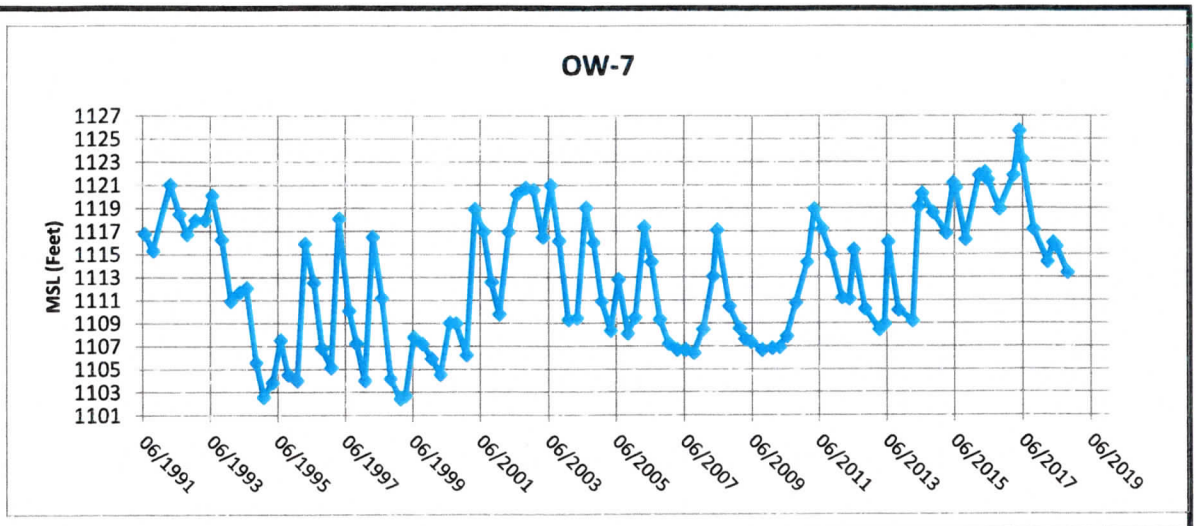

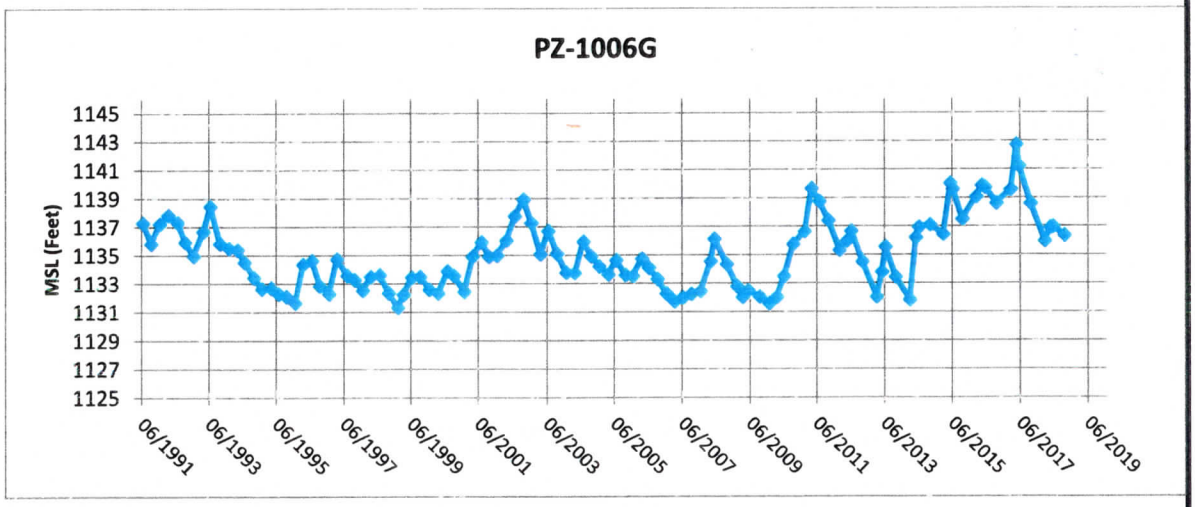

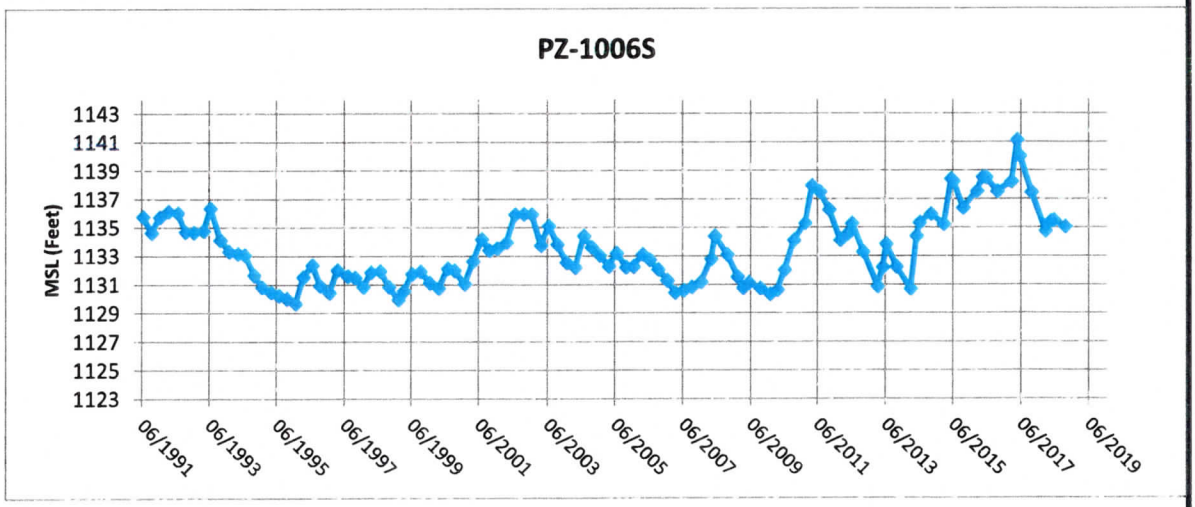

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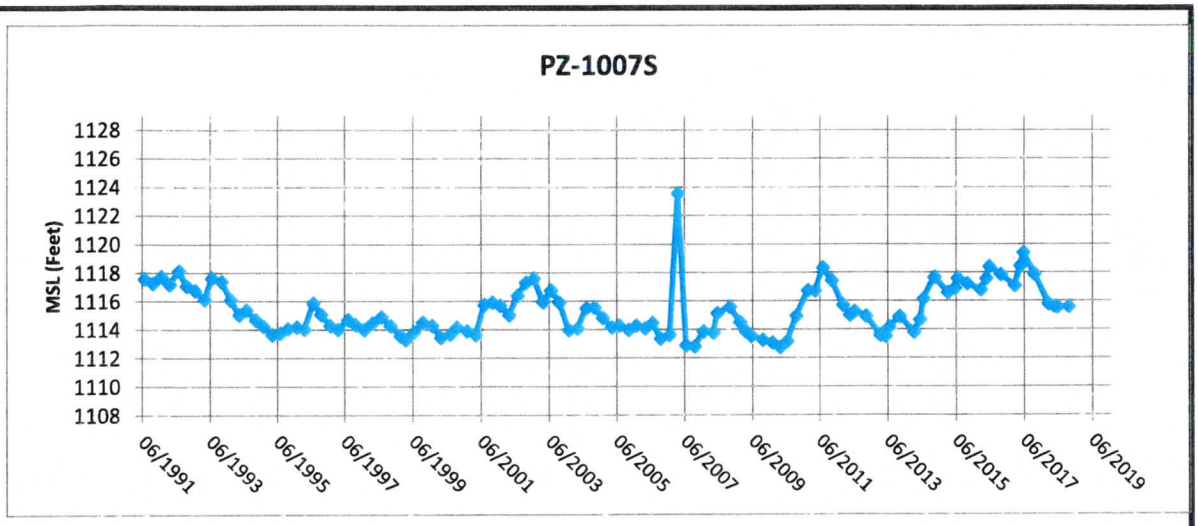
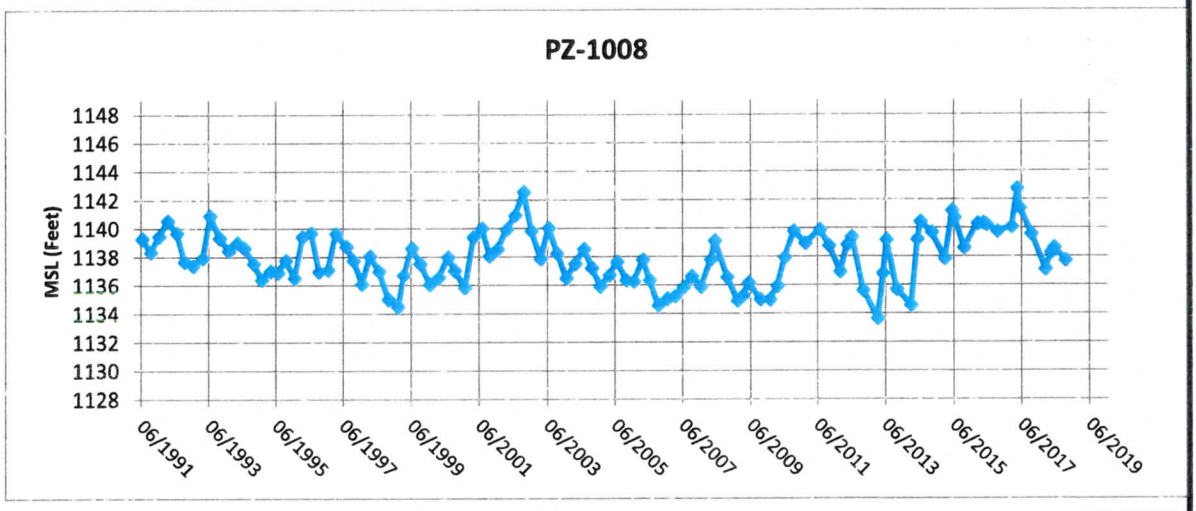
Figure B-16h
Hydrographs

Scale: NA	Date: January 2019
Prepared By: SGL	Checked By: SVF	Project: 17F777.18





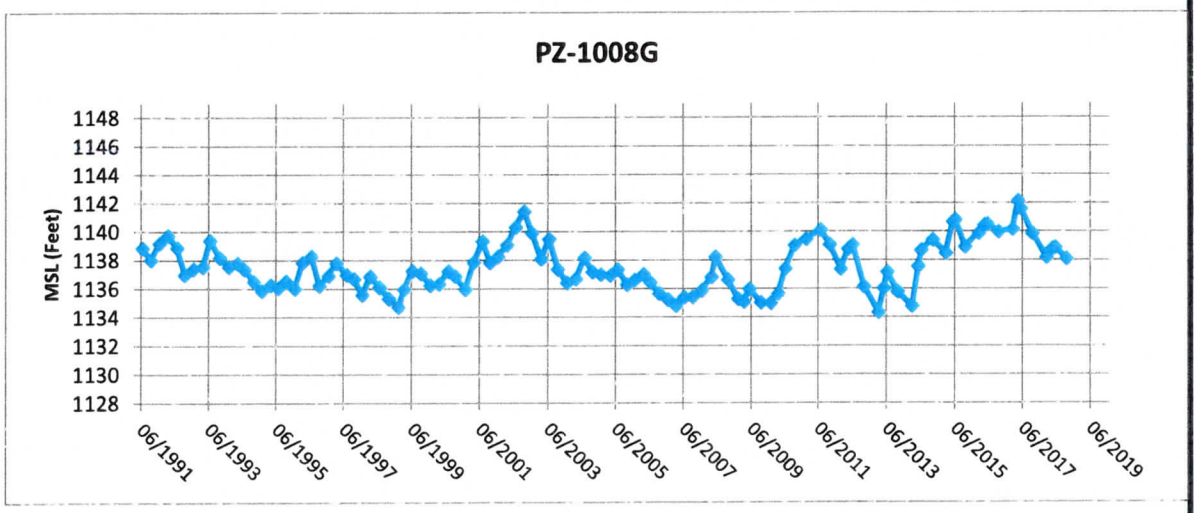


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Figure B-16i
Hydrographs

Scale: NA	Date: January 2019	
Prepared By: SGL	Checked By: SVF	Project: 17F777.18

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2018 Annual Summary Memorandum

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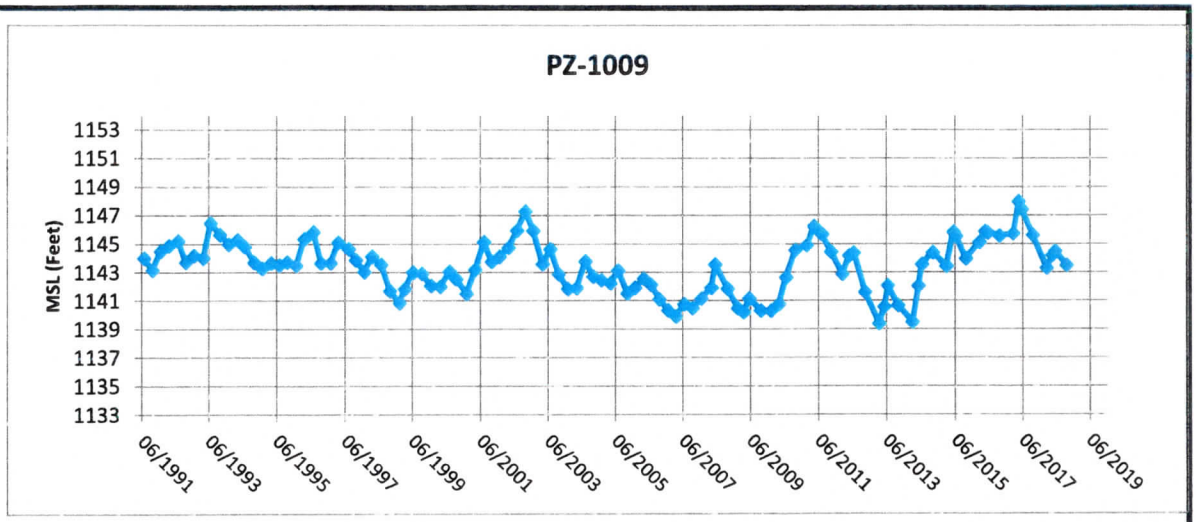

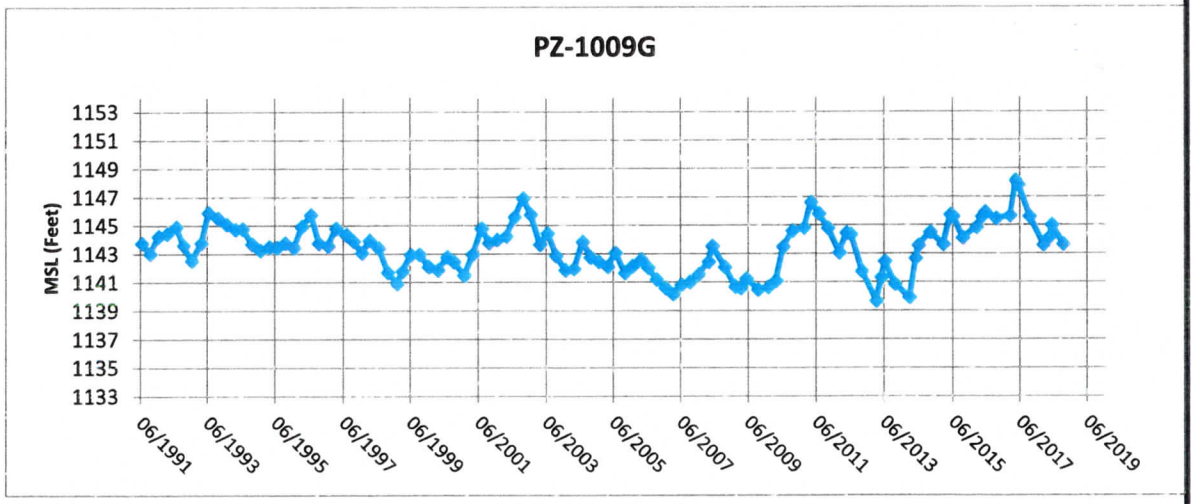

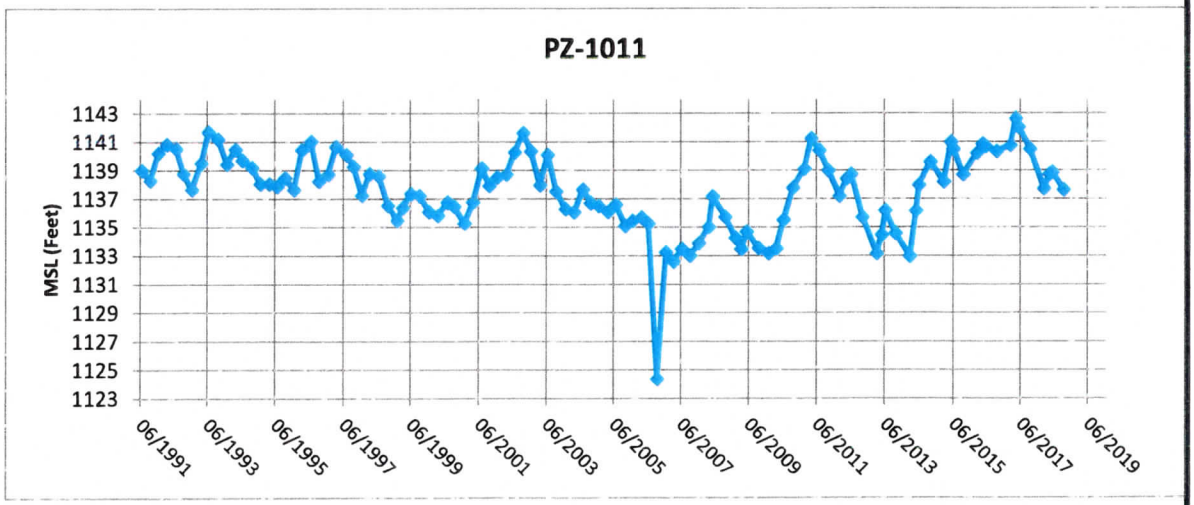

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Figure B-16j
Hydrographs

Scale: NA	Date: January 2019
Prepared By: SGL	Checked By: SVF	Project: 17F777.18

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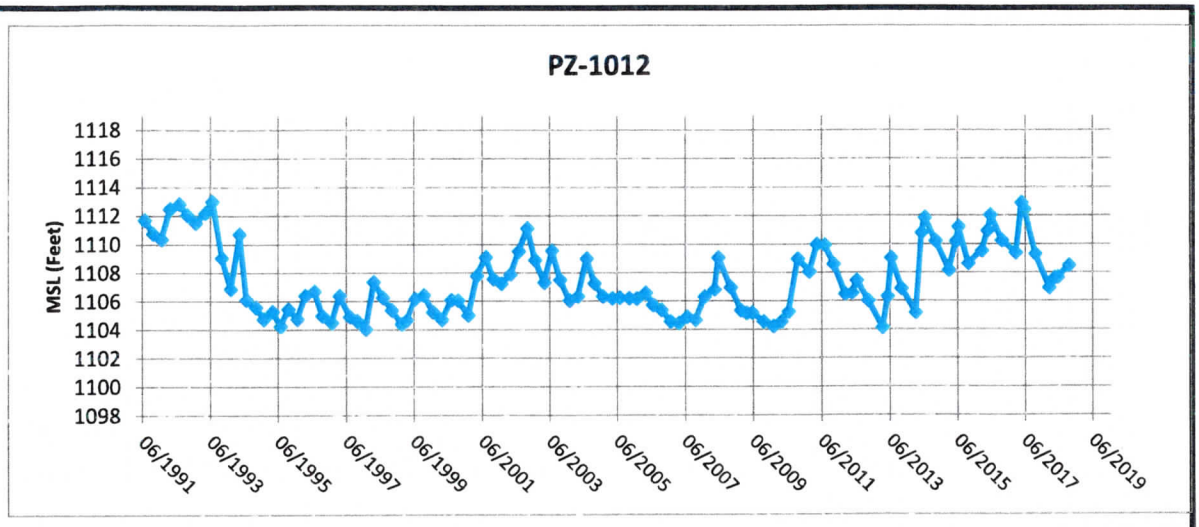

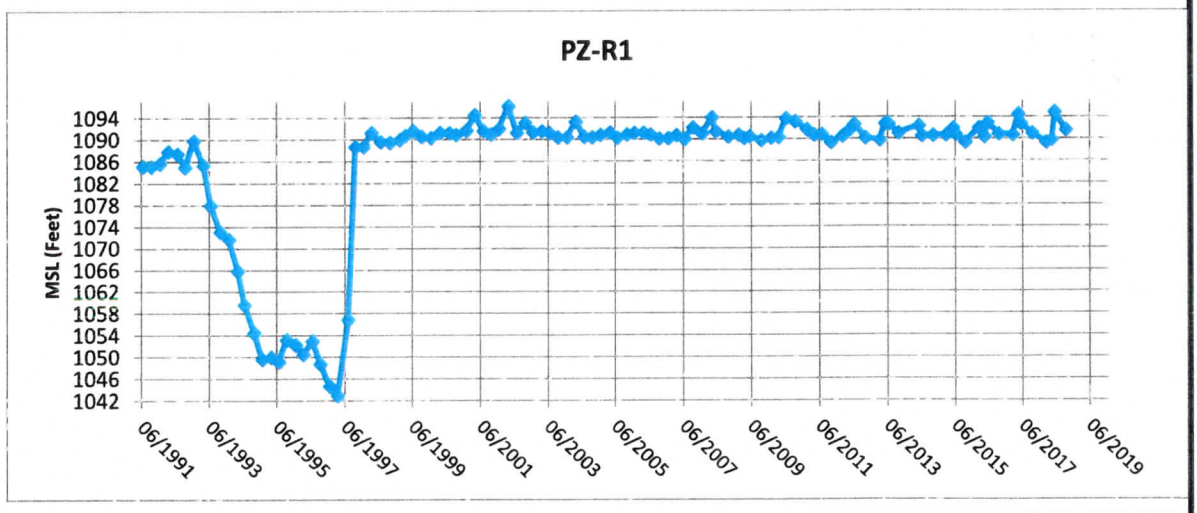

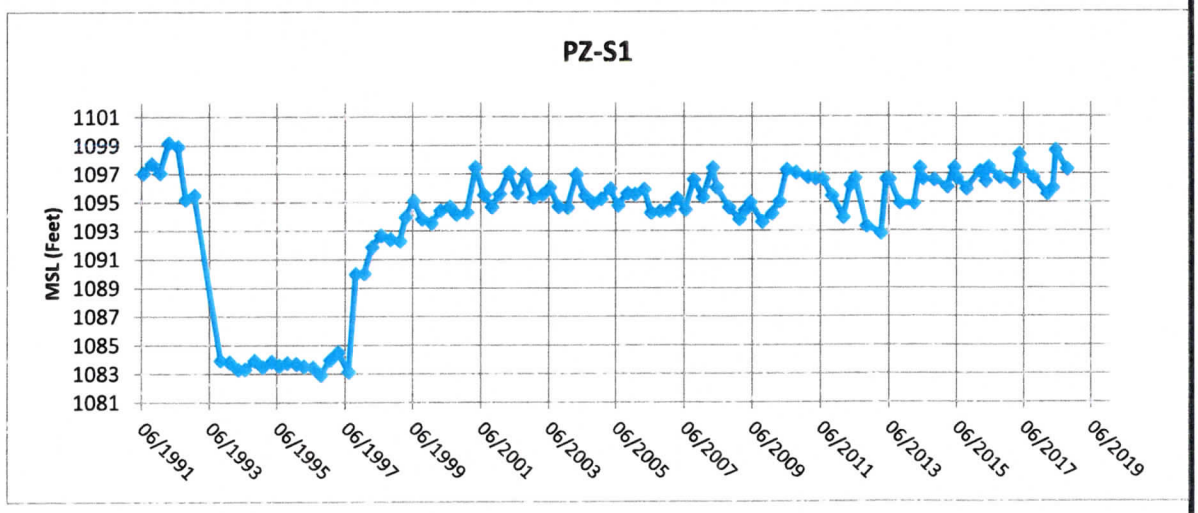

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Figure B-16k
Hydrographs

Scale: NA	Date: January 2019
Prepared By: SGL	Checked By: SVF	Project: 17F777.18

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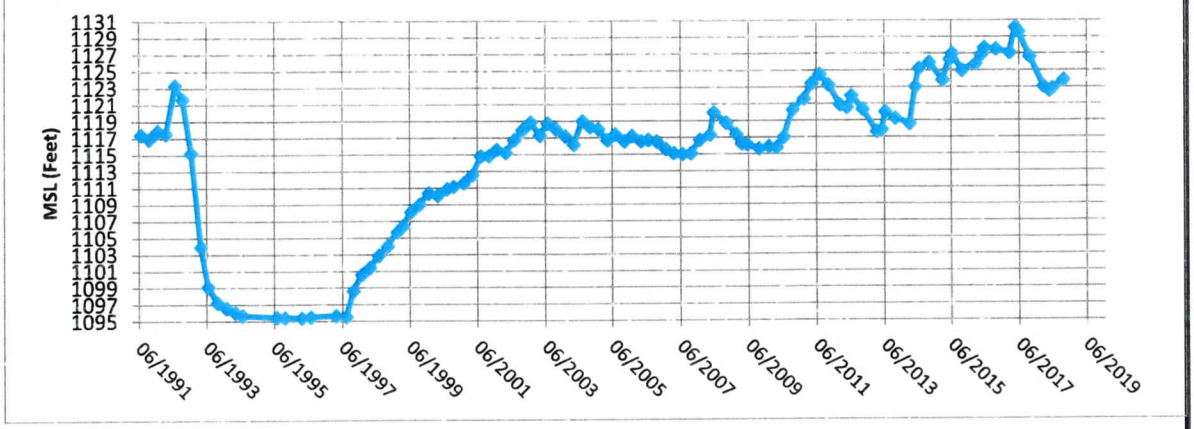

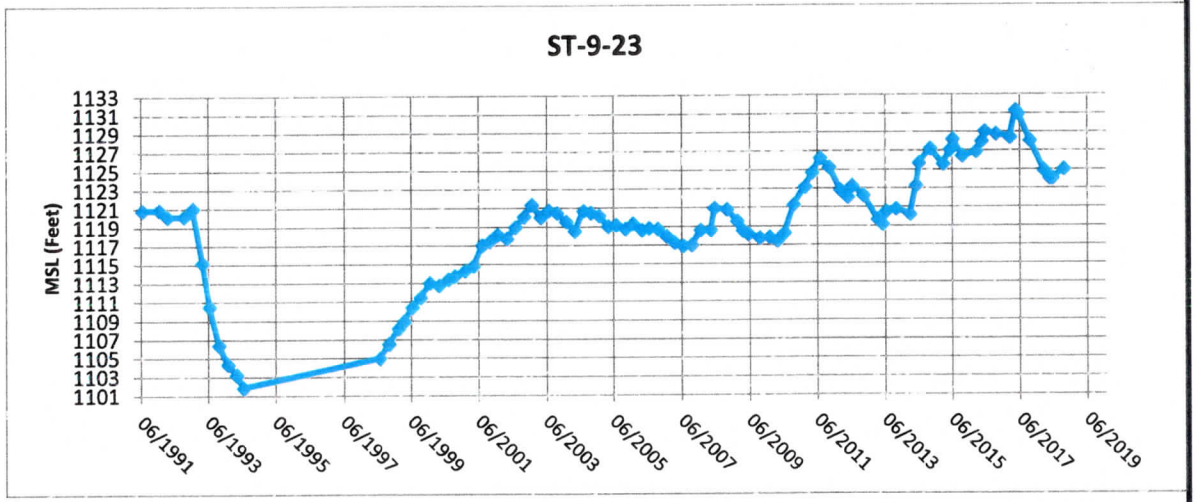

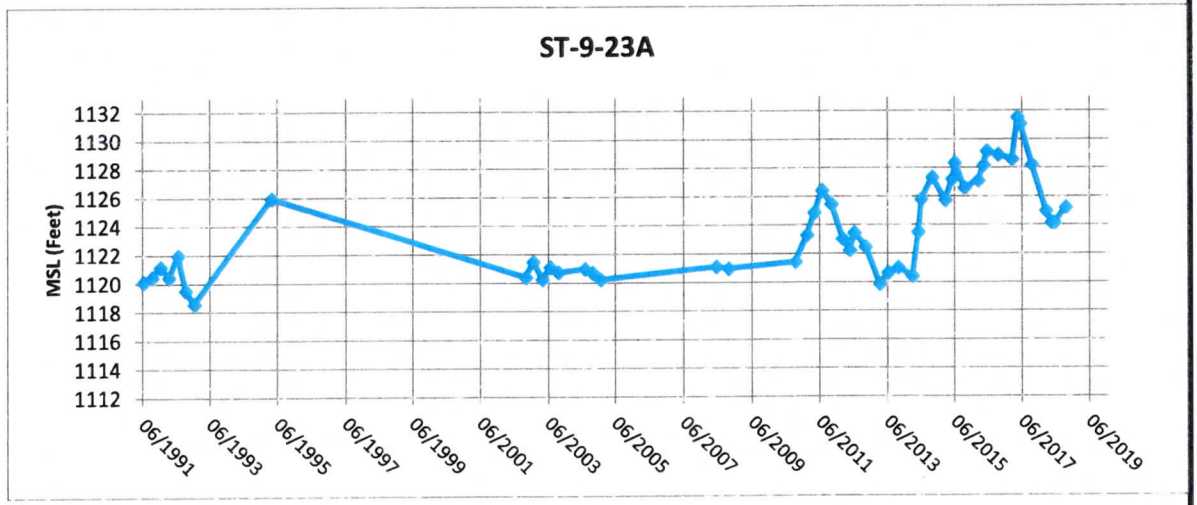

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Figure B-16l
Hydrographs

Scale: NA	Date: January 2019
Prepared By: SGL	Checked By: SVF	Project: 17F777.18

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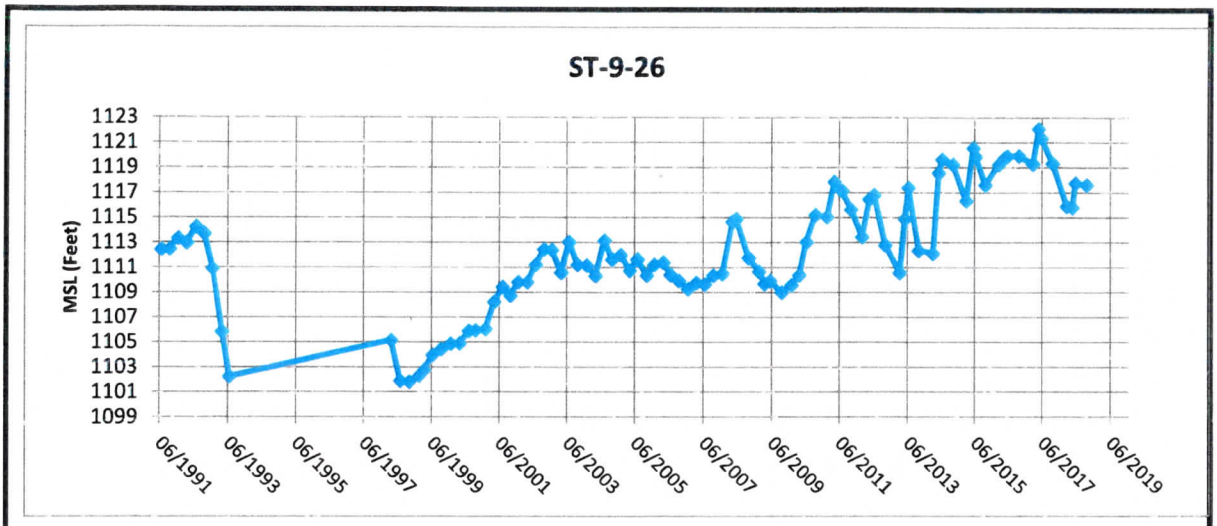

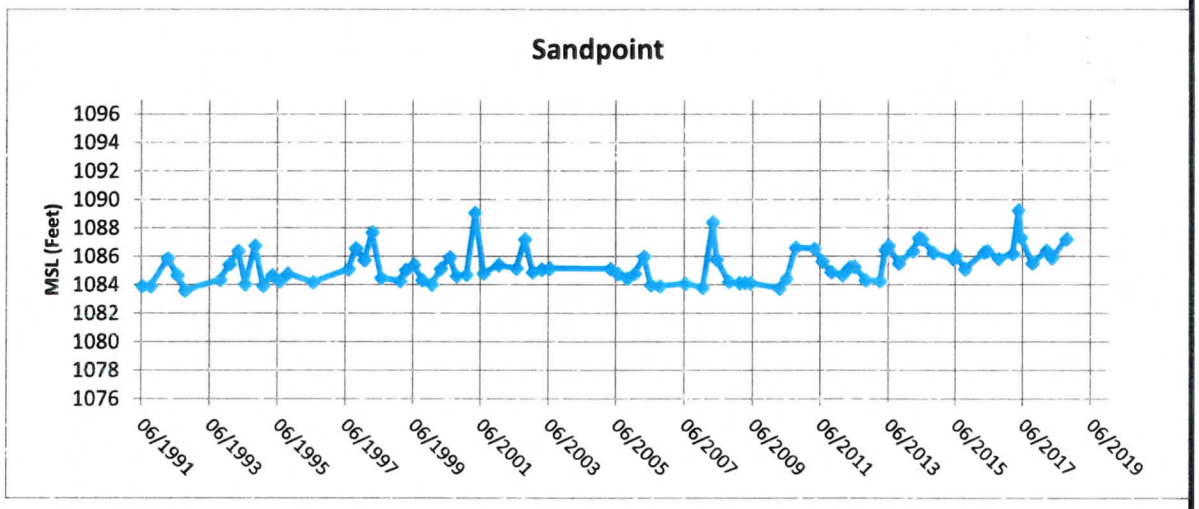

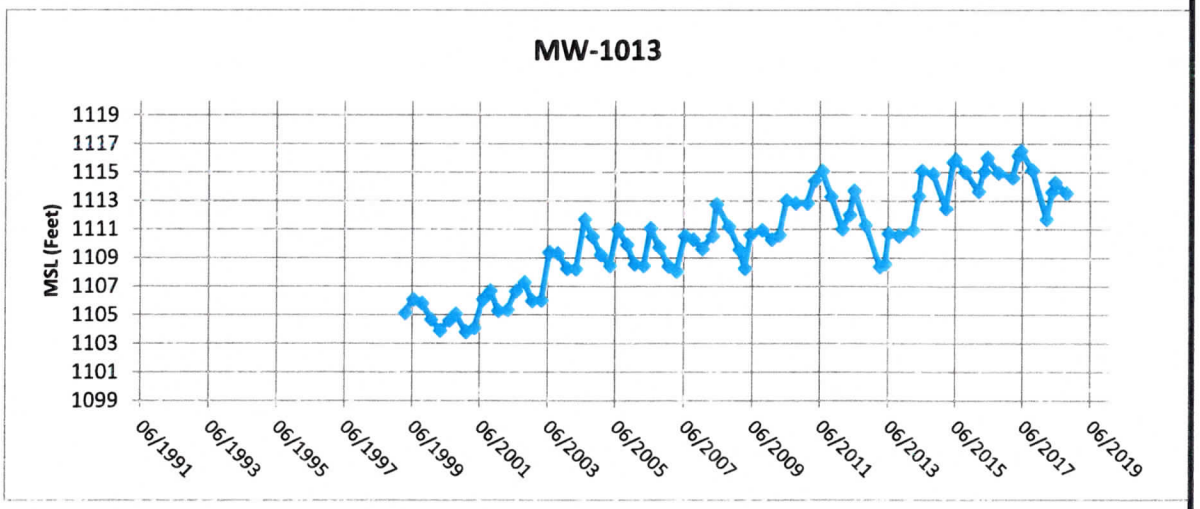

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Figure B-16m
Hydrographs

Scale: NA	Date: January 2019	
Prepared By: SGL	Checked By: SVF	Project: 17F777.18

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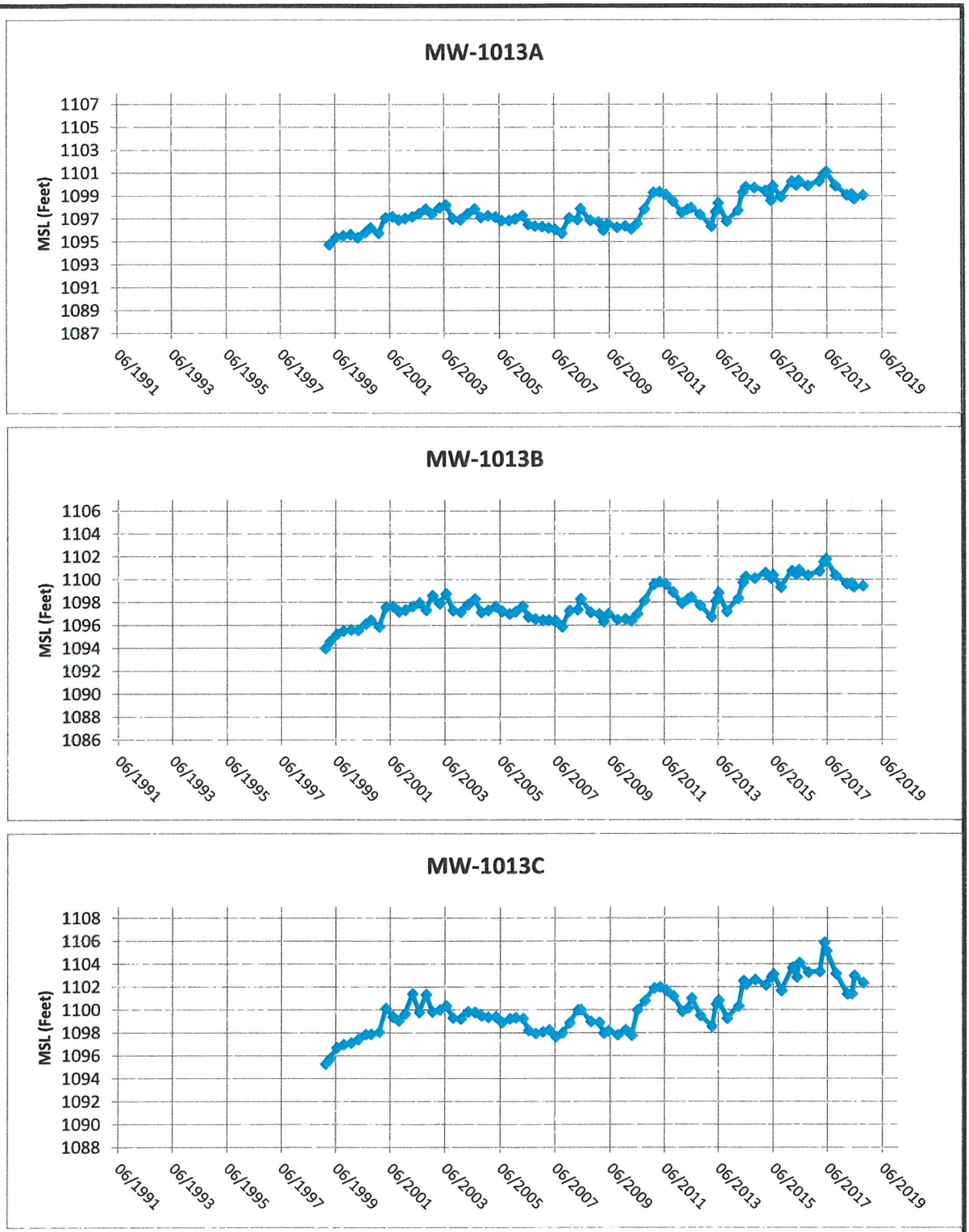

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Figure B-16n
Hydrographs

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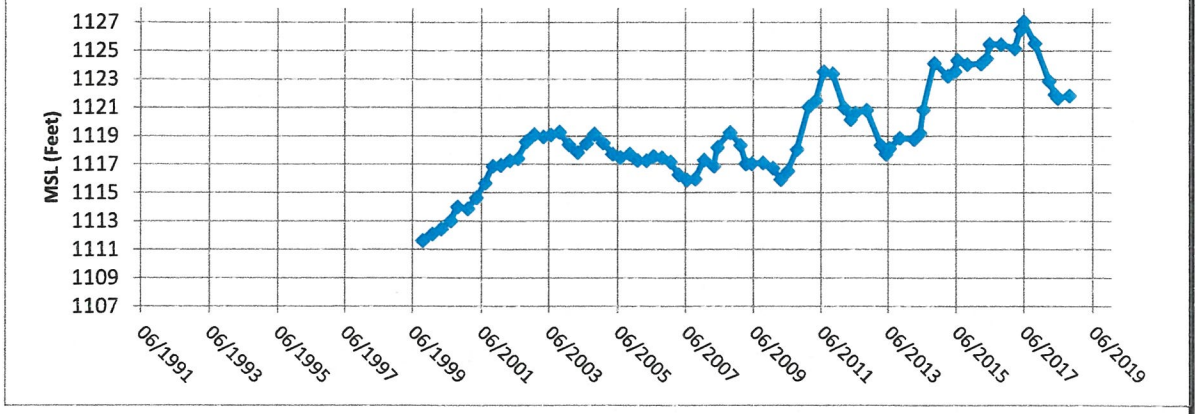

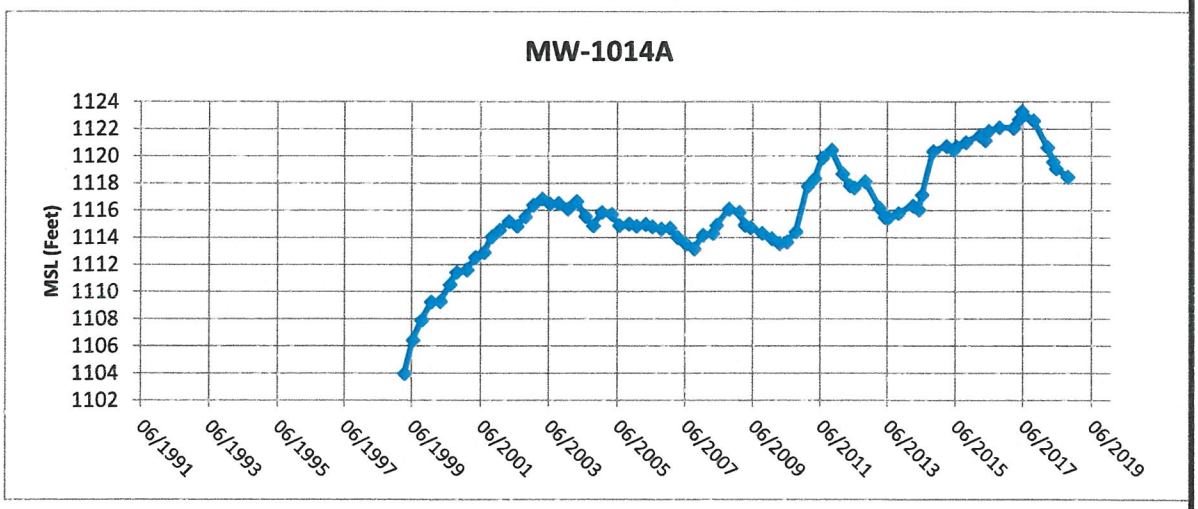

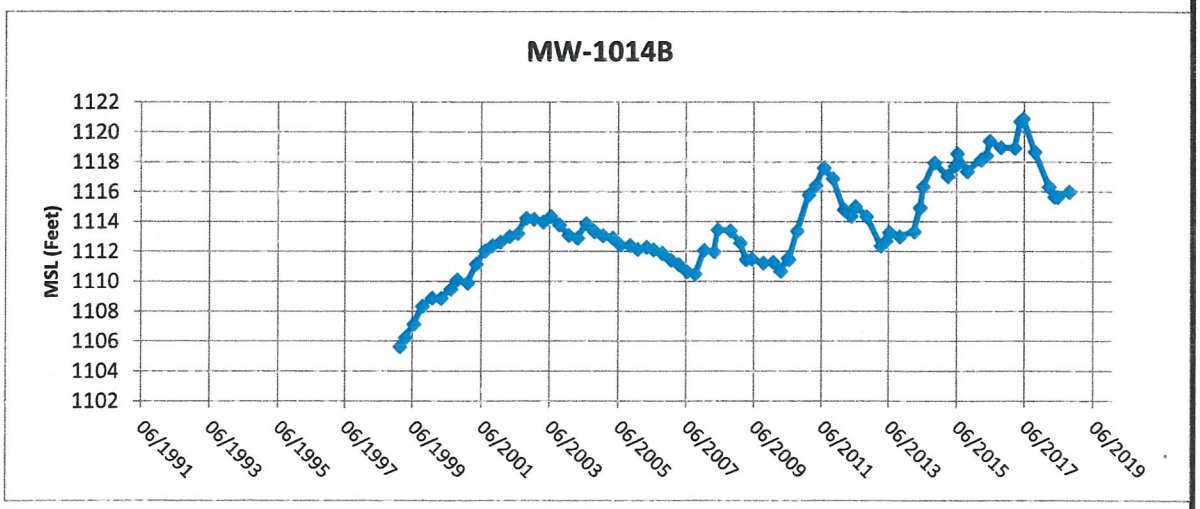

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Figure B-16o
Hydrographs

Scale: NA	Date: January 2019	
Prepared By: SGL	Checked By: SVF	Project: 17F777.18

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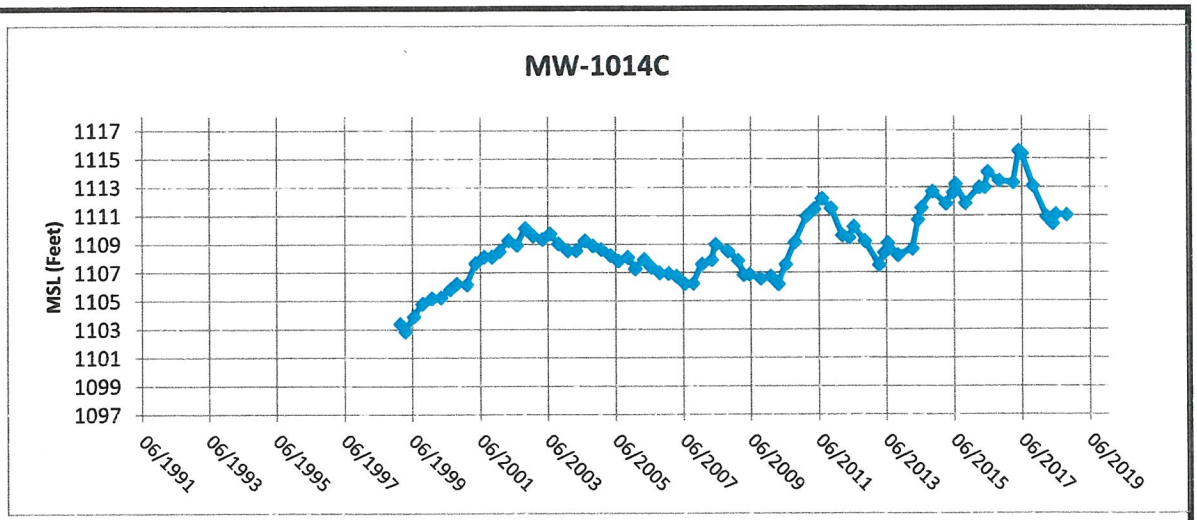

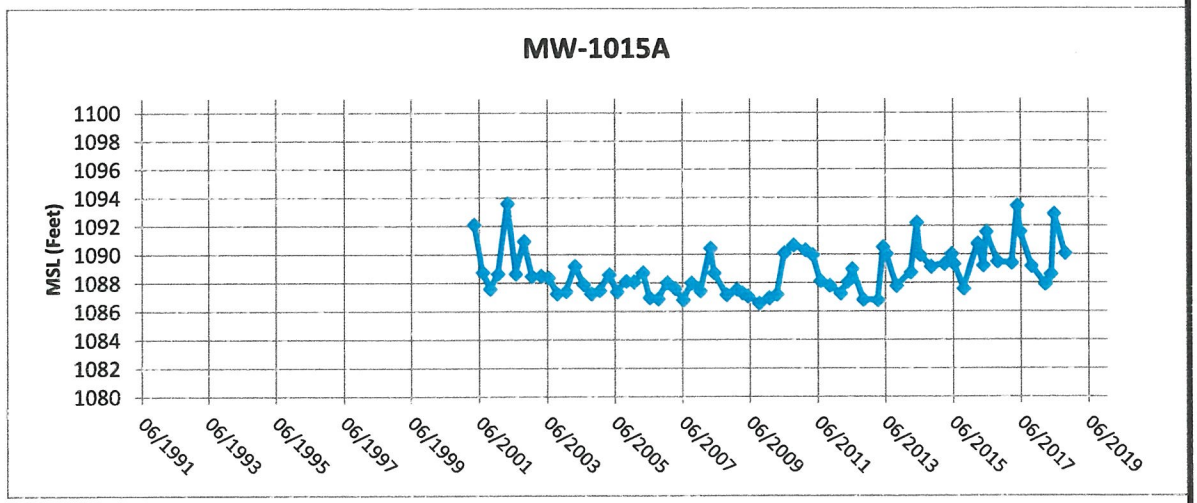

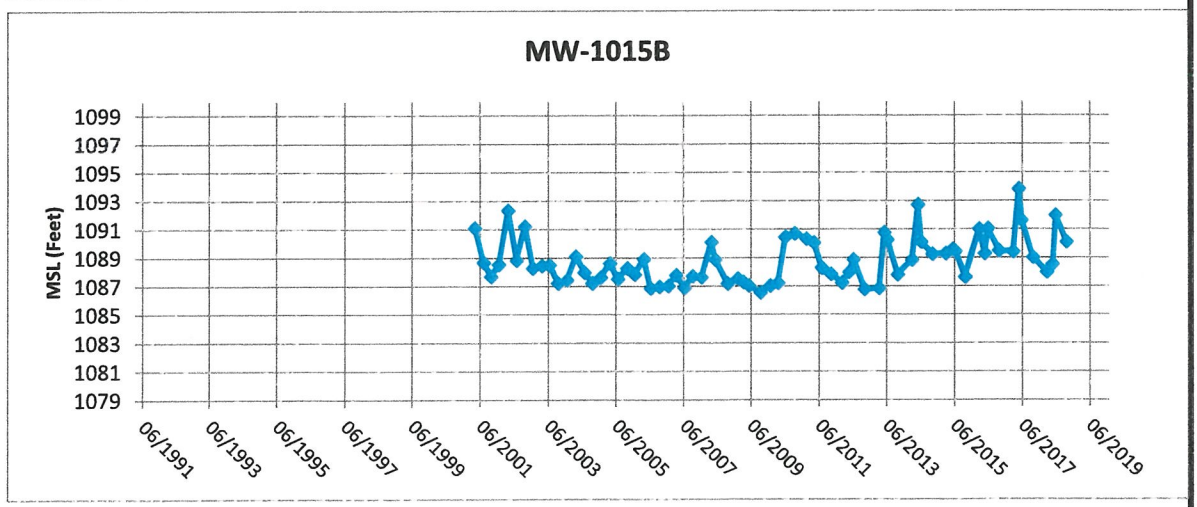

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FLAMBEAU MINING COMPANY

Figure B-16p
Hydrographs

Scale: NA	Date: January 2019
Prepared By: SGL	Checked By: SVF	Project: 17F777.18

Attachment 5

WT-5 Water Levels

Wetland 1 (WT-5) Water Level Readings

Date	Level (ft.)	Elevation	Comment
5/29/2018	-	(1)	Approximately 1 inch of standing water but below staff gauge reading.
6/19/2018	-	(1)	Approximately 1 inch of standing water but below staff gauge reading.
10/23/2018	-	(1)	Approximately 1 inch of standing water but below staff gauge reading.

(1)"0" mark elevation not established.

Attachment B

2018 Ecological Monitoring for the Flambeau Copper Park Business and Recreation Area

APPLIED ECOLOGICAL SERVICES

TO: Sharon Kozicki, P.G.
Foth Infrastructure & Environment, LLC
2121 Innovation Court, Suite 300
De Pere, WI 54115-5126

FROM: John L. Larson Ph.D.
Applied Ecological Services (AES)
17921 Smith Road, PO Box 256
Brodhead, WI 53520

DATE: September 19, 2018

RE: Memo: 2018 Ecological monitoring for the Flambeau Copper Park Business & Recreation Project (AES Project #14-0863)

Dear Sharon,

On August 29, 2018 a site visit by AES was made to view and assess the vegetation progress of the above referenced project per the monitoring plan approved by the WDNR (see below). This site visit constitutes the third of three annual site assessments per the WDNR permit.

Annual monitoring of all planting zones shall be conducted during the short term (three years) monitoring period. An annual site visit each year shall be conducted between June 1 and August 31. Each annual visit shall be conducted by a qualified professional ecologist with adequate plant identification skills and who is also able to make recommendations regarding management of the native plantings.

The vegetation monitoring shall be conducted using the meander search method to identify 1) dominant vegetation (native vs. non-native) within each native plant community, 2) the approximate percent vegetative coverage by native and non-native species within each plant community, 3) a species list for each plant community that can be compared to installed plant lists, and 4) to make recommendations related to site management. Representative photographs of the restored native plant communities shall be taken to document the site conditions through time.

An annual letter report shall be prepared and submitted to the Owner at the end of each growing season (2016, 2017 & 2018) and not later than December 31 of the monitoring year. The report shall identify general ecological site conditions of the native plantings, management recommendations and services that have been conducted throughout the growing season and provide future management recommendations. Site photographs shall be included in the report to document the site conditions.

Data collected in 2018 was consolidated into 5 main sections; East Area; West Area; North Area; East-West Swale; and Wetland 7 (includes stream C). Where appropriate, a chronological photography representation of the various areas restored is included for years 2015 through 2018. In each plant community, plant species were identified and each species was given an estimate of visual cover (%). Due to plant layering the visual areal cover estimate of a community can exceed 100%.

1.0 East Area

The East Area (Figure 1) was constructed and seeded (Tables 1 & 2) in fall 2015 (Photographs 1 & 2 & 6). In 2016 and 2017 continuing into 2018, a diversity of native wetland and upland prairie species has established (Photographs 3, 4, 5, 7 & 8). Two seeded areas were evaluated on August 29, 2018 in the East Area. These were; 1) emergent that included the naturalized low flow channel and wet prairie community in the basin bottom and 2) upland prairie that included a newly seeded upland prairie slope (Table 3) and an existing upland prairie slope.

Table 1. Emergent species seeded in the low flow channel in the East and North Areas and Emergent zones in the West Area.

Species	Common Name
Alisma subcordatum	Water plantain
Echinochloa crusgalli	Barnyard grass
Iris virginica shrevei	Wild iris
Sagittaria latifolia	Arrowhead
Scirpus fluviatilis	River bulrush
Scirpus validus	Soft stem bulrush
Sparganium eurycarpum	Burreed

Table 2. Wet prairie species seeded in the East, North, and West Emergent zones.

Species	Common Name
Asclepias incarnata	Marsh milkweed
Aster novae-angliae	New England aster
Aster umbellatus	Flat top aster
Calamagrostis canadensis	Canada blue joint grass
Carex lacustris	Lake bank sedge
Carex scoparia	Painted broom sedge
Carex vulpinoidea	Fox sedge
Elymus virginicus	Virginia wild rye
Eupatorium perfoliatum	Boneset
Euthamia graminifolia	Grass leaf goldenrod
Helenium autumnale	Sneezeweed
Lobelia siphilitica	Great blue lobelia
Scirpus atrovirens	Dark green bulrush
Scirpus cyperinus	Wool grass
Spartina pectinata	Cord grass
Verbena hastata	Blue vervain

Table 3. Upland prairie species seeded on (East, West & North Areas) side slopes.

Species	Common Name
Grasses	
Andropogon gerardii	Big blue stem
Elymus canadensis	Canada wild rye
Panicum virgatum	Switch grass

Species	Common Name
Schizachyrium scoparium	Little blue stem
Sorghastrum nutans	Indian grass
Wildflowers	
Desmodium canadense	Canada tick trefoil
Monarda fistulosa	Bergamot
Penstemon digitalis	Smooth Penstemon
Ratibida pinnata	Yellow coneflower
Rudbeckia hirta	Black eyed Susan
Solidago rigida	Stiff goldenrod
Tradescantia ohiensis	Spiderwort

1.1 East Area Prairie Slope

The East Area side slopes had been restored to upland prairie (Photographs 9 & 10). Of the 12 upland prairie species seeded on side slopes, nine were observed in August 2018 (Appendix 1, Table 1). Overall vegetation cover was estimated at 96% with native species comprising 65% of the cover. The upland slopes contained individuals of black-eyed Susan (*Rudbeckia hirta*), yellow coneflower (*Ratibida pinnata*) and Canada wild rye (*Elymus canadensis*), beardtongue (*Penstemon digitalis*), bergamot (*Monarda fistulosa*), stiff goldenrod (*Solidago rigida*), switch grass (*Panicum virgatum*), big bluestem grass (*Andropogon gerardii*) and Indian grass (*Sorghastrum nutans*) with varying areal coverage.

1.2 East Area Emergent/Wet Prairie

The low flow channel construction was completed in fall 2015 (Photographs 1 & 2). Both the naturalized low flow channel and the bottom areas were vegetated by September 2016 (Photographs 3 & 6). Native and non-native species cover increased from 2017 through August 29, 2018 (Photographs 4, 5, 7 & 8). A total of 46 plant species were observed in the emergent area in 2018 (Appendix 1 Table 2). Of the seven emergent species seeded from Table 1, three were observed and of the sixteen wet prairie species seeded from Table 2, twelve species were observed with an additional 25 native volunteer species. Typical species observed included; water plantain (*Alisma subcordatum*), blunt spikerush (*Eleocharis obtusa*), rice cut grass (*Leersia oryzoides*), arrowhead (*Sagittaria latifolia*) and cattails (*Typha* spp.) The vegetation areal coverage was estimated at 121% with native species comprising 110% of the total areal cover.

Photograph 1. East Area naturalized low flow channel with side tapering on November 11, 2015.

Photograph 2. East Area naturalized low flow channel with erosion blanket on November 17, 2015.

Photograph 3. Vegetated naturalized low flow channel (dark green strip) and wet meadow with cattails in East Area, taken on September 8, 2016.

Photograph 4. Vegetated East Area with low flow channel and wet meadow, taken on August 9, 2017.

Photograph 5. Vegetated East Area with low flow channel (darker color) and wet meadow, taken on August 29, 2018.

Photograph 6. East Area and naturalized low flow channel with initial seed germination on June 16, 2016. Erosion blanket is still intact.

Photograph 7. East Area and naturalized low flow channel (darker green areas) and wet prairie areas in between, taken on August 9, 2017.

Photograph 8. East Area and naturalized low flow channel (foreground) and wet prairie areas in between, taken August 29, 2018.

Photograph 9. East Area prairie slope dominated by saw tooth sunflower, taken on August 9, 2017.

Photograph 10. Recently seeded upland prairie (foreground) on the East Area buffer slope, taken on August 29, 2018.

2.0 North Area

The North Area (Figure 1) is comprised of a naturalized low flow channel containing emergent species, a wet prairie zone between the low flow channels and an upland prairie on the side slopes. The North Area was seeded with species listed in Tables 1-3 in after construction in fall 2015 (Photographs 11, 12 & 17). Native seed was observed germinating as soon as June, 2016 (Photograph 13) and the areas were densely covered with vegetation by September 2016 (Table 14). Vegetative cover continued to increase into 2018 (Photographs 15, 16, 18, 19 & 20). In 2018, plant species and vegetative cover were assessed in two zones; the upland prairie side slopes and the emergent/wet prairie basin bottom. Plant species were identified and given an estimate of visual cover (%).

2.1 North Area Prairie Slope

Portions of the upland prairie slope surrounding the North Area had been disturbed during construction and these areas being over-seeded with an upland species mix (Table 3). A variety of native species were observed on the north area slopes in 2018 (Appendix 1, Table 3). Eight of the 12 seeded species were observed. Overall vegetation cover was estimated at 99% for the upland prairie buffer, of which 73% of the cover was estimated to be by native species. Typical species observed included; big bluestem grass, bergamot, Indian grass and Canada goldenrod (*Solidago canadensis*).

2.2 North Area Emergent/Wet Prairie

The North Area naturalized low flow channel was seeded with an emergent mix and the remainder was seeded with a wet prairie seed mix in 2015 (Tables 1 & 2). Of the seven emergent species seeded, three were observed growing in the low flow channel in 2018 (Appendix 1, Table 4). Of the 16 wet prairie species seeded, 13 were observed along with 20 additional native "volunteer" species. Overall plant cover was estimated at 104% with native species estimated as comprising 83% of the vegetation cover in 2018.

Photograph 11. North Area naturalized low flow channel, looking east on November 11, 2015.

Photograph 12. North Area naturalized low flow channel with erosion blanket installed on November 17, 2015, looking east.

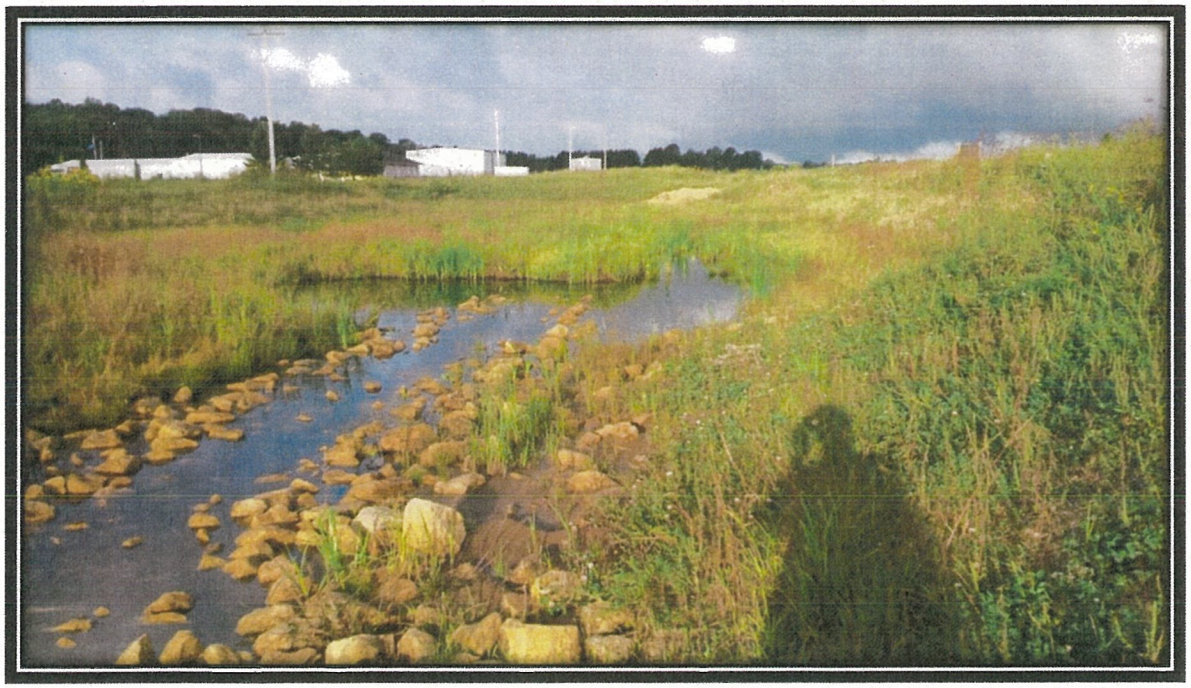
Photograph 13. North Area low flow channel looking east on June 16, 2016.

Photograph 14. North Area naturalized low flow channel (S shaped depression) amongst wet meadow "fingers" in September, 2016.

Photograph 15. North Area with darker green low flow channel evident looking east, on August 9, 2017.

Photograph 16. North Area looking east on August 29, 2018.

Photograph 17. North Area looking west with naturalized low flow channel erosion control and side slope blanket along western slope on November 17, 2015.



Photograph 18. North Area looking west with naturalized low flow channel and rock-lined swale on September 8, 2016.

Photograph 19. North Area looking west with naturalized low flow channel and rock-lined swale (mostly under water) on August 9, 2017.

Photograph 20. North Area looking west with naturalized low flow channel and rock-lined swale (mostly under water), on August 29, 2018.

2.3 North Area Rock-lined Inlet

A rock-lined surface water inlet was installed in the northwest corner of the North Area as an erosion control measure (Photograph 21). The upland slope near the inlet was seeded with an upland native mix (Table 3). Seedling germination was evident by June 2016 and the area was well vegetated by September 2016 and continued through August 29, 2018 (Photographs 22-24).

Photograph 21. Surface water inlet in the northwestern corner of North Area with rock rip rap and side slope with erosion blanket in November, 2015.

Photograph 22. Surface water inlet in the northwestern corner of North Area, with side slope stabilized on September 8, 2016.

Photograph 23. Surface water inlet in the northwestern corner of North Area with rock rip rap, August 9, 2017.

Photograph 24. Surface water inlet in the northwestern corner of North Area with rock rip rap on August 29, 2018.

2.4 North Area Connection to East Area

A rock-lined swale connection between the North and East Areas was completed in November 2015 (Photograph 25). Seed germination along the slopes of this swale connection was observable in June 2016 and the swale and upland prairie side slope were fully vegetated by August 29, 2018 (Photographs 26 & 27).

Photograph 25. North and East Area rock-lined swale connection completed and slopes blanketed on November 17, 2015.

Photograph 26. North Area southwest outlet swale connection to East Area on August 9, 2017.

Photograph 27. North Area southwest outlet swale connection to East Area on August 29, 2018.

3.0 East-West Swale

Reshaping/contouring of an East-West Swale (Figure 1) connecting the West Area to the East Area began in 2015 and continued into June 2016 (Photograph 28). After the swale re-shaping was completed, the bottom was seeded with the emergent mix in the swale bottom and the slopes were

seeded with wet prairie and upland prairie seed (Tables 1-3). After seeding, erosion control blanket was installed on slopes and along swale bottom. By September 2016, portions of the swale had been vegetated with a mixture of native species (Photographs 29 & 30), and by August 2018 the swale was dominated by native species (Photographs 31, 32, 33 & 34). Thirty nine native species were observed in the East-West Swale in August 2018 (Appendix 1, Table 5). Typical native species included; water plantain, big bluestem grass, arrowhead, dark green bulrush (*Scirpus atrovirens*), woolgrass (*Scirpus cyperinus*), Indian grass and cattail. The overall cover of the swale bottom and slopes was estimated at 128% with natives comprising an estimated 109% of the cover (Appendix 1, Table 5).

Photograph 28. East-West Swale final shaping and erosion control blanket in place along the swale on June 16, 2016.

Photograph 29. East-West Swale at the connection to the West Area on September 8, 2016.

Photograph 30. East-West Swale emergent and prairie vegetation on September 8, 2016.

Photograph 31. East-West Swale with wetland and prairie species on August 9, 2017.

Photograph 32. East-West Swale with wetland and prairie species on August 29, 2018.

Photograph 33. East-West Swale with wetland and prairie species on August 29, 2018.

4.0 West Area

The West Area (Figure 1) final grading was completed in 2016 (Photograph 34) after which areas were seeded with native species (Tables 1-3). The upland prairie vegetative cover (excluding open water ponds) exceeded 100% in the West Area by August 2018 (Photograph 35and Appendix 1, Table 6). Of the seven emergent species seeded in the West Area, three species were observed in August 2018 and 11 of the seeded wet prairie species were observed (Appendix 1, Table 6). Eight of the seeded upland prairie species were observed. A variety of native wetland species have established around the shoreline of the three emergent zones and in the upland prairie (Photograph 36-41). Typical wetland species included water plantain, dark green bulrush and cattail with typical upland species being Canada wild rye and switch grass.

Photograph 34. Final grading of the West Area on June 16, 2016.

Photograph 35. West Area mesic prairie surrounding emergent pockets on August 29, 2018.

Photograph 36. West Area emergent pool on September 8, 2016. Seeded prairie slope is on right side and background in the photo.

Photograph 37. West Area prairie slope on August 29, 2018.

Photograph 38. West Area emergent pool on August 9, 2017.

Photograph 39. West Area emergent pool on August 9, 2017.

Photograph 40. West Area emergent pool on August 29, 2018.

Photograph 41. West Area emergent pool with upland prairie side slope on the right on August 9, 2017.

Wetland 7

Wetland 7 (Figure 1) is a wetland along the east side of the project site that includes "Stream C". Herbicide treatment to reed canary grass (*Phalaris arundinacea*) and a prescribed burn (Photograph 42) occurred in spring 2016. This was followed up with an enhancement seeding. The Wetland 7 evaluation in August 29, 2018 found reed canary grass had likely increased in both density and stature from the 2016 post-treatment condition. However, in both August 2017 and 2018, a variety of native wetland plants were still growing in Wetland 7 (Photograph 43-46). The existing seed/propagules bank and over-seeded wet prairie species have become established in localized areas of Wetland 7. Overall cover of vegetation was estimated at 115% with native species comprising an estimated 59% of the cover in 2018 (Appendix 1, Table 7).

The upland buffer for Wetland 7 continues to contain a variety of non-native weeds and a few native upland species such as black-eyed Susan, yellow cone flower and switch grass. Several non-native species; burdock (*Arctium minus*), Canada thistle (*Cirsium arvense*) and reed canary grass were present.

Photograph 42. Wetland 7 after prescribed burn with native species emergence on June 16, 2016.

Photograph 43. Wetland 7 with a dominance of reed canary grass and some native species on August 29, 2018.

Photograph 44. Wetland 7 with sedges and other natives on August 9, 2017.

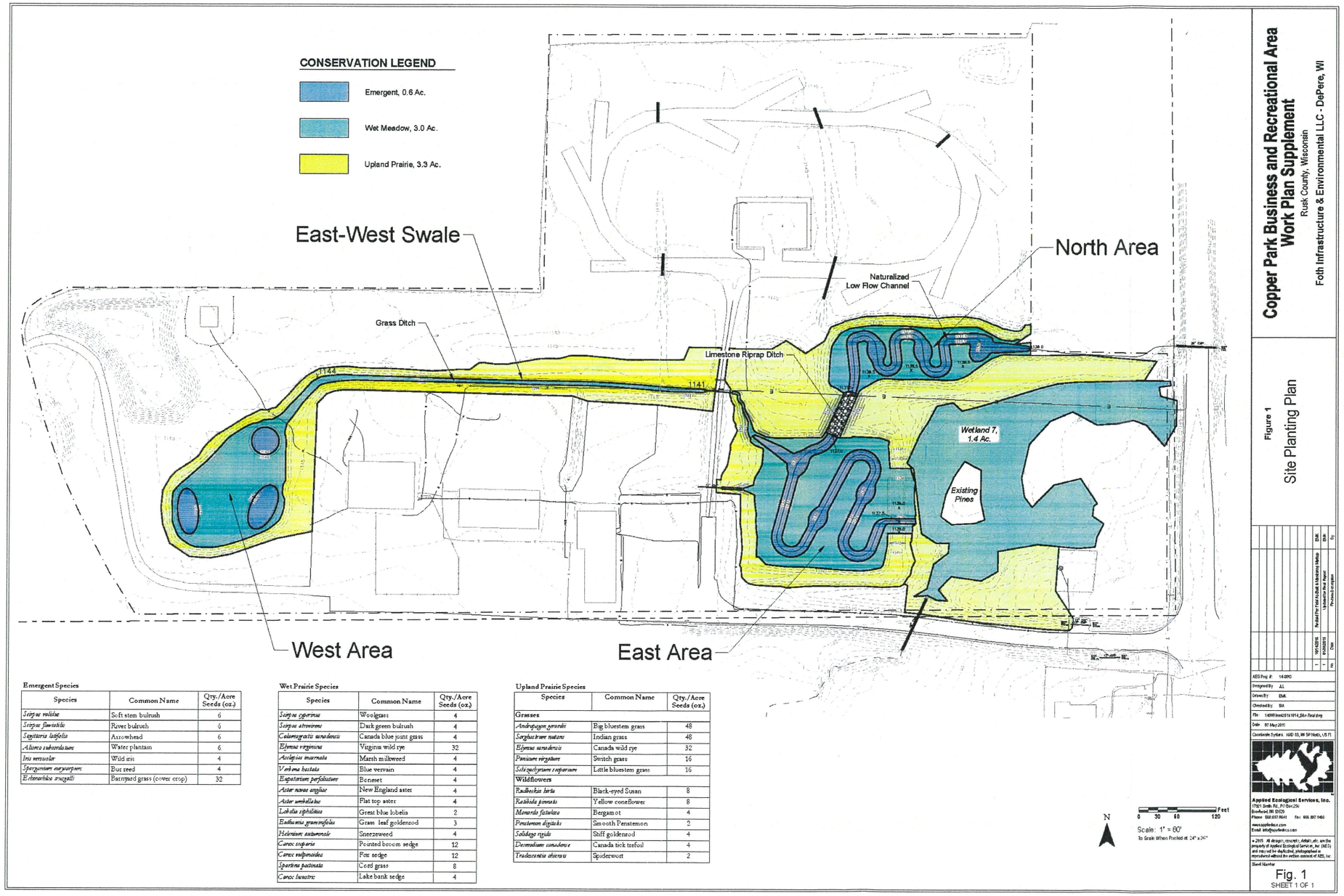
Photograph 45. Pockets of native sedges and other species within Wetland 7 on August 29, 2018.

Photograph 46. Wetland 7 with native vegetation such as blue vervain (*Verbena hastata*) and woolgrass, along "Stream C" on August 9, 2017.

Summary

The 4 years of photo-documentation provided in this report shows the vegetative response of all the areas in the Flambeau Copper Park Business and Recreation Area Outlot (Figure 1). All areas were well vegetated with a majority of native prairie and wetland species by August 2018 (Appendix 1). All areas, except the existing wetland #7, had a dominance of native species. A variety of emergent, wet prairie and upland prairie species seeded in 2015/2016 were found in the Outlot. In addition a diversity of "native volunteer" species was also observed in the emergent and wet prairie North, East and West basin bottoms. Side slopes and other areas seeded with upland prairie species were also well vegetated with a variety of native prairie grasses and wildflowers

Figure 1. Flambeau Copper Park Business and Recreation Project Seeding Plan.



Emergent Species

Species	Common Name	Qty./Acre Seeds (oz.)
Scirpus validus	Soft stem bulrush	6
Scirpus fluviatilis	River bulrush	6
Sagittaria latifolia	Arrowhead	6
Alisma subcordatum	Water plantain	6
Iris versicolor	Wild iris	4
Sparganium eurycarpum	Bur reed	4
Echinochloa crusgalli	Barnyard grass (cover crop)	32

Wet Prairie Species

Species	Common Name	Qty./Acre Seeds (oz.)
Scirpus cyperinus	Woolgrass	4
Scirpus atrovirens	Dark green bulrush	4
Calamagrotis canadensis	Canada blue joint grass	4
Elymus virginicus	Virginia wild rye	32
Asclepias incarnata	Marsh milkweed	4
Verbena hastata	Blue vervain	4
Eupatorium perfoliatum	Boneset	4
Aster novae angliae	New England aster	4
Aster umbellatus	Flat top aster	4
Lobelia siphilitica	Great blue lobelia	2
Euthamia graminifolia	Grass leaf goldenrod	3
Helenium autumnale	Sneezeweed	4
Carex scoparia	Pointed broom sedge	12
Carex vulpinoidea	Fox sedge	12
Spartina pectinata	Cord grass	8
Carex lacustris	Lake bank sedge	4

Upland Prairie Species

Species	Common Name	Qty./Acre Seeds (oz.)
Grasses		
Andropogon gerardii	Big bluestem grass	48
Sorghastrum nutans	Indian grass	48
Elymus canadensis	Canada wild rye	32
Panicum virgatum	Switch grass	16
Schizachyrium scoparium	Little bluestem grass	16
Wildflowers		
Rudbeckia hirta	Black-eyed Susan	8
Ratibida pinnata	Yellow coneflower	8
Monarda fistulosa	Bergamot	4
Penstemon digitalis	Smooth Penstemon	2
Solidago rigida	Stiff goldenrod	4
Desmodium canadense	Canada tick trefoil	4
Tradescantia ohiensis	Spiderwort	2

Appendix 1. Plant species Lists by Area and Zone at the Flambeau Copper Park Business and Recreation Area.

Table 1. East Area Upland Prairie		
Species	Common Name	Cover Percent %
Achillea millifolium	Yarrow	1
Agrostis alba	Red top	2
Andropogon gerardii	Big bluestem grass	5
Asclepias syrica	Common milkweed	2
Coronilla varia	Crown vetch	3
Daucus carota	Queen Anne's lace	2
Elymus canadensis	Canada wild rye	10
Erigeron strigosus	Daisy fleabane	2
Euthamia graminifolia	Common grass-leaved goldenrod	2
Helianthus grosseserratus	Sawtooth sunflower	10
Hypericum perforatum	St John's wort	1
Juncus effusus	Common rush	2
Juncus torreyi	Torrey's rush	1
Lotus corniculatus	Bird's foot trefoil	3
Monarda fistulosa	Wild bergamot	2
Panicum virgatum	Switch grass	2
Penstemon digitalis	Smooth fox glove	1
Phalaris arundinacea	Reed canary grass	2
Pycnanthemum virginianum	Mountain mint	2
Ratibida pinnata	Yellow coneflower	3
Rubus idaeus	Red raspberry	1
Rudbeckia hirta	Black-eyed Susan	2
Setaria glauca/pumila	Foxtail grass	2
Solidago canadensis	Canada goldenrod	2
Solidago gigantea	Tall goldenrod	1
Solidago rigida	Stiff goldenrod	2
Sorghastrum nutans	Indian grass	5
Spartina pectinata	Prairie cord grass	2
Symphyotrichum novae angliae	New England aster	2
Symphyotrichum lanceolatum	Marsh aster	2
Symphyotrichum pilosum	Frost aster	2
Trifolium hybridum	Alsike clover	10
Trifolium pratense	Red clover	2
Trifolium repens	White clover	2
Total Estimated Cover		96
Total Estimated Native Species Cover		65

Table 2. East Area Bottom		
Species	Common Name	Percent %
Ambrosia artemisifolia	Common ragweed	2
Agalinus tenuifolia	Common fox glove	4
Agrostis alba	Red top grass	2
Alisma subcordatum	Common water plantain	5
Alnus rugosa	Speckled alder	2
Asclepias incarnata	Swamp milkweed	2
Bidens frondosa	Beggarticks	2
Carex annectens	Yellow sedge	1
Carex scoparia	Pointed broom sedge	2
Carex vulpinodea	Fox sedge	2
Coronilla varia	Crown vetch	5
Eleocharis erythropoda	Red rooted spikerush	1
Eleocharis obtusa	Blunt spike rush	5
Erechtites hieracifolia	Burn weed	1
Eupatorium perfoliatum	boneset	2
Euthamia graminifolia	Common grass-leaved goldenrod	2
Glyceria striata	Fowl manna grass	1
Helenium autumnale	Sneezeweed	2
Helianthus grossesseratus	Saw tooth sunflower	2
Juncus effusus	Common rush	1
Juncus torreyi	Torrey's rush	1
Leersia oryzoides	Rice cut grass	5
Lemna minor	Duck weed	1
Lobelia siphilitica	Great blue lobelia	2
Ludwigia palustris	Seed box	1
Lycopus americana	Water horehound	1
Panicum virgatum	Switch grass	2
Phalaris arundinacea	Reed canary Grass	2
Polygonum pensylvanica	Pinkweed	2
Polygonum sagittatum	Tear thumb	2
Populus tremuloides	Aspen	1
Salix interior	Sand bar willow	3
Sagittaria latifolia	Common arrowhead	8
Salix sp.	willow	2
Scirpus atrovirens	Dark green rush	2
Scirpus cyperinus	Woolgrass	2
Scirpus validus creber	Great bulrush	3
Solidago gigantea	Tall goldenrod	1
Spartina pectinata	Prairie cord grass	3
Symphyotrichum novae-angliae	New England aster	3
Symphyotrichum lanceolatum	Panicle aster	2
Symphyotrichum pilosum	Frost aster	2
Trifolium hybridum	Alsike clover	2
Typha angustifolia	Narrow-leaved cattail	10

Table 2. East Area Bottom		
Species	Common Name	Percent %
Typha latifolia	Broad-leaved cattail	10
Verbena hastata	Blue vervain	2
Total Estimated Cover		121
Total Estimated Native Species Cover		110

Table 3. North Area Upland Prairie		
Species	Common Name	Cover Percent %
Achillea millifolium	Yarrow	1
Agrostis alba	Redtop	2
Ambrosia artemisiifolia	Common ragweed	1
Andropogon gerardii	Big bluestem grass	10
Carex vulpinodea	Fox sedge	1
Centaurea maculosa	Knapweed	1
Cicuta maculata	Water hemlock	1
Daucus carota	Queen Anne's lace	2
Elymus canadensis	Canada wild rye	2
Erigeron strigosus	Daisy fleabane	2
Euthamia graminifolia	Common grass-leaved goldenrod	2
Helianthus grosseserratus	Sawtooth sunflower	2
Heliopsis helianthoides	False sunflower	1
Lotus corniculatus	Bird's foot trefoil	10
Monarda fistulosa	Wild bergamot	5
Panicum virgatum	Switch grass	4
Phalaris arundinacea	Reed canary grass	5
Physalis sp.	Ground cherry	1
Polygonum sagittatum	Tear thumb	1
Ratibida pinnata	Yellow coneflower	2
Rudbeckia hirta	Black-eyed Susan	1
Scirpus atrovirens	Dark green bulrush	2
Scirpus cyperinus	Wool grass	2
Solidago canadensis	Canada goldenrod	5
Solidago gigantea	Late goldenrod	1
Solidago rigida	Stiff goldenrod	1
Sorghastrum nutans	Indian grass	15
Symphyotrichum lanceolatum	Panicled aster	2
Symphyotrichum novae-angliae	New England aster	2
Symphyotrichum pilosum	Hairy aster	5
Trifolium hybridum	Alsike clover	5
Verbena hastata	Blue vervain	2
Total Estimated Cover		99
Total Estimated Native Species Cover		73

Table 4. North Area Bottom		
Species	Common Name	Cover Percent %
Agrostis alba	Red top grass	1
Alisma subcordatum	Common water plantain	2
Ambrosia artemisiifolia elatior	Common ragweed	5
Asclepias incarnata	Swamp milkweed	2
Bidens cernua	Nodding bur marigold	2
Bidens frondosa	beggarticks	1
Carex hystricina	Porcupine sedge	1
Carex scoparia	Lance-fruited oval sedge	2
Carex vulpinoidea	Brown fox sedge	3
Eleocharis obtusa	Blunt spike rush	2
Eleocharis sp.	Spikerush	2
Elymus canadensis	Canada wild rye	1
Elymus virginicus	Virginia wild rye	5
Eupatorium perfoliatum	boneset	1
Euthamia graminifolia	Common grass-leaved goldenrod	2
Glyceria grandis	Manna grass	1
Helenium autumnale	Sneezeweed	2
Juncus effusus	Common rush	2
Juncus torreyi	Torrey's rush	1
Leersia oryzoides	Rice cut grass	1
Lemna minor	duckweed	1
Lobelia siphilitica	Great blue lobelia	2
Lotus corniculatus	Bird's foot trefoil	10
Mimulus ringens	Monkey flower	2
Panicum virgatum	Switch grass	2
Phalaris arundinacea	Reed canary grass	5
Polygonum hydropiperoides	Water pepper	2
Populus tremuloides	Aspen	1
Sagittaria latifolia	Arrowhead	4
Salix sp.	willow	2
Scirpus atrovirens	Dark green rush	2
Scirpus cyperinus	Wool grass	4
Scirpus validus	Great bulrush	4
Setaria glauca	Yellow foxtail	1
Spartina pectinata	Prairie cord grass	5
Symphyotrichum ericoides	Heath aster	1
Symphyotrichum lanceolatum	Panicled aster	2
Symphyotrichum novae-angliae	New England aster	2
Symphyotrichum pilosum	Hairy aster	2
Trifolium hybridum	Alsike clover	5
Typha latifolia	Broad-leaved cattail	5
Verbena hastata	Blue vervain	1
Total Estimated Cover		104
Total Estimated Native Species Cover		83

Table 5. East-West Swale		
Species	Common Name	Percent %
Achillea millifolium	yarrow	1
Alisma subcordatum	Common water plantain	5
Ambrosia artemisiifolia	Common ragweed	1
Andropogon gerardii	Big bluestem grass	5
Andropogon scoparium	Little bluestem grass	2
Asclepias incarnata	Swamp milkweed	2
Baptisia alba	White wild indigo	1
Bidens cernua	Nodding bur marigold	2
Bidens frondosa	Common beggar's tick	1
Bidens vulgata	beggarticks	1
Carex scoparia	Lance-fruited oval sedge	2
Carex vulpinoidea	Fox sedge	2
Chrysanthemum leucanthemum	Oxeye daisy	1
Daucus carota	Queen Anne's lace	1
Echinochloa crusgallii	Barnyard grass	2
Elymus canadensis	Canadian wild rye	2
Equisetum arvense	Common horsetail	1
Euthamia graminifolia	Common grass-leaved goldenrod	2
Glyceria striata	Fowl manna grass	2
Helianthus grossesseratus	Sawtooth Sunflower	2
Helenium autumnale	sneezeweed	1
Juncus dudleyi	Dudley's rush	1
Juncus torreyi	Torrey's rush	1
Lemna minor	duckweed	1
Lotus corniculatus	Bird's foot trefoil	2
Panicum virgatum	Switchgrass	2
Phalaris arundinacea	Reed canary grass	3
Poa pratensis	Kentucky blue grass	2
Polygonum hydropiperoides	Water pepper	1
Polygonum persicaria	smartweed	1
Polygonum sagittatum	Tear thumb	1
Populus tremuloides	aspen	1
Pycnanthemum virginianum	Mountain mint	1
Ratibida pinnata	Yellow coneflower	1
Rhamnus frangula	Glossy buckthorn	3
Rudbeckia hirta	Black eyed Susan	1
Sagittaria latifolia	Common arrowhead	10
Salix interior	Sand bar willow	2
Scirpus atrovirens	Dark green rush	10
Scirpus cyperinus	Wool grass	20
Solidago canadensis	Canada goldenrod	2
Solidago rigida	Stiff goldenrod	2
Sorghastrum nutans	Indian grass	5
Spartina pectinata	Cord grass	2

Table 5. East-West Swale		
Species	**Common Name**	**Percent %**
Symphyotrichum lanceolatum	Panicled aster	2
Symphyotrichum novae angliae	New England aster	1
Symphyotrichum pilosum	Frost aster	1
Tradescantia ohiensis	Common spiderwort	2
Trifolium agragium	Hop clover	1
Trifolium hybridum	Alsike clover	2
Typha angustifolia/latifolia	Cattail	5
Total Estimated Cover		128
Total Estimated Native Species Cover		109

Table 6. West Area		
Species	**Common Name**	**Percent %**
Agrostis alba	Redtop grass	2
Alisma subcordatum	Common water plantain	5
Ambrosia artemisiifolia	Common ragweed	2
Andropogon gerardii	Big bluestem grass	2
Asclepias incarnata	Swamp milkweed	1
Bidens frondosa	beggarticks	1
Carex scoparia	Pointed broom sedge	2
Carex vulpinoidea	Fox sedge	2
Daucus carota	Queen Anne's Lace	2
Desmodium canadense	Canada tick trefoil	2
Echinochloa crusgalli	Barnyard grass	2
Eleocharis obtusa	Blunt spike rush	2
Elymus canadensis	Canada wild rye	5
Elymus virginicus	Virginia wild rye	1
Erigeron strigosus	Fleabane	2
Eupatorium perfoliatum	boneset	1
Euthamia graminifolia	Grass leaf goldenrod	2
Festuca arundinacea	Tall fescue	1
Glyceria grandis	Reed manna grass	2
Juncus effusus	Common rush	1
Helenium autumnale	sneezeweed	1
Helianthus grossesseratus	Saw tooth sunflower	1
Leersia oryzoides	Rice cut grass	2
Lemna minor	duckweed	1
Lobelia siphilitica	Great blue lobelia	1
Lotus corniculatus	Bird foot trefoil	2
Mimulus ringens	Monkey flower	1
Monarda fistulosa	bergamot	1
Panicum virgatum	Switch grass	25
Phalaris arundinacea	Reed canary grass	2
Polygonum pennslyvanicum	Pinkweed	1
Polygonum sagittatum	Tear thumb	1
Pycnanthemum virginianum	Mountain mint	1

Table 6. West Area		
Species	**Common Name**	**Percent %**
Ratibida pinnata	Yellow coneflower	2
Rudbeckia hirta	Black eyed Susan	2
Rumex crispus	Curly dock	1
Sagittaria latifolia	Common arrowhead	5
Scirpus atrovirens	Dark green bulrush	5
Scirpus cyperinus	woolgrass	2
Solidago canadensis	Canada goldenrod	2
Solid ago gigantea	Tall goldenrod	2
Sorghastrum nutans	Indian grass	2
Spartina pectinata	cordgrass	2
Symphyotrichum lanceolatum	Panicle aster	1
Symphyotrichum pilosum	Frost aster	2
Trifolium arvense	Rabbit foot clover	2
Typha latifolia/angustifolia	Cattail	5
Total Estimated Cover		116
Total Estimated Native Species Cover		103

Table 7. Wetland 7		
Species	**Common Name**	**Percent %**
Arctium minus	Common burdock	1
Asclepias incarnata	Swamp milkweed	1
Bidens frondosa	Common beggar's ticks	2
Carex bebbii	Bebb's oval sedge	1
Carex crinita	Fringed sedge	2
Carex lacustris	Common lake sedge	5
Carex scoparia	Pointed broom sedge	2
Carex vulpinoidea	Fox Sedge	1
Cirsium arvense	Canada thistle	2
Epilobium coloratum	Cinnamon willow herb	1
Eupatorium perfoliatum	Boneset	1
Euthamia graminifolia	Common grass-leaved goldenrod	2
Glyceria grandis	Manna grass	1
Helianthus grosseserratus	Sawtooth sunflower	2
Helenium autumnale	Sneezeweed	1
Hypericum perforatum	St. John's wort	1
Impatiens capensis	Orange jewelweed	3
Juncus effusus	Common rush	2
Lathyrus palustris	Marsh pea	1
Leersia oryzoides	Rice cut grass	2
Lobelia siphilitica	Great blue lobelia	1
Onoclea sensibilis	Sensitive fern	3
Phalaris arundinacea	Reed canary grass	50
Pinus resinosa	Red pine	2
Polygonum amphibium	Water knotweed	1
Polygonum sagittatum	Arrow-leaved tear thumb	5

Table 7. Wetland 7		
Species	**Common Name**	**Percent %**
Populus tremuloides	Aspen	1
Rhamnus frangula	Glossy buckthorn	2
Sagittaria latifolia	Arrowhead	2
Salix sp.	Willow	2
Scirpus atrovirens	Dark green rush	1
Scirpus cyperinus	Wool grass	3
Solidago canadensis	Canadian goldenrod	2
Spartina pectinata	cordgrass	1
Symphyotrichum lanceolatum	Panicled aster	2
Typha latifolia	Broad-leaved cattail	1
Verbena hastata	Blue vervain	2
Total Estimated Cover		115
Total Estimated Native Species Cover		59