Valentine Gold Project: Federal Information Requirements

Response to Conformity Review

Prepared for:

Marathon Gold Corporation
10 King Street East, Suite 501,
Toronto, ON M5C 1C3

June 14, 2021

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RESPONSE TO IR-08

ID:	**IR-08**
Expert Department or Group:	NRCan-01
Guideline Reference:	Section 7.1 Section 7.1.5 Project Setting and Baseline Conditions – Groundwater and Surface Water
EIS Reference:	Baseline Study Appendices 3, Attachment 3-D, Hydrogeology Baseline Report, Section 4.4
Context and Rationale:	The EIS Guidelines state that the EIS will present information in sufficient detail to enable the identification of how the project could affect the Valued Components and the analysis of those effects. In particular, Section 7.1.5 require temporal changes in groundwater flow (e.g., seasonal and long-term changes in water levels). Adequate groundwater level information, both in terms of spatial and temporal distribution, is required to understand groundwater flow quantity and timing in terms of seepage towards, or loss of flow from, surface water bodies. These changes are a component of the assessment of changes to fish and fish habitat and the aquatic species. A complete seasonal cycle of groundwater elevation change was only monitored in open exploration holes, which may dampen temporal variability. Monitoring from October to March in hydrogeological monitoring wells resulted in 3m of seasonal variability in the absence of potential summer seasonal lows. Additionally, groundwater level information is spatially limited to the area within, and between the open pits. There is very limited information down gradient of the waste rock storage facilities and tailings management facility (TMF).
Original Information Request:	a. Provide groundwater elevation data from hydrogeological monitoring wells for a complete 12-month period. Incorporate this information into the conceptual model of groundwater flow, and the assessment of impacts from the project. b. Provide information on groundwater elevation down gradient of the waste rock storage facilities, and the Tailings Management Facility.
Original Response:	a. Groundwater monitoring has continued at the mine site at three of the monitoring locations presented in the EIS - MW1 (located north of the site), MW4 (located downstream of the Tailings Management Facility), and MW5 (located in the footprint of the Leprechaun Waste Rock Pile), as presented in Figure IR-08-1 (in Appendix IR-08.A). The year-long water level hydrographs show that groundwater levels were typically lower during the winter months and in the mid- to late-summer,

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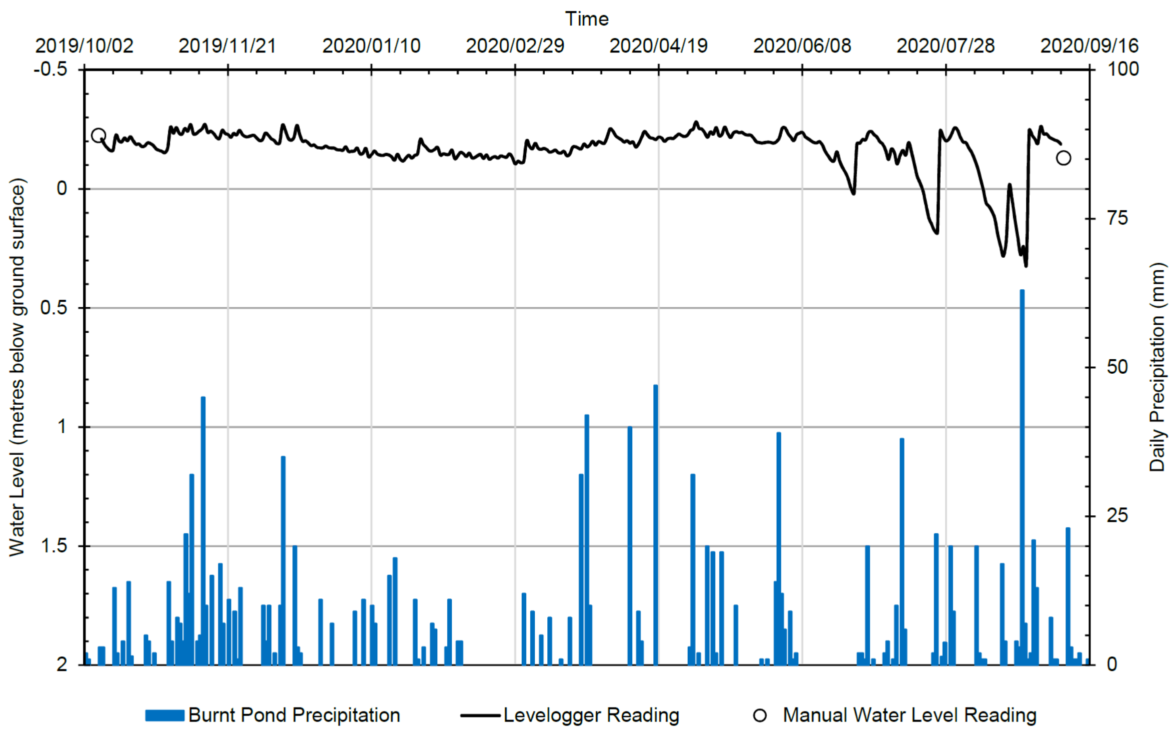
	corresponding to periods with relatively lower infiltration rates. The highest groundwater levels were recorded during the spring corresponding to the spring freshet, and during the fall rainy period. Seasonal fluctuations in groundwater levels ranged from 0.6 m in MW1 to 1.12 m in MW5. Although the averages are slightly different than the values used in the model calibration, the calibration statistics from the model are slightly improved, and do not require the conceptual model, model calibration, or effects assessment to be updated. b. Additional groundwater monitoring has been conducted at the mine site that includes the installation of new wells to support ongoing design work for the mine components, as shown on Figure IR-08-1 (in Appendix IR-08.A). The water level data associated with these locations is shown on Table IR-08-1 (in Appendix IR-08.A). The majority of the wells are located inside the footprints of the project components. Additional monitoring wells will be installed downgradient of the waste rock piles and Tailings Management Facility prior to the development of the Project to characterize the water quality and water levels downgradient of the Project.
Missing Information / Conformity Issue:	The Proponent provided a map of borehole and test pit locations, and not time series plots of water levels for 12 months from the monitoring wells. As context, the provision of 12 consecutive months of water level data is important, and in some cases critical, to understanding seasonal flow patterns and relationships to baseflow and fish habitat. At least one monthly water level reading from each monitoring well is required, plotted on a linear plot using appropriate scales.
Response:	The long-term groundwater level hydrographs from MW1, MW4, and MW5 prepared by GEMTEC (2021; Appendix IR-08.B) are provided in Figures IR-08.2 to IR-08.4. References: GEMTEC Consulting Engineers and Scientists Limited. 2021. Hydrogeology Baseline Characterization - Update on Long-Term Groundwater Level Monitoring, Marathon Valentine Gold Project, Central Newfoundland. Letter report to Marathon Gold Corporation dated March 2, 2021.
Appendix:	Appendix IR-08.A, Appendix IR-08.B

Title: **MW1 Long-Term Water Level Data**

Project: Long-term Groundwater Level Monitoring: October 2019 to September 2020
Marathon Valentine Gold Project, Central Newfoundland



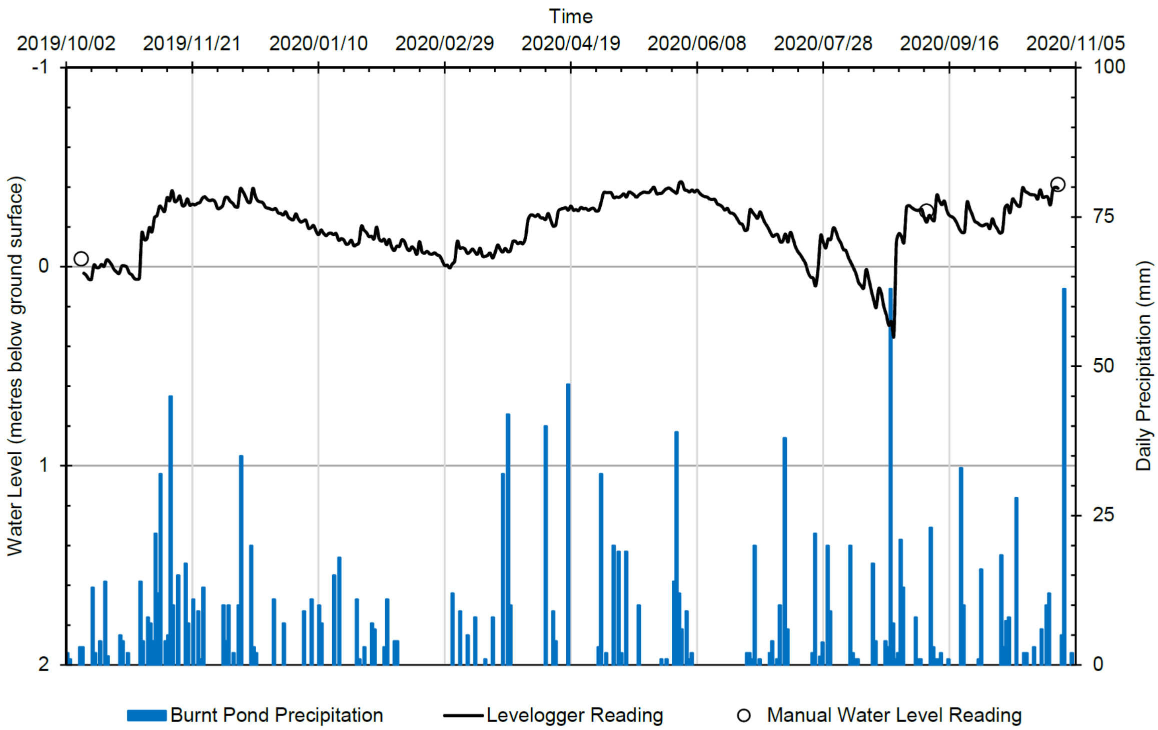
GEMTEC

Letter to: Marathon Gold Corporation
GEMTEC File: 80018.05

Figure IR-08.2 MW1 Long-term Water Level Data

Title: **MW4 Long-Term Water Level Data**

Project: Long-term Groundwater Level Monitoring: October 2019 to October 2020
Marathon Valentine Gold Project, Central Newfoundland



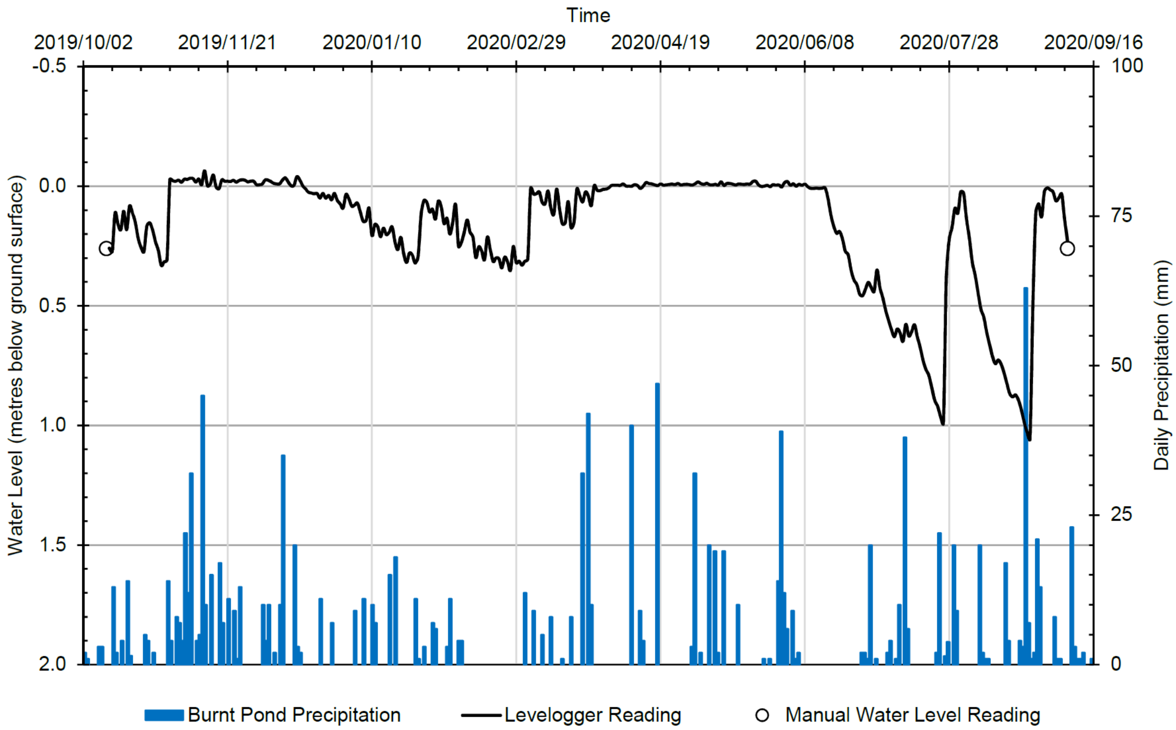
GEMTEC

Letter to: Marathon Gold Corporation
GEMTEC File: 80018.05

Figure IR-08.3 MW4 Long-term Water Level Data

Title: **MW5 Long-Term Water Level Data**

Project: Long-term Groundwater Level Monitoring: October 2019 to September 2020
Marathon Valentine Gold Project, Central Newfoundland



GEMTEC

Letter to: Marathon Gold Corporation
GEMTEC File: 80018.05

Figure IR-08.4 MW5 Long-term Water Level Data

RESPONSE TO IR-09

ID:	**IR-09**
Expert Department or Group:	NRCan-02 MW-48
Guideline Reference:	7.1.5 Project Setting and Baseline Conditions – Groundwater and Surface Water
EIS Reference:	Baseline Study Appendices 3, Attachment 3-D, Hydrogeology Baseline Report, Sections 4.2,4.3, 4.4 Chapter 2, Appendix 2C Prefeasibility Geotechnical Report, Sections 5.6, 7.2, and7.4
Context and Rationale:	The EIS Guidelines require the inclusion of a delineation and characterization of groundwater - surface water interactions. Natural Resources Canada has noted that in the EIS the Valentine Lake Thrust Fault, and other mapped faults fracture and shear zones are not well characterized. However, complimentary data indicates the potential for the fault zone to be a zone of increased hydraulic conductivity (e.g., lower rock quality designation (Section 4.2)), or a structural control on groundwater flow direction (the presence of artesian conditions in bedrock (Section 4.4)). One packer test was completed within the fault zone (Baseline Report Section 4.3) and it indicated that the fault zone has lower rock quality and a higher hydraulic conductivity (Appendix 2C, Prefeasibility Geotechnical Report, Section 5.6). During pit dewatering, faulting that has enhanced hydraulic conductivity may reduce water levels within connected waterbodies impacting fish and fish habitat. Conversely, if there are clay gouge along fault planes, faulting may lower hydraulic conductivity and may direct drawdown related to open pit dewatering much further in one direction relative to another. Both fault types may influence the degree to which open pit dewatering influences groundwater – surface water interactions.
Original Information Request:	a. Provide more information on the results of the packer test completed within the fault and the relationship between rock quality and hydraulic conductivity within the context of the conceptual model of groundwater flow. b. Discuss the location and orientation of mapped fault, fracture and shear zones including the potential for these zones to hydraulically connect the open pits to surface water features. c. In the numerical assessment of the fault, provide maps indicating the drawdown and seepage flow paths under the various fault scenarios for both the water table and at depth within the bedrock.

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Original Response:	a. Packer testing of faults has been completed by Gemtec for Terrane Geoscience Inc. (Terrane 2020, 2021). The hydraulic conductivity for the Valentine Lake thrust fault ranged from 2.5×10^{-9} m/s to 6.7×10^{-6} m/s, with a geometric mean of 7.0×10^{-8} m/s at the Marathon deposit. Similar results were also obtained for the other faults local to the Marathon deposit. A single packer test was completed for the Valentine Lake thrust fault, with a hydraulic conductivity value of 1.4×10^{-9} m/s; it is noted that this value is approximately one order of magnitude lower than that determined at the Marathon deposit. The geometric mean for the other faults local to the Leprechaun deposit was 4.8×10^{-8} m/s. Overall, the hydraulic conductivities determined for the Marathon and Leprechaun deposit faults (including the Valentine Lake thrust fault) were within the range of values for the various rock types, and were not found to be hydraulically distinct from the surrounding rock mass. This continues to support the assumption the faults in the proposed open pits are not expected to be substantial preferred pathways for groundwater flow, or constitute problem areas for seepage control. b. Maps showing local and regional faults within the vicinity of the faults were prepared by Terrane, and are presented in Terrane (2021) Figures 9 and 10 (attached). The structural geology information for these faults is presented in Terrane (2021) Tables 13 and 15 (attached). As shown, the regionally extensive Valentine Lake Thrust Fault is sub-vertical, dipping from 80º in the Marathon deposit, to 70.1º in the Leprechaun deposit. The faults are dominantly oriented along a east-northeast direction (strike between 230º to 250º). c. As discussed in the response to part a), the hydraulic conductivities determined for the Marathon and Leprechaun deposit faults (including the Valentine Lake thrust fault) were within the range of values for the various rock types, and were not found to be hydraulically distinct from the surrounding rock mass. This continues to support the assumption the faults in the proposed open pits are not expected to be substantial preferred pathways for groundwater flow, or constitute problem areas for seepage control. Maps showing the drawdown and particle tracks showing potential seepage pathways for the fault scenarios are included in the response to IR-13.
Missing Information / Conformity Issue:	To facilitate technical review of the assessment of fault hydraulic conductivity, details on the packer testing are required. Packer testing is useful for assessing the effects of faulting on groundwater flow patterns, but to be properly interpreted requires documentation on each packer test. This includes information such as straddle length (distance between packers if double packer), packer length, stem diameter, depth of test, inflation

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	pressure, borehole diameter and borehole depth. These are all commonly recorded details of packer testing programs. If these details are included in Terrane (2020, 2021) delivery of those reports may be sufficient to meet the requirements of the IR.
Response:	The packer testing described in Terrane (2020) and Terrane (2021) were conducted by GEMTEC. The details and results of the packer testing conducted at the site is summarized in Appendix IR-09.A (GEMTEC 2021). References: GEMTEC Consulting Engineers and Scientists Limited. 2021. Summary of Packer Testing, 2020 FS-Level Geotechnical Pit Design Program, Marathon Valentine Gold Project, Central Newfoundland. Letter report prepared for Marathon Gold Corporation, dated May 31, 2021.
Appendix:	Appendix IR-09.A

MARATHON GOLD

VALENTINE GOLD PROJECT
FEASIBILITY
GEOTECHNICAL INVESTIGATION

FIGURE 9 - Terrane 2020 Fault Model
Marathon Deposit

Scale: 1:7000	Date: Jan.07, 2021
Drawn: ACH	Checked: AG
Approved: TLG	Figure 9

LEGEND

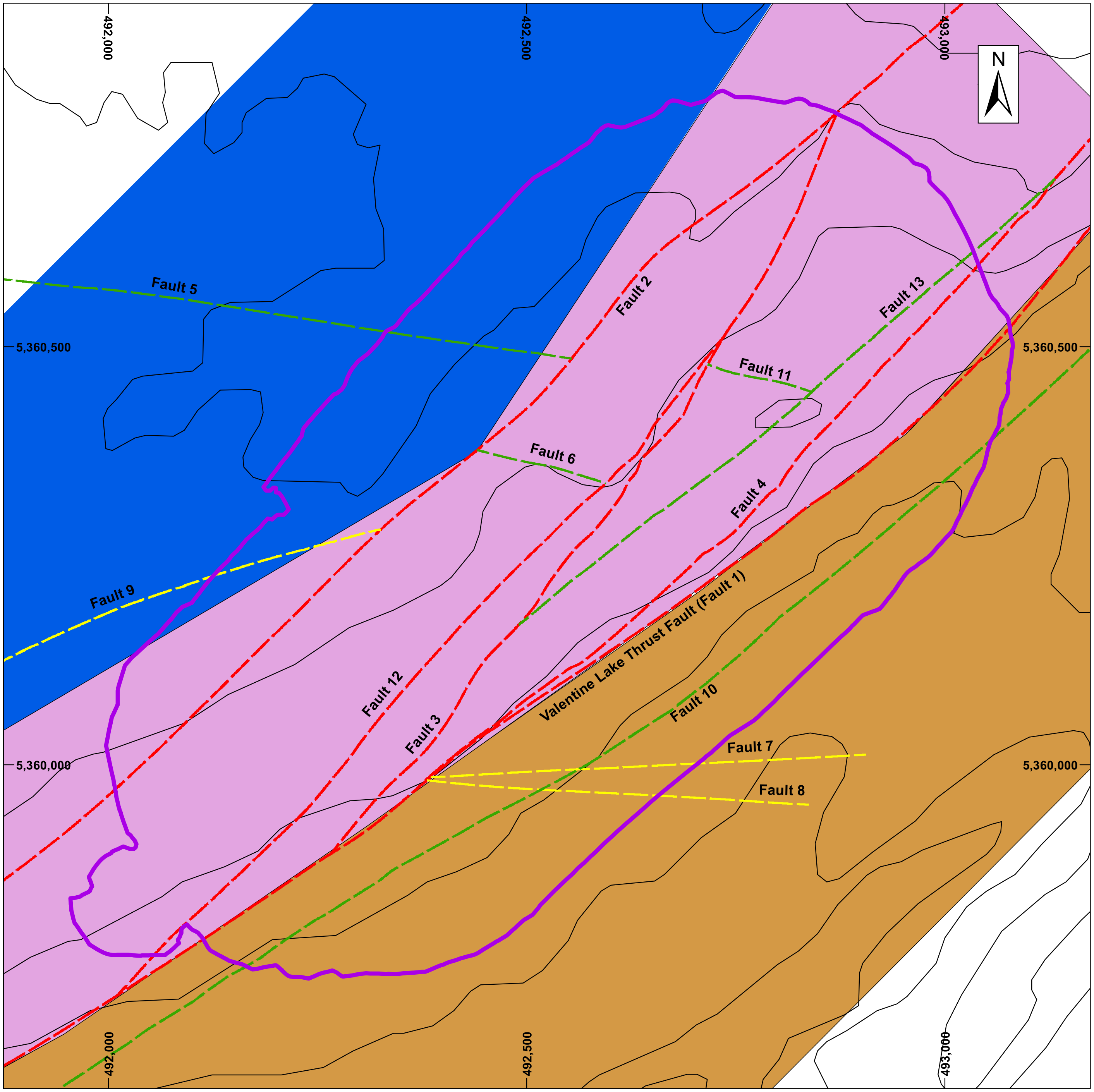
- Mafic Intrusive Domain[1.]
- Quartz-Eye Porphyry Domain[1.]
- Conglomerate Domain[1.]
- Fault - High Confidence[2.]
- Fault - Medium Confidence[2.]
- Fault - Low Confidence[2.]
- 10 m Topographic Contours
- Marathon Pit Outline (December 2020)

0 125 250 Meters

TERRANE GEOSCIENCE INC.

www.terranegeoscience.com

Notes
1) Lithology polygons provided by Marathon
2) All faults from 2020 Terrane Modelling
3) NAD83 UTM Z21N



MARATHON GOLD

VALENTINE GOLD PROJECT
FEASIBILITY
GEOTECHNICAL INVESTIGATION

FIGURE 10 - Terrane 2020 Fault Model
Leprechaun Deposit

Scale: 1:7,500	Date: Jan.07, 2021
Drawn: ACH	Checked: AG
Approved: TLG	Figure 10

LEGEND

- Trondhjemite Domain
- Conglomerate Domain
- Fault - High Confidence [1.]
- Fault - Medium Confidence [1.]
- Fault - Low Confidence [1.]
- 10 m Topographic Contours
- Leprechaun Pit Outline (December 2020)

0 150 300 Meters

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Notes
1) All faults from 2020 Terrane Modelling
2) NAD83 UTM Z21N

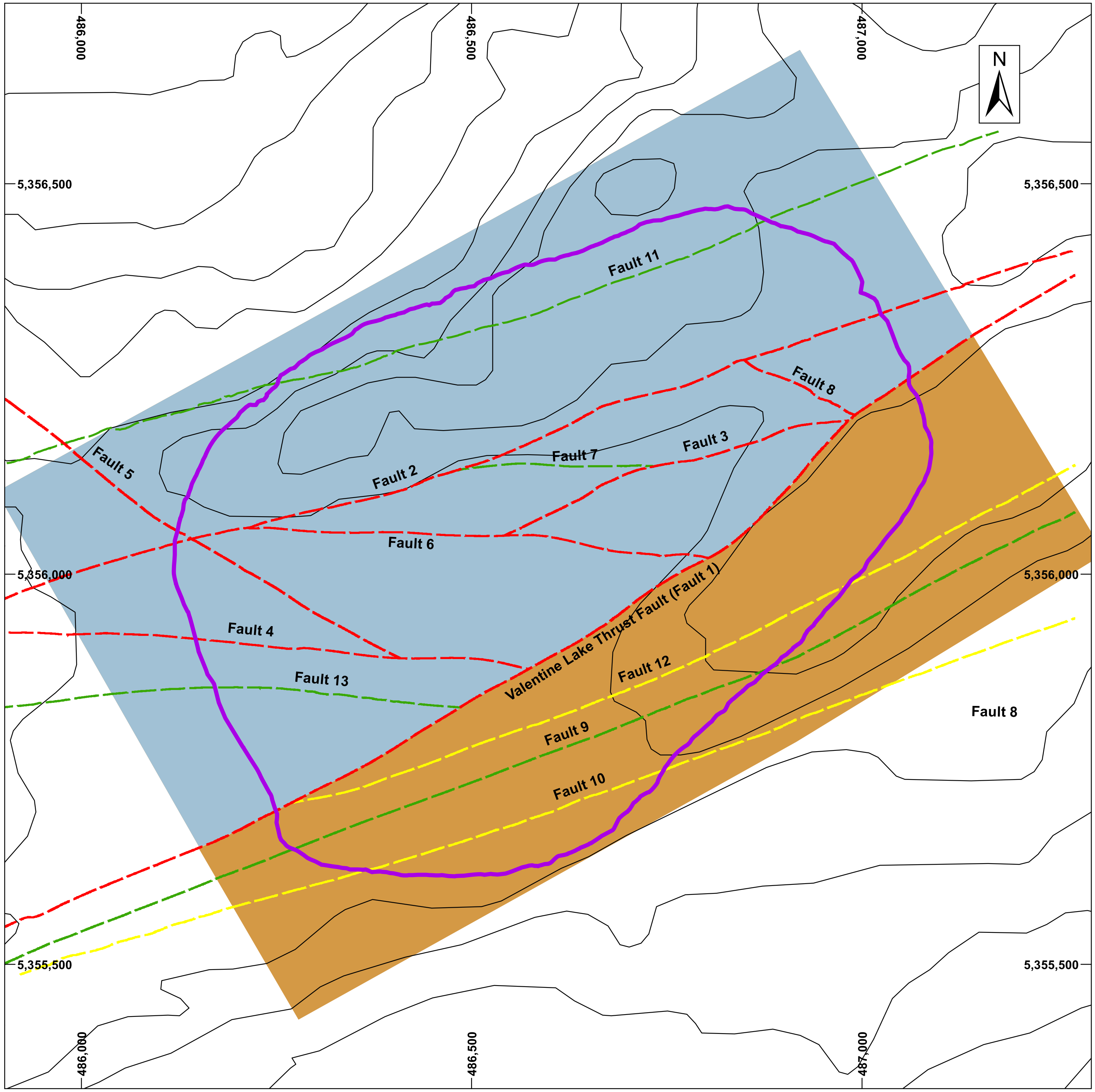

Table 13 - Marathon Modelled Fault Summary

Fault ID	Strike (°)[1.]	Dip (°)[2.]	Topo. Lineament[3.]	Magnetic Lineament[3.]	No. DDH Logged Faults[4.]	No. DDH Intercepts RQD < 50%[5.]	Televiewer /Orientated Core[6.]	Observed in Surface Mapping[7.]	Confidence Score	Confidence[8] .
Fault 1	233.6	80	1	1	5	5	3	1	16	High
Fault 2	226.4	77.1	1	1	2	5	3	0	12	High
Fault 3	216.8	79.1	0	1	5	5	4	1	16	High
Fault 4	228.8	75.1	1	1	3	5	3	1	14	High
Fault 5	277.1	66.8	1	0	1	1	2	0	5	Medium
Fault 6	283.9	77.1	0	1	0	3	3	0	7	Medium
Fault 7	265.6	76.5	1	0	0	2	1	0	4	Low
Fault 8	273.6	77.4	0	0	0	1	2	0	3	Low
Fault 9	254.2	41.9	1	0	0	0	1	0	2	Low
Fault 10	232.5	85.7	1	1	0	1	2	0	5	Medium
Fault 11	287.5	69.6	0	1	0	2	2	0	5	Medium
Fault 12	222.6	75.9	0	1	0	5	4	0	10	High
Fault 13	230.6	77.1	0	1	0	5	1	0	7	Medium

Notes:
1. Strike using right-hand rule, reported strike is the mean strike from stereonet analysis of each faults modelled vertices.
2. Dip is the mean dip from stereonet analysis of each faults modelled vertices.
3. Does a topographic or magnetic geophysical lineament exist, yes (1) or no (0).
4. Number of logged structures used to model fault that are coincide with logged fault zone (>0.25 m), lost core zones, and/or conglomerate-quartz eye porphyry contact (Fault 1 – Valentine Lake thrust fault). Score ranges from 0-5, score capped at 5.
5. Number of RQD runs used to model fault that are coincident with modelled fault with RQD<50%. Score ranges from 0-5, score capped at 5.
6. Number of times fault is observed in televiewer and/or oriented core. Score ranges from 0-3, score capped at 3.
7. Observed in surface mapping from S. Kruse, 2020.
8. Low (0-4), Medium (5-9), High (>10).

Table 15 - Leprechaun Modelled Fault Summary

Fault ID	Strike (°)[1.]	Dip (°)[2.]	Weak Topo. Lineament[3.]	Strong Topo. Lineament[3.]	No. DDH Logged Faults[4.]	No. DDH Intercepts RQD < 50%[5.]	Televiewer /Orientated Core[6.]	Observed in Surface Mapping[7.]	Confidence Score	Confidence[8.]
Fault 1	236.5	70.1	1	1	5	5	2	1	15	High
Fault 2	250.7	56.7	1	1	5	5	3	1	16	High
Fault 3	250	57.1	1	1	3	5	2	1	13	High
Fault 4	275.9	54.5	1	1	5	5	3	1	16	High
Fault 5	299.7	52.6	1	1	5	5	1	1	14	High
Fault 6	274.8	52.4	1	1	4	5	0	1	12	High
Fault 7	269	54.6	1	0	2	5	0	1	9	Medium
Fault 8	294.2	54.3	1	0	1	5	3	0	10	High
Fault 9	248.6	57.8	1	1	0	2	2	0	6	Medium
Fault 10	251	53.3	1	0	0	1	2	0	4	Low
Fault 11	250.2	55	1	1	0	2	0	1	5	Medium
Fault 12	248.1	64.3	0	0	0	0	3	0	3	Low
Fault 13	275.7	55.1	1	1	0	4	2	0	8	Medium

Notes:
1. Strike using right-hand rule, reported strike is the mean strike from stereonet analysis of each faults modelled vertices.
2. Dip is the mean dip from stereonet analysis of each faults modelled vertices.
3. Does a topographic lineament exist, if so, is it weak or very well defined, strong, yes (1) or no (0).
4. Number of logged structures used to model fault that are coincide with logged fault zone (>0.25 m), lost core zones, and/or conglomerate-quartz eye porphyry contact (Fault 1 – Valentine Lake thrust fault). Score ranges from 0-5, score capped at 5.
5. Number of RQD runs used to model fault that are coincident with modelled fault with RQD<50%. Score ranges from 0-5, score capped at 5.
6. Number of times fault is observed in televiewer and/or oriented core. Score ranges from 0-3, score capped at 3.
7. Observed in field mapping from S. Kruse, 2020.
8. Low (0-4), Medium (5-9), High (>10).

RESPONSE TO IR-11

ID:	**IR-11**
Expert Department or Group:	NRCan-05
Guideline Reference:	7.1.5 Project Setting and Baseline Conditions – Groundwater and Surface Water7.2.2 Changes to Groundwater and Surface Water
EIS Reference:	Chapter 6, Appendix6A, Sections 4.3.3,4.3.4, Tables 5-1, 5-2, and 5-3, and Figures 4.1, 5.2 and 5.4
Context and Rationale:	The EIS Guidelines require the delineation and characterization of groundwater - surface water interactions. Boundary conditions within the groundwater flow model are user specified, and control the degree to which groundwater may interact with surface water. In the EIS, the Victoria River has been assigned a general head boundary condition. While this condition is reasonable for lakes with large catchment areas (such as Valentine Lake and the Victoria Lake Reservoir), groundwater drawdown in the vicinity of smaller lakes (such as the Middle, East and West Ponds, and Frozen Ear Lake), or in the upper reaches of the Victoria River, may result in lowering of the surface water levels. As shown on both Figures 5.2 and 5.4 of Appendix 6A, the assignment of these boundary conditions limits drawdown near these features during both operations and closure. The potential for these waterbodies to sustain the simulated flux to groundwater should be evaluated. In Section 4.5.4 it is noted that 2nd order or greater streams have been assigned a river boundary condition. Unlike a general head boundary, groundwater drawdown may occur below these features. However, the assumption that there is sufficient surface water flow to sustain continued flux to the groundwater remains. This assumption should be validated using water balances for these streams. In both cases, it is critical that these boundary conditions be applied only in cases where sufficient surface water flow is available to counter the loss of surface water to groundwater. Dewatering of surface water features and loss of fish habitat is possible with pit dewatering, and should be properly represented within the groundwater model. Although distant from the mine infrastructure, the northwest (abutting the northern reaches of Long Lake) and northeast (abutting Red Cross Lake) model boundaries appear to be set as no flow boundaries. These

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	boundaries should be specified to reflect the lake elevation to ensure regional groundwater flow is represented.
Original Information Request:	a. Update the following information: Figure 4.1 of Appendix 6A so that the type, elevation, and location of all boundary conditions (General Head, River, and Drain) are clearly visible, including those at the boundary of the model. Tables 5-1 and 5-2 of Appendix 6A to include the boundary condition type for each surface water feature listed. Include the Victoria River reach that is within the groundwater model. b. Complete a water balance for all surface water features for which a general head or river boundary has been applied. The water balances must be completed for baseline, operations and closure conditions. Compare the simulated flux to groundwater to available water, and update model boundaries accordingly.
Original Response:	a. Figure 4.1 has been updated to refine the presentation of boundary conditions and is presented as Figure IR-11.1. Tables 5-1 and 5-2 are updated with flux boundary types and presented as Tables IR-11.1 and IR-11.2, respectively. In the tables, GHB represents a "general head boundary" condition, and RIV represents a "river" boundary condition. As shown in the tables, waterbodies (i.e., lakes and ponds) were represented using GHBs, and more linear watercourses were represented with RIVs. GHBs and RIVs operate in a similar fashion, in that they allow inflows to or outflows from groundwater, at a rate based on the conductance assigned to the boundary condition, based on the stage of the surrounding aquifer. The main difference between how GHBs and RIVs operate is that RIVs have a maximum rate at which they can add water, defined by the bottom elevation assigned to the river (i.e., RBOT). This is illustrated on Figure IR-11.2. As discussed in Section 5.2.1 of Appendix 6A of the EIS, the general head boundaries and rivers in the vicinity of the pits were switched to drains as they are unlikely to maintain their constant heads or stages given the drop in water table associated with the pit drainage. b. The fluxes for the GHB, RIV, and drain (DRN) boundary conditions were extracted from the model using the General Head Boundary Observation Package, River Boundary Observation Package, or Drain Boundary Observation Package. These observation packages present the net fluxes only. In all cases, the net groundwater flow is to the streams and lake boundaries. Table IR-11.3 presents Table 5-3 from

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	Appendix 6A of the EIS with the estimated baseline fluxes for the features based on the catchment areas at end of operation. Similarly, Table IR-11.4 presents Table 5-6 from Appendix 6A of the EIS with the estimated baseline fluxes for the features based on the catchment areas following post-closure. As shown on the tables, the net flows to the features are from groundwater to surface water. However, the mean annual flow rates in the streams are sufficient to maintain these net flows, should it be required.
Missing Information / Conformity Issue:	IR-11a requests details on the type of boundary condition set for the Victoria River, and the net groundwater flux at this boundary from pre-construction (baseline) through closure. This information has been provided for the tributaries to the river, but not the river itself as requested. This information is lacking from both Figure IR-11.1 and Tables IR-11.1 and IR-11.2. This information cannot be extrapolated from the tributaries. Groundwater flow models are constructed with various types of boundary conditions around their edges (constant head, no flow, etc.) that reflect the characteristics of the natural system. A description and rationale for all boundary conditions is an important part of numerical model documentation, and is needed to ensure a comprehensive technical review.
Response:	Updated versions of Figure IR-11.1, Table IR-11.1 and IR-11.2 are attached to this response. Figure IR-11.3 shows a subset of boundary condition types assigned to surface water features near Victoria River.
Attachment:	None

Table IR-11.1 Baseline Groundwater Baseflow to Surface Water Features (formerly Appendix 6A, Table 5-1)

Water Feature	Net Flow from Groundwater to Feature (m^3/d)	Baseline Boundary Types
Unnamed Tributary to Victoria Lake Reservoir NT1	332.6	GHB - waterbodies RIV – watercourses
Unnamed Tributary to Victoria Lake Reservoir NT2	61.2	GHB – waterbodies RIV – watercourses
Frozen Ear Lake and Tributaries NT3	2874.2	GHB – waterbodies RIV – watercourses
Unnamed Tributary to Valentine Lake NT4	357.4	GHB – waterbodies RIV – watercourses
Unnamed Tributary to Valentine Lake NT5	408.4	GHB – waterbodies RIV – watercourses
Middle and East Pond and Tributaries EP1	919.9	GHB – ponds RIV – watercourses
West Pond and Tributaries WP1	2167.9	GHB – ponds RIV – watercourses
Unnamed Tributary to Victoria Lake Reservoir ST1	782.5	GHB – waterbodies RIV – watercourses
Unnamed Tributary to Victoria Lake Reservoir ST2	2872.6	GHB – waterbodies RIV – watercourses
Unnamed Tributary to Victoria River ST3	1306.4	RIV – watercourses
Unnamed Tributary to Victoria River ST4	5201.6	GHB – waterbodies RIV – watercourses
Unnamed Tributary to Victoria River VR1	0.002	RIV – watercourses
Unnamed Tributary to Victoria River VR2	0.2	RIV – watercourses
Unnamed Tributary to Victoria River VR3	153.5	GHB – waterbodies RIV – watercourses
Unnamed Tributary to Victoria River VR4	12	RIV – watercourses
Victoria River	23635.8	GHB – watercourses and waterbodies

Table IR-11.2 Estimated Groundwater Discharge to Surface Water Features under Operation Phase (formerly Appendix 6A, Table 5-3) With Boundary Condition Types

Water Feature	Net Flow from Groundwater to Feature (m^3/d)		Operation Boundary Types
	Baseline	Operation	
Unnamed Tributary to Victoria Lake Reservoir NT1	332.6	623.7	DRN – watercourses
Unnamed Tributary to Victoria Lake Reservoir NT2	61.2	768.6	DRN – watercourses
Frozen Ear Lake and Tributaries NT3	2874.2	2349.8	RIV – watercourses
Unnamed Tributary to Valentine Lake NT4	357.4	13	RIV – watercourses
Unnamed Tributary to Valentine Lake NT5	408.4	367.6	DRN – watercourses GHB – waterbodies
Middle and East Pond and Tributaries EP1	919.9	547.4	RIV – watercourses GHB – waterbodies
West Pond and Tributaries WP1	2167.9	751.6	RIV – watercourses
Unnamed Tributary to Victoria Lake Reservoir ST1	782.5	614.9	DRN – watercourses GHB – waterbodies
Unnamed Tributary to Victoria Lake Reservoir ST2	2872.6	2469.3	RIV – watercourses GHB – waterbodies
Unnamed Tributary to Victoria River ST3	1306.4	208.1	DRN – watercourses
Unnamed Tributary to Victoria River ST4	5201.6	3113.4	RIV – watercourses
Unnamed Tributary to Victoria River VR1	0.002	206.4	DRN – watercourses
Unnamed Tributary to Victoria River VR2	0.2	387	DRN – watercourses
Unnamed Tributary to Victoria River VR3	153.5	962.3	DRN – watercourses GHB – waterbodies
Unnamed Tributary to Victoria River VR4	12	1947.4	DRN – watercourses
Victoria River	23635.8	19748.8	GHB – watercourses and waterbodies

Table IR-11.3 Estimated Groundwater Discharge to Surface Water Features under Operation Phase (formerly Appendix 6A, Table 5-3) with Mean Annual Flowrates

Water Feature	Net Flow from Groundwater to Feature (m^3/d)		Mean Annual Flow (m^3/d)
	Baseline	Operation	
Unnamed Tributary to Victoria Lake Reservoir NT1	332.6	623.7	1580.7
Unnamed Tributary to Victoria Lake Reservoir NT2	61.2	768.6	2157.1
Frozen Ear Lake and Tributaries NT3	2874.2	2349.8	8739.5
Unnamed Tributary to Valentine Lake NT4	357.4	13	1077.9
Unnamed Tributary to Valentine Lake NT5	408.4	367.6	1552.9
Middle and East Pond and Tributaries EP1	919.9	547.4	6710.2
West Pond and Tributaries WP1	2167.9	751.6	6633
Unnamed Tributary to Victoria Lake Reservoir ST1	782.5	614.9	3481
Unnamed Tributary to Victoria Lake Reservoir ST2	2872.6	2469.3	5787.1
Unnamed Tributary to Victoria River ST3	1306.4	208.1	3934.4
Unnamed Tributary to Victoria River ST4	5201.6	3113.4	17021.8
Unnamed Tributary to Victoria River VR1	0.002	206.4	837.5
Unnamed Tributary to Victoria River VR2	0.2	387	968.5
Unnamed Tributary to Victoria River VR3	153.5	962.3	2219.5
Unnamed Tributary to Victoria River VR4	12	1947.4	1705.2

Table IR-11.4 Estimated Groundwater Discharge to Surface Water Features under Closure Phase (formerly Appendix 6A, Table 5-6) with Mean Annual Flowrates

Water Feature		Net Flow from Groundwater to Feature (m^3/d)		Mean Annual Flow (m^3/d)
	Baseline	End of Post-Closure (with ditches)	End of Post-Closure (without ditches)	
Unnamed Tributary to Victoria Lake Reservoir NT1	332.6	625.8	623.8	1580.7
Unnamed Tributary to Victoria Lake Reservoir NT2	61.2	769.5	769.5	2157.1
Frozen Ear Lake and Tributaries NT3	2874.2	2330.4	2481.1	8739.5
Unnamed Tributary to Valentine Lake NT4	357.4	173	327.1	1077.9
Unnamed Tributary to Valentine Lake NT5	408.4	367.7	548.6	1552.9
Middle and East Pond and Tributaries EP1	919.9	560.7	565.8	6710.2
West Pond and Tributaries WP1	2167.9	953.5	1197	6633
Unnamed Tributary to Victoria Lake Reservoir ST1	782.5	616.6	972.5	3481
Unnamed Tributary to Victoria Lake Reservoir ST2	2872.6	2468.7	2525.8	5787.1
Unnamed Tributary to Victoria River ST3	1306.4	139.5	852.6	3934.4
Unnamed Tributary to Victoria River ST4	5201.6	3355	3691.9	17021.8
Unnamed Tributary to Victoria River VR1	0.002	206.2	206.3	837.5
Unnamed Tributary to Victoria River VR2	0.2	348.7	361.4	968.5
Unnamed Tributary to Victoria River VR3	153.5	879.4	627.9	2219.5
Unnamed Tributary to Victoria River VR4	12	2043.1	2050.4	1705.2

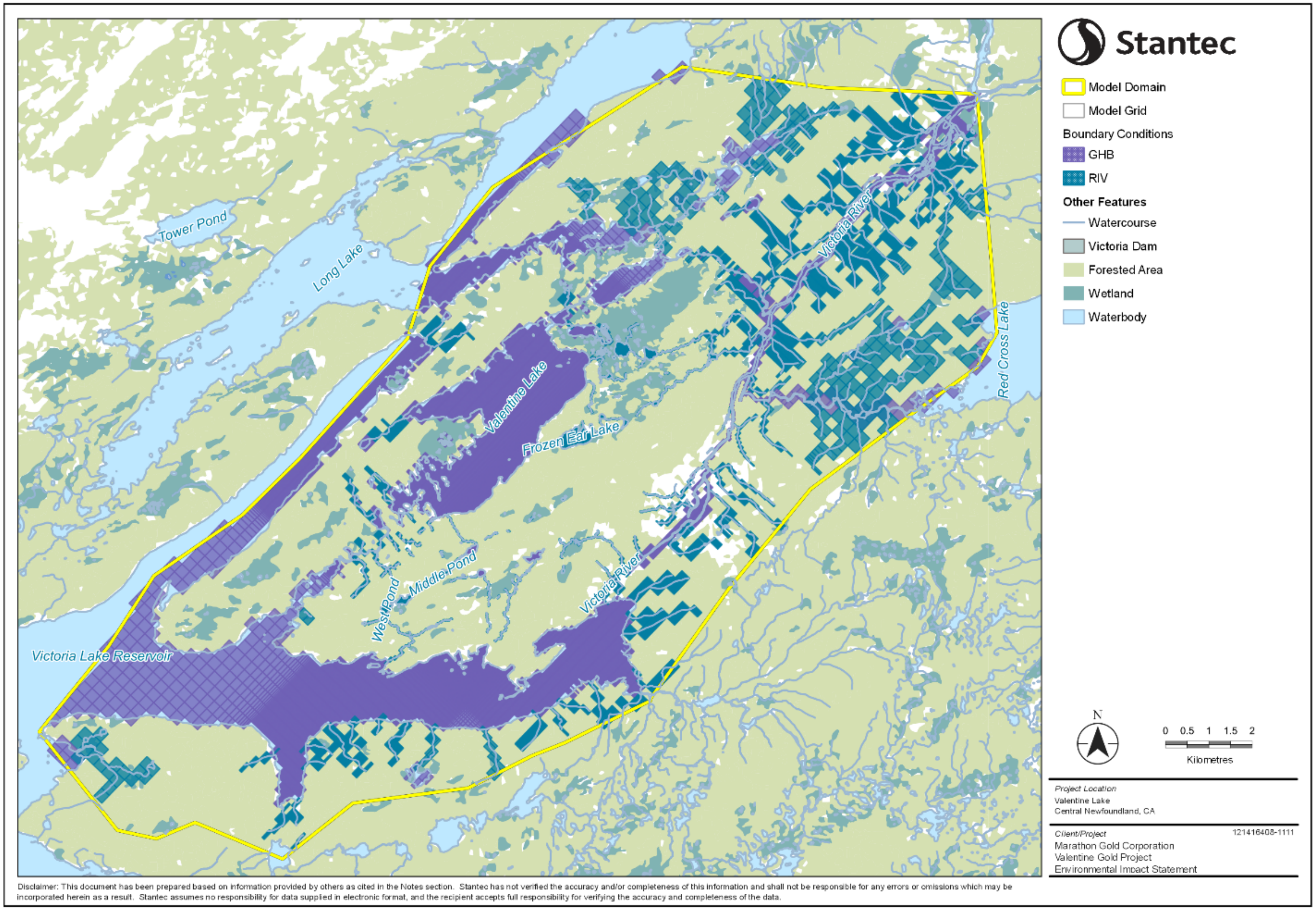

Figure IR-11.1 Boundary Condition Types Assigned to Surface Water Features

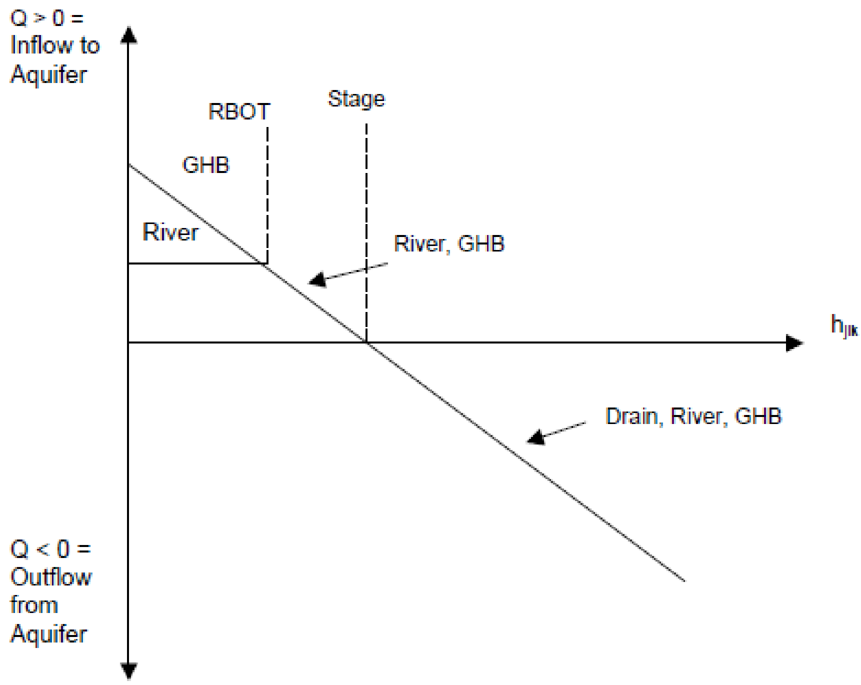

Figure IR-11.2 Model Domain and Boundary Conditions

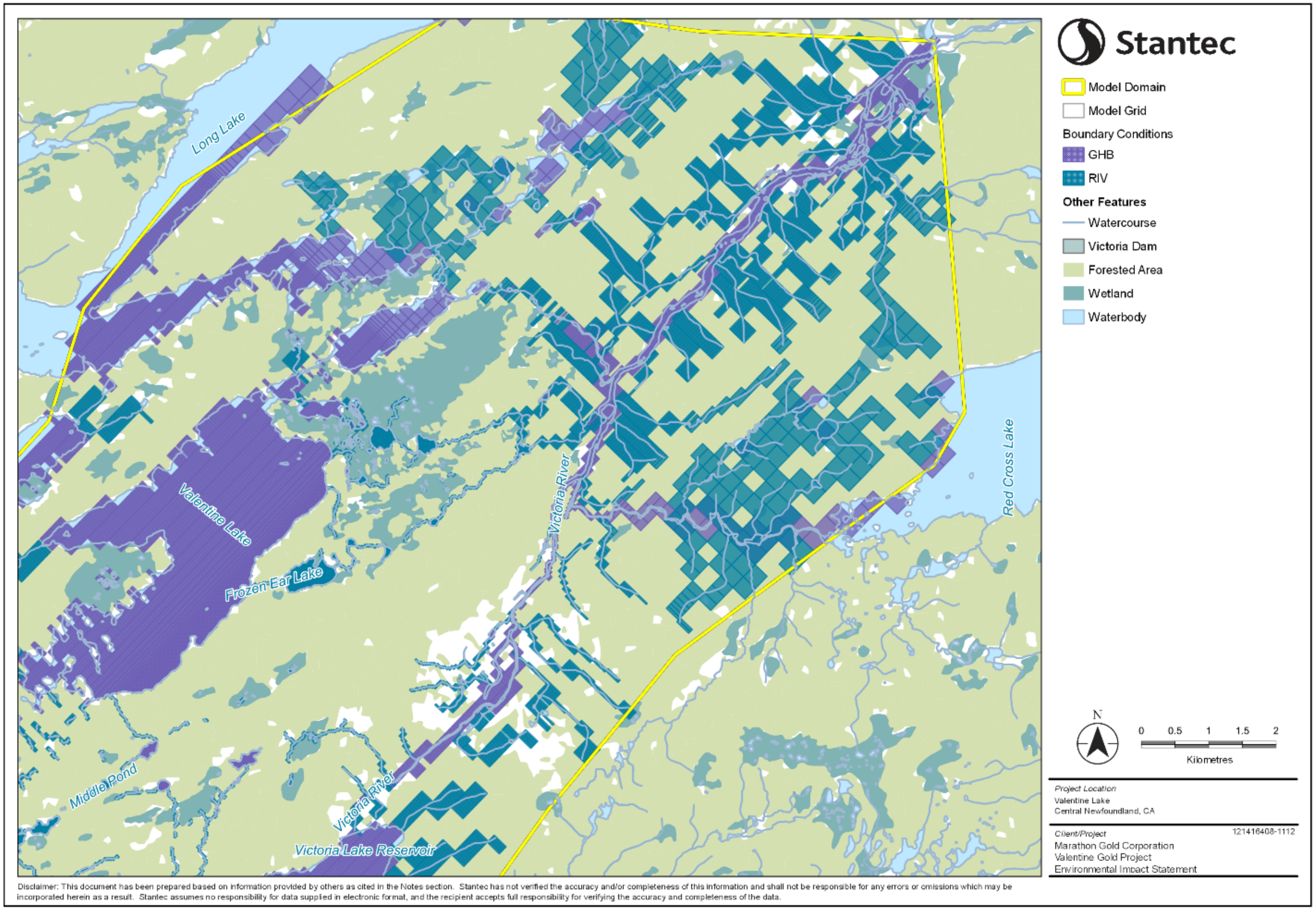

Figure IR-11.3 Subset of Boundary Condition Types Assigned to Surface Water Features Near Victoria River

RESPONSE TO IR-12

ID:	IR-12
Expert Department or Group:	NRCan-06
Guideline Reference:	Section 7.1.5
EIS Reference:	Appendix 6A, Section 4.4, Tables 4-2 and 4-3, and Figures 4-3 and 4-4
Context and Rationale:	The EIS Guidelines require the delineation and characterization of groundwater - surface water interactions. Without a reasonable calibration of the groundwater model, any forecasted changes to groundwater quantity, or groundwater-surface interaction are not reliable. These results are then transferred to the assessment of surface water flow, and subsequently fish and fish habitat. Although it was stated in the EIS that calibration to baseflow was conducted, no results have been provided. Simulated baseflow may be sensitive to parameters such as river conductance, recharge, and the hydraulic conductivity of the overburden. Given that the calibrated value of river conductance is a factor of 26 times greater than the host overburden (a much higher conductance factor than is typical), calibration to baseflow should be presented and justified. Calibration to water levels was conducted primarily using data from long open exploration holes (96% of data). An open hole can connect several hydrostratigraphic units (HSUs) such that groundwater elevations are representative of several units. As a result, differentiation of the water levels in the various HSUs is difficult. While several methods are available to integrate this type of data into a calibration process, the method chosen should be discussed, as should its implications on calibration. Calibration to water levels is evaluated by comparing simulated to observed groundwater elevation values at the various observation points (Shown on Figure 4-3 and summarized in Table 4-2). Results show that the modelled groundwater levels tend to be higher than observed at low elevations, and lower than observed at high elevations. These results indicate that the model may underrepresent the observed magnitude of hydraulic gradients. Magnitude of error should be discussed in both a spatial and geological sense, and its implications on model performance should be discussed. Although automated calibration can efficiently generate parameter sets that minimize errors, the solution is non-unique, meaning that other possible parameter combinations may yield the same result. As such, it is important that results are evaluated to ensure that they align with observations and

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	the conceptual model. In Section 4.4.3 it is stated that the calibrated hydraulic conductivity is generally less than that observed in the single well tests. This result does not seem to be consistent with the accepted observation that hydraulic conductivity increases with scale (e.g. Schulze-Makuch et al., 1999). Although it is noted that bedding in the bedrock units follows the near vertical dip of the units, the calibrated anisotropy value results in a higher hydraulic conductivity across the bedding planes. This result is inconsistent with typical conceptualization. As discussed in NRCan-04 these results may indicate that the modelled hydrostratigraphy is not aligned with observations. As shown on Figure 4-4, recharge is the most sensitive parameter in the calibration. The calibrated recharge value is validated against an assumed range for all of Newfoundland. However, sufficient water balance data is presented in Baseline Study Appendix 3C Section 4.1 that would allow calibrated recharge to be compared to a local annual water surplus. Given that hydraulic conductivity parameters are outside of the assumed range, calibrated recharge warrants this level of comparison. Reference: Schulze-Makuch, D., Carlson, D. A., Cherkauer, D. S. & Malik, P. Scale Dependency of Hydraulic Conductivity in Heterogeneous Media. Groundwater 37, 904–919 (1999).
Original Information Request:	a. Discuss the calibration of the groundwater model to baseflow. Provide a rationale for the river conductance factor derived from the calibration. b. Describe the methodology for specifying the exploration holes as observation wells in the groundwater model. If each hole is assigned to a single HSU, include this unit in Table 4-2, and colour the data by HSU on Figure 4-3. Discuss the number of observation points in each HSU. c. Discuss calibration to water levels in terms of HSU and spatial location. reevaluate the calibration to ensure hydraulic gradients are properly represented. d. Review and update the hydrostratigraphic conceptualization and its effect on calibrated hydraulic conductivity and anisotropy values. e. Provide details on the presentation of two overburden units on Figure 4-4, which are not included in Table 4-3. f. Discuss calibrated recharge relative to site water balance data.

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Original Response:	a. The calibration of the groundwater flow model to baseflow was conducted for six surface water monitoring locations presented on Table IR-12.1. As shown on the table, a good match of the baseflow in the model to the targets was obtained, ranging from 0.3 to 28%, with an average match of 12%. The river conductance was fit during calibration. The conductance term controls the interaction of the boundary condition to the aquifer, and conceptually simulates a stream or lake bed material. The higher the conductance, the better the connection of the water level in the boundary with the water level in the aquifer cell the boundary condition is located. The flow rates between the aquifer and the boundary conditions tend to vary linearly as the conductance rate increases from low to high but flattens to a peak value that is governed by the flow from the aquifer to the boundary. In this case, the conductance value suggests the boundary condition has a good connection with the aquifer, and the flow rate is governed by the aquifer properties rather than the lakebed or riverbed materials. b. The screen intervals for monitoring wells, or open intervals for the bedrock wells were assigned in the model. The water levels for these intervals were calculated in ModelMuse using the Modflow Head Observation (HOB) package (Hill et al. 2000). These multi-layer water level observations were calculated using the average of the transmissivity-weighted water levels in each layer intersected. c. The distribution of residual water levels (i.e., simulated - observed) by elevation is shown on Figure IR-12.1. As shown, there is a slight bias to overestimate the water levels in the lower elevations, and to slight bias to underestimate the water levels at higher elevations. However, the majority (i.e., 59%) of the water level residuals are within 2 m of the target, with 29% of the residuals between 2 and 5 m, and 12% of residuals greater than 5 m. d. Vertical anisotropy is challenging to measure in the field, and is often applied in groundwater practice with a rule of thumb assumption of vertical hydraulic conductivity an order of magnitude lower than the horizontal. However, this simplifying assumption can vary significantly due to actual hydrogeological conditions. As shown on Table 4-3 of Appendix 6A of the EIS, the vertical anisotropy was allowed to vary within the model between 0.05 and 5. The vertical anisotropy within the bedrock was fit at the low end of this range (0.05), suggesting that vertical flow into the deeper bedrock is limited.

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	e. Figure 4-4 presented in Appendix 6A of the EIS referenced an earlier iteration of PEST that discretized the hydraulic conductivity of the overburden into two layers. The results of that PEST run arrived at a uniform hydraulic conductivity for the two layers, and because it was uniform, a single value for hydraulic conductivity for the till overburden was presented in Table 4-3 of Appendix 6A of the EIS. The overall sensitivities presented in Appendix 6A of the EIS are unchanged, with the recharge and overburden hydraulic conductivity remaining the most sensitive parameters. f. The calibrated recharge rate of 381 mm/yr is able to match the overall head distribution within a normalized RMS of water levels of 2.7%, and an average baseflow in stream measurements of 12%. Reference: Hill, M.C., E.R. Banta, A.W. Harbaugh, and E.R. Anderman. 2000. MODFLOW-2000, the U.S. Geological Survey modular ground-water model -- User guide to the Observation, Sensitivity, and Parameter-Estimation Processes and three post-processing programs: U.S. Geological Survey Open-File Report 00-184, 210 p.Attachment: https://marathongold.stanport.com/Shared%20Documents/IR-12.docx
Missing Information / Conformity Issue:	IR-12f requests that the calibrated recharge rate of 381 mm/yr be discussed relative to the site water balance data including the annual water surplus (i.e., a discussion on the model calibrated recharge value in the context of the site water balance data). The IR response discusses this value in the context of model calibration rather than relative to the site water balance data. The groundwater flow model uses an annual recharge rate of 381 mm/yr to optimise the calibration of the model with various water level measurements around the project site. Independently of the numerical model, the proponent has completed a site water balance that accounts for precipitation, runoff, recharge, discharge, river flows, etc. in a process that inherently defines infiltration. It is important to compare the two infiltration values and discuss variations and their significance, including seasonal effects, with respect to model calibration.

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Response:	The calibrated groundwater recharge rate of 381 mm/yr represents about 30% of the mean annual precipitation at the site. The calibration included matching baseflow estimates at six flow stations within the model domain, as well as available water level targets. The overall match between the baseflow and water level targets, as well as the visual similarity in the shape of the water level contours generated from the model compared to the water level contours developed based on field measurements suggested that the selected recharge rate utilized in the groundwater flow model presented in the EIS was appropriate, as shown in Figure IR-12.2. The site-wide water balance referenced above was used to evaluate the runoff characteristics and infiltration rates associated with Project components. These rates are not associated with the calibration of the groundwater model. Recharge rates determined for the waste rock piles, tailings management facility, etc., used in the site-wide water balance, were also applied to the groundwater flow model during the predictive model scenarios. A review of the baseflow estimates in the Central Newfoundland Region (AMEC 2013), suggested baseflow accounted for approximately 9.4% to 38.3% of the total precipitation applied to the watersheds (i.e., recharge estimates from baseflow of 178 to 424 mm/yr). The site is located within Subregion 2 of the Central Newfoundland Region (AMEC 2013). Baseflow estimates within this region were based on flows observed at the Exploits River at Grand Falls which were 19.6% of total precipitation (214 mm/yr). However, the Exploits River is a highly-regulated river based on hydroelectric usage, and as such the baseflow estimates may be biased to the lower range due to increased storage in the river system. Therefore, the recharge rates based baseflow estimates within the region (i.e., 9.4 to 38.4% of total precipitation) are deemed appropriate for the range observed at the site. Reference: AMEC. 2013. Hydrogeology of Central Newfoundland. Submitted to Water Resources Management Division, Department of Environment and Conservation. Project #: TF8312718.
Attachment:	None

Table IR-12.1 Baseflow Calibration in Groundwater Flow Model

Surface Water Station	Observed	Simulated	% Difference
HS3_1	700	587	-16%
HS5_1	997	782	-22%
HS1_1	401	515	28%
HS7_1	1737	1805	3.9%
HS9_1	2918	2894	-0.8%
HS8_1	5058	5040	0.3%

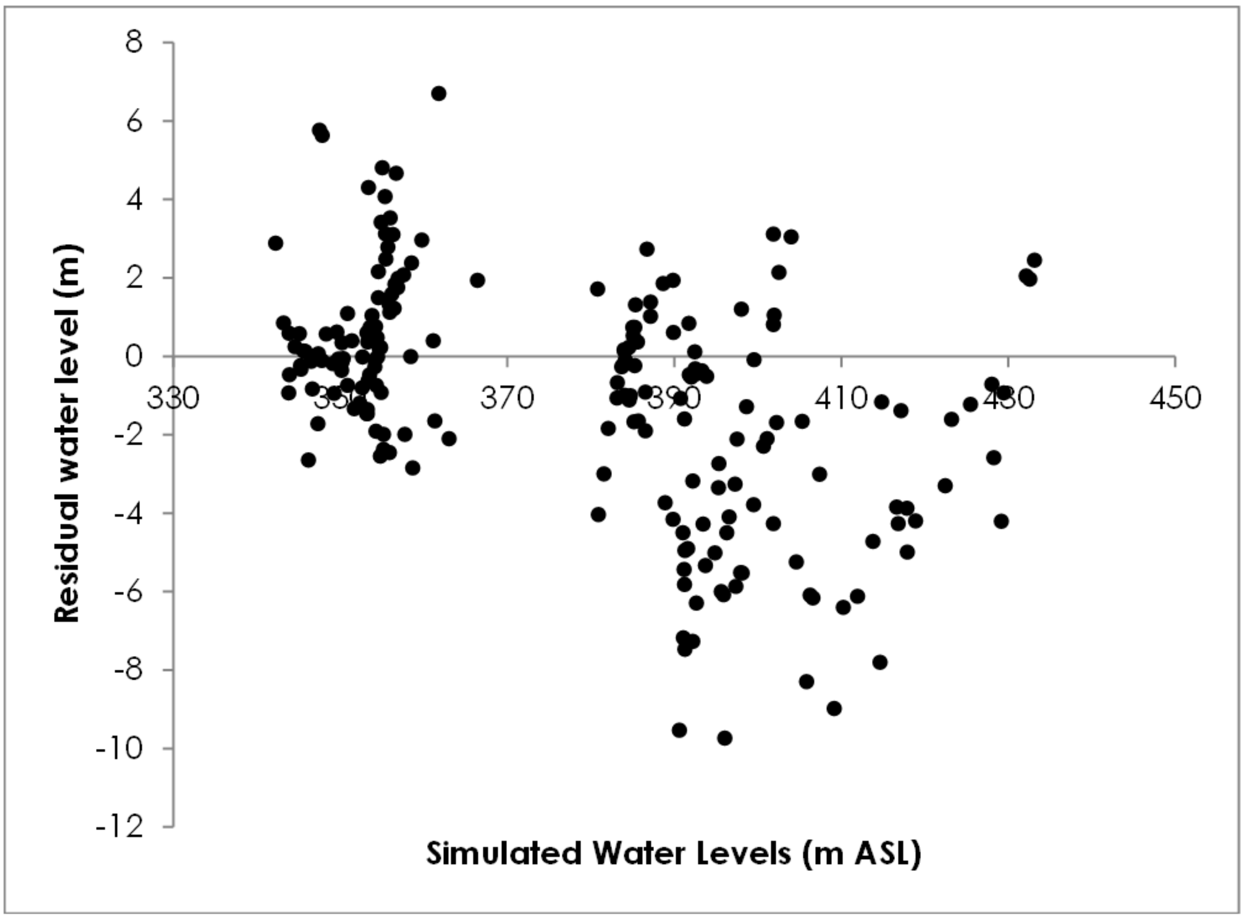

Figure IR-12.1 Distribution of model residuals (simulated – observed water levels) by observed water level elevation

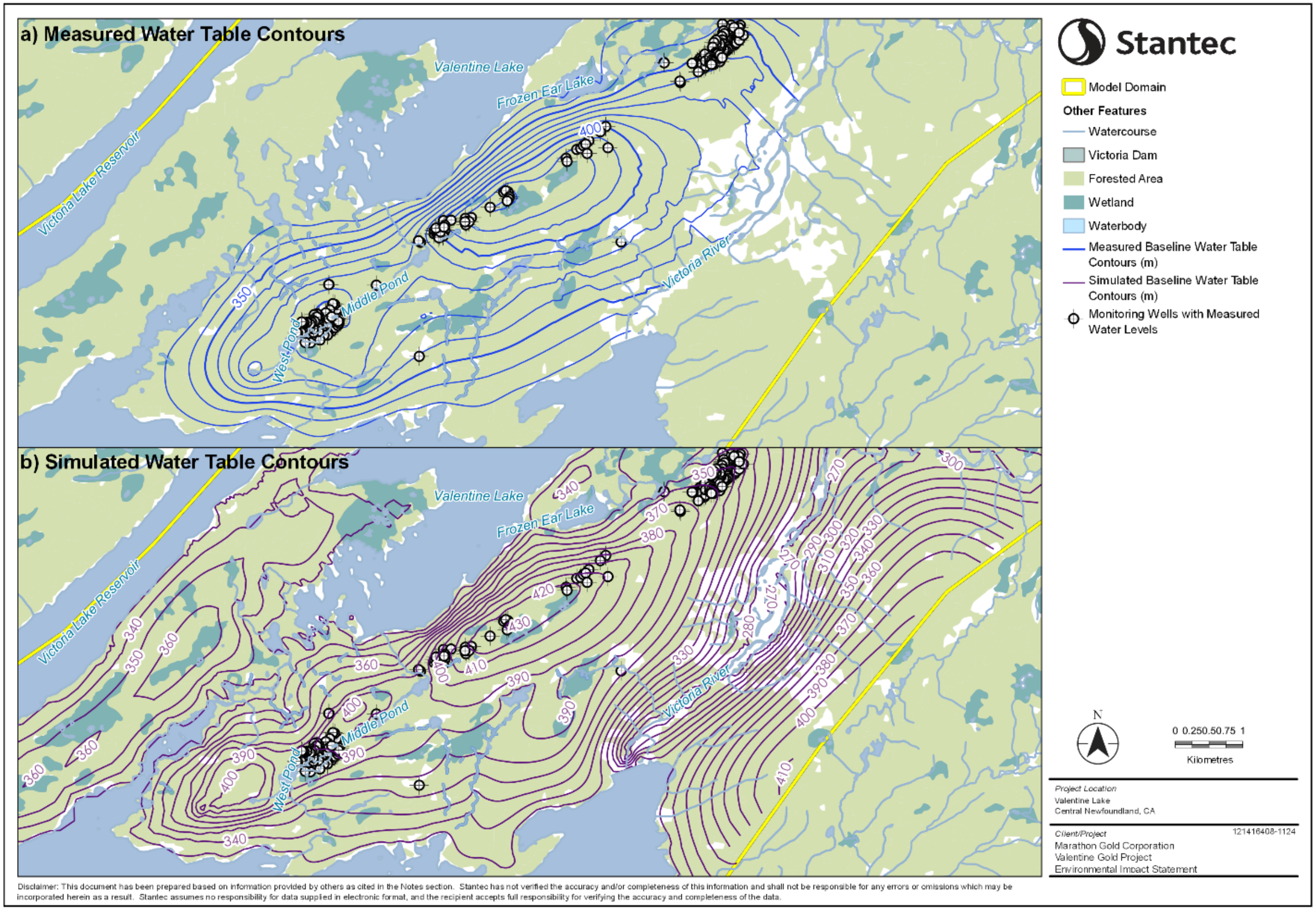

Figure IR-12.2 Comparison of Measured and Simulated Baseline Water Table Contours

RESPONSE TO IR-41

ID:	IR-41
Expert Department or Group:	ECCC-12 NRCan-22 Pub-07.11
Guideline Reference:	Section 7.1.5
EIS Reference:	Chapter 4: Assessment of Effects to Surface Water Appendix 7C – Assimilative Capacity Assessment Report
Context and Rationale:	The EIS guidelines require a sediment quality analysis for key sites likely to receive mine effluents. Sediment quality is an important aspect of a healthy ecosystem especially in supporting fish health in the receiving environment. The proponent has conducted baseline sediment studies but has not modelled or predicted impacts to sediments nor is any monitoring program planned to evaluate sediment quality. While water quality modelling and monitoring programs give good information related to the health of the aquatic environment, continuous loadings of elevated contaminants of potential concern (COPCs) may be deposited to sediments over time which may then act as an ongoing source of contamination in the benthic environment which can affect fish health. COPCs in sediments in streams and rivers can be remobilized over time or during high flow events to create risks to downstream aquatic receptors. Section 4.4.2 of the EIS BSA4-C provides sediment quality for 3 locations in Victoria and Valentine Lakes. However, these locations do not directly correlate to discharge locations. This information is needed to determine significance of effects on fish and fish habitat.
Original Information Request:	a. Provide time series plots (construction, operation, closure and post-closure) of Al, As, AG, Cd, Cr, Cu, Fe, Mn, Hg, Se, U, Zn, NO2, Cyanide, UN-NH3, SO4, F in sediments of Victoria Lake Reservoir, Valentine Lake and Victoria River. Provide an evaluation of sediment quality and assess the potential environmental effects to fish and fish habitat as a result of any sediment contamination, if applicable. Indicate whether a monitoring program to evaluate changes in sediment quality will be established. b. Provide predicted contaminated sediment conditions for each of the nine Final Discharge Points locations.
Original Response:	In response to this information request, the following presents further information regarding sediment loading, quality and deposition in effluent receiving environments.

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	A design objective for the water management infrastructure is to keep contact water (any runoff, groundwater or process water that has come into direct contact with mine rock, tailings, or terrain where mine workings and infrastructure occur) and non-contact water separate. Contact water is directed to water management ponds to allow for flow attenuation and water quality treatment prior to discharge to the environment at the final discharge points (FDPs). Non-contact water has been assumed to be represented by baseline water quality. Contact water quality, which includes surface water contacting any mine component, process water, and seepage flow out of stockpiles (ore, overburden and topsoil) and waste rock piles to and from the water management ponds, was modelled using GoldSim. As described in the EIS, the Project has a planned total of 11 FDPs. There are four FDPs at the Marathon Complex that drain to Valentine Lake and the Victoria River either directly or through tributaries. There are five FDPs at the Leprechaun Complex that drain to Victoria Lake Reservoir, either directly to the lake or through tributaries. The Processing Plant and Tailings Management Facility Complex has two FDPs that flow to Victoria Lake Reservoir. Sedimentation ponds provide removal of total suspended solids (TSS); however, sedimentation effects were not incorporated into geochemical or Assimilative Capacity modeling. The following response provides additional information with respect to sediment load and sediment water quality related to contact water. <u>Sediment Load</u> Sedimentation ponds are designed to: • Provide safe and efficient runoff and seepage collection to reduce disruptions to the mine operation during wet weather events/periods • Collect and treat contact water from waste rock piles, stockpiles and open pits • Provide peak flow reduction to mitigate potential flooding issues • Provide sediment removal to meet the *Metal and Diamond Mining Effluent Regulations* (MDMER) effluent TSS concentrations of 15 mg/L The results of sediment load on the ponds are presented in Table IR-41.1. Long term average annual erosion rates from the Project Area were predicted using the Revised Universal Soil Loss Equation for Application in Canada (RUSLEFAC) (Wall et al. 2002). The sedimentation pond design for sediment trapping efficiency was 80%. Particle size distribution was taken into account when deriving the erodibility factor in the Revised Universal Soil Loss Equation (RUSLE). It was assumed that 10% of mobile particles are sand and silt (size < 2 mm). The soil structure was assumed to

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	be medium or coarse granular size with slow to moderate permeability. The ponds were assumed to settle out sediment particle sizes ≥ 0.005 mm. Background TSS water quality concentrations in small tributaries in the Project Area are presented in Table IR-41.2. Table IR-41.3 presents sediment load at the ultimate receivers from the contact and non-contact areas of the mine. The distance from each FDP to the ultimate receiver is different in each case, however, for the purposes of this assessment, a worst-case scenario was assumed in which 100% of the sediment load at the FDP is transported to and settles out in the ultimate receiving water mixing zone. Thus, for MA-FDP-02 discharging to Valentine Lake, it was assumed that 1,253 kg/year will be deposited in the Valentine Lake mixing zone at an approximate material density of 2.0 tonne/m^3, equating to 0.616 m^3 of sediment deposition. Using a mixing zone of 100 m as determined in the Assimilative Capacity Report and calculating 100 m as the radius of a semicircle, the mixing zone area is 1.57 ha and the average sediment deposition depth is < 0.1 mm/year. Alternatively, for LP-FDP-03 (including 03A&B) and LP-FDP-05 with 16,487 kg/year sediment and an ultimate mixing zone of up to 300 m, the sediment deposition in Victoria Lake Reservoir would be approximately 8.2 m^3/year at an annual sediment depth of < 0.1 mm/year. In both cases, and covering the wide range of conservative sediment deposition, the accumulation of sediment in the ultimate receivers is comparable to natural (background) deposition rates. It is therefore not expected to result in adverse effects with respect to redd disturbance, egg smothering, groundwater discharge or sediment-water column oxygen exchange. With respect to the potential for Project discharges to adversely affect sediment chemistry, Table IR-41.4 presents sediment baseline chemistry as well as Canadian Environmental Quality Guidelines (CEQG) for sediment, including the Interim Sediment Quality Guidelines (ISQG) and probable effects levels (PELs). Sediment sampling was conducted in September of 2019 on small creeks and lakes representing catchment areas of the Victoria River, Valentine Lake, and Victoria Lake Reservoir. Baseline sediments exceed the CEQG ISQG for arsenic, cadmium and zinc and the CEQG PEL for arsenic. Table IR-41.5 presents modeling results of sediment chemistry from contact water using the geochemical model. No exceedances of CEQG ISQG and CEQG PEL are predicted for sediment in contact water leaving the sedimentation ponds.

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	Sediment chemistry load predictions for contact areas are presented in Table IR-41.6 and predictions for non-contact areas are shown in Table IR-41.7. Sediment quality for sedimentation pond discharges was estimated based on the proportional distribution of parameters of potential concern observed in geochemical testing and modelling. Table IR-41.8 presents estimates of sediment quality at each FDP based on proportioning sediment load contributions from undisturbed catchment areas at baseline quality and from the sedimentation ponds at the predicted geochemical quality. Based on these predictions of ultimate combined sediment quality, the following observations are made: • Baseline sediment chemistry exceeds CSQG ISQG for arsenic, cadmium and zinc and exceeds CEQG PEL for arsenic • No CEQG ISQG and CEQG PEL exceedances are predicted in sediments from contact areas discharging from Project sedimentation ponds • Average sediment deposition depth in the mixing zone of ultimate receivers for all FDPs is less than 0.1 mm /year which is comparable to natural (background) deposition rates for receivers with similar hydraulics (Chien and Wan 1999) It is anticipated that sediment quality may change due to Project discharges, however, sediment quality in these discharges will not increase above ISQG or PEL and will not diminish baseline sediment quality. Consequently, no adverse effects to fish, fish habitat or benthos are anticipated. The above assessment of sediment deposition and quality is representative of the period in operation when each pond source to each FDP is fully built-out and functional. During construction, approximately half of the proposed sedimentation ponds will be constructed to support construction phase topsoil and overburden stripping and mine facility excavation and dewatering. Except where required early to support construction, sedimentation ponds associated with the waste rock piles are planned for full commissioning in early operations when the Project begins to stockpile waste rock. Therefore, the construction phase sedimentation ponds will primarily be addressing topsoil and overburden sedimentation and dewatering activities at a portion of the site. As a result, the amount of sediment produced during this period will be less, and of better quality than the detailed assessment presented above for the operations phase. Similarly, as per the response to IR-31 and IR-44, the closure concept is to convert the proposed perimeter ditches to passive permeable reactive

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	barriers and, where required, sedimentation ponds to engineered wetland features. The vegetated soil cover proposed for residual mine waste stockpiles will produce non-contact overland runoff which will be routed to natural ground. Only infiltration-based seepage will remain as contact water requiring further treatment in closure. Groundwater is naturally low in "sediment" or particulate form and metals in groundwater are typically considered in the dissolved format, thus not producing significant sediment load. Further, the passive seepage approach uses sulphate reducing bacteria and the carbon-rich material to sequester metals in the subsurface reactive barrier zone thus "discharging" to the receiving groundwater environment treated seepage in dissolved metal format. For these reasons during closure and post-closure, sediment production will be less, and its quality better, than that predicted in the detailed operations phase assessment. Marathon will undertake baseline environmental effects monitoring (EEM) sediment monitoring in 2021 and will continue sediment monitoring in keeping with EEM requirements under MDMER throughout mine life. <u>Summary</u> The above assessment demonstrates that sediment deposition, even when estimated for the worst-case (operation) scenario, would not adversely affect sediment accretion depth in the ultimate receiver mixing zones. No adverse sediment deposition effects are therefore predicted for benthos, fish or fish habitat. Sediment quality will remain the same or potentially improve from baseline conditions for all parameters. The results of this sediment prediction assessment indicate that the Project will not have adverse effects on fish, fish habitat or benthos. References: Ning Chien and Zhaohui Wan (1999) Mechanics of Sediment Transport. ASCE Press. Wall G.J., Coote D.R., Pringle E.A. & Shelton I.J. (2002) RUSLEFAC – Revised Universal Soil Loss Equation for Application in Canada: A Handbook for estimating Soil Loss from Water Erosion in Canada. Research Branch, Agriculture and Agri-Food Canada, Ottawa, ON.
Missing Information / Conformity Issue:	The need for sediment quality modelling is an important part of addressing the quantification of residual effects for the Environmental Assessment. The proponent was requested to present time series plots of sediment quality. Instead, only values during operations were provided. The proponent's rationale for only providing operations information is that contamination will be highest during this period and will be associated with release of a

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	maximum of 15 mg/L of suspended solids, the Metals and Diamond Mining Effluent Regulations limit. The time series plots were requested to add certainty to the prediction of effects of contaminants in sediments that may be present after the mine ceases production and to allow a comparison with field tests during follow-up and monitoring. For instance, during closure and post-closure, the proponent explains that no suspended sediments will be released; hence, low contamination of sediment will occur. However, problematic rock piles on site, when covered, will erode with time and may become a source of contamination over the long-term. The proponent is correct in stating that seepage contains mainly dissolved elements, however, these dissolved constituents will precipitate or be taken up into the food chain.
Response:	The following information has been provided to support the predicted effects of contaminants in sediments that may be present after the mine ceases production. Monthly time-series of Parameters of Potential Concern (POPCs) loading (in kg/day) at the ultimate receiver for operation and post-closure were generated. Sedimentation pond discharge was characterized under the operations scenario as it is assumed that during closure and as the Project is rehabilitating and in transition from operations to a fully closed condition, discharge will continue within *Metals and Diamond Mining Effluent Regulations* (MDMER) limits. Post-closure (after rehabilitation is complete) and the mine moves to a recognized closed mine (RCM) status, the thresholds for discharge are understood to be those of baseline or Canadian Council of Ministers of the Environment (CCME) Canadian Water Quality Guidelines – Freshwater Aquatic Life (CWQG-FAL). The loading of dissolved forms of metals for operation and post-closure is presented in graphical time series plots in Appendix IR-41.A and loading of suspended forms is presented in Appendix IR-41.B. The following assumptions were used to generate the time series: • Effluent concentrations of POPC for operation conditions were assumed at MDMER or at 95th percentile of modeling prediction where no MDMER limit exists. • Effluent concentrations of POPC for post-closure conditions were assumed at CCME CWQG-FAL or baseline, whichever has the higher value. • Monthly average flows for operation and post-closure were generated using the GoldSim model.

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	• Loading of suspended POPC was calculated from disturbed and non-disturbed areas separately and then combined. Total Suspended Solids (TSS) removal of the ponds was assumed at 80%. • Monthly TSS concentrations were distributed proportionally to average monthly flows. It was observed that loading of dissolved forms (Appendix IR-41.A) reduces substantially from operation to post-closure. For metals with relatively high background concentration such as aluminum, iron and manganese, the loading reduction from operation to closure ranges from 50 to 80%. Metals with very low background concentrations (arsenic, copper, lead and zinc) show a reduction of dissolved forms in the range of 80-95%. The highest dissolved loading was observed at MA-FDP 3/4 as it has the largest total catchment area (7.1 km^2) and largest disturbed area (1.55 km^2). The lowest dissolved loading was observed at LP-FDP-04 due to its very small size; the total area is 0.54 km^2 and disturbed is 0.1 km^2. Loading of monthly suspended forms is presented in Appendix IR-41.B. It was observed that most of the suspended loading originates from background conditions (i.e., undisturbed areas). Reduction of loading from operation to closure is on average approximately 5-10%. Loading of suspended metals during operation is not significant due to treatment (i.e., sedimentation ponds, perimeter ditches) and relatively small project footprint in comparison to non-disturbed areas. As with the dissolved forms, the highest suspended loading was observed at MA-FDP 3/4 due to its largest total catchment area. The lowest dissolved loading was observed at LP-FDP-04 due to its very small size. Most of the suspended and dissolved loading occurs in April when flows are the highest. Lowest dissolved and suspended load is observed in June and July.
Appendix:	Appendix IR-41.A; Appendix IR-14.B

Table IR-41.1 Long Term Sediment Load Predictions from Contact Areas

Sedimentation Pond	Facility	Final Discharge Point	Discharge Location	Pond Catchment Area, ha	Long-term Average Soil Loss, kg/yr	Mean Annual Flow at Pond, m^3/day	TSS in Pond, mg/L	TSS at Pond outflow, mg/L
MA-SP-01A/B	Topsoil/Low Grade	MA-FDP-01A/B	Valentine Lake	69.1	8,524	1,492	15.6	3.1
MA-SP-01C	Waste Rock	MA-FDP-01C		18.5	2,978	389	20.9	4.2
MA-SP-02	Waste Rock	MA-FDP-02		55.6	2,931	1,196	6.7	1.3
MA-SP-03	Waste Rock	MA-FDP-03	Victoria River	34.2	2,785	728	10.5	2.1
MA-SP-04	Waste Rock	MA-FDP-04		71.9	7,464	1,556	13.1	2.6
MA-SP-05	Pit			70.4	4,837	1,522	8.7	1.7
LP-SP-01A	Low Grade	LP-FDP-01	Victoria Lake Reservoir	16.0	676	335	5.5	1.1
LP-SP-01B	Topsoil/W Rock			38.8	1,607	828	5.3	1.1
LP-SP-02A	Waste Rock	LP-FDP-02		75.0	9,004	1,623	15.2	3.0
LP-SP-03A	Waste Rock	LP-FDP-03C		52.0	30,464	1,118	74.6	14.9
LP-SP-03C	Overburden/ W Rock			39.1	18,041	836	59.1	11.8
LP-SP-05	Pit	LP-FDP-05		57.8	27,622	1,244	60.8	12.2

Table IR-41.2 Background TSS Concentration from Non-Contact Areas

	Average TSS, mg/L	75^{th}% TSS, mg/L
LP02, LP04 (Tribs to Victoria Lake, LP-FDP-01 to LP-FDP-05)	0.79	1.1
VL01 (Tribs of Valentine Lake, MA-FDP 01, 02)	2.1	2.7
R02 (Tribs to Victoria River, MA-FDP-03,04)	3.6	4.4

Table IR-41.3. Sediment Load at Final Discharge Points (FDPs)

Sedimentation Pond	Final Discharge Point	Discharge Location	Sediment Load from Contact Areas, kg/year	Sediment Load from Non- Contact Areas, kg/year	Total Load at FDP, kg/year
MA-SP-01A/B	MA-FDP-01A/B	Valentine Lake	1,705	5,790	8,090
MA-SP-01C	MA-FDP-01C		596		
MA-SP-02	MA-FDP-02		586	667	1,253
MA-SP-03	MA-FDP-03	Victoria River	557	20,205	23,222
MA-SP-04	MA-FDP-04		1,493		
MA-SP-05			967		
LP-SP-01A	LP-FDP-01	Victoria Lake Reservoir	135	557	1,014
LP-SP-01B			321		
LP-SP-02A	LP-FDP-02		1,801	85	1,885
LP-SP-03A	LP-FDP-03C		6,093	1,261	16,487
LP-SP-03C			3,608		
LP-SP-05	LP-FDP-05		5,524		

Table IR-41.4 Baseline Sediment Chemistry

Parameter	UNITS	CEQG ISQG	CEQG PEL	Valentine Lake Tributaries	Victoria River Tributaries	Victoria Lake Tributaries
Aluminum (Al)	mg/kg	-	-	16,500	18,000	22,000
Arsenic (As)	mg/kg	5.9	17	**125**	**120**	**114**
Cadmium (Cd)	mg/kg	0.6	3.5	**0.86**	**1.50**	**0.73**
Copper (Cu)	mg/kg	35.7	197	23.5	23.0	31.0
Iron (Fe)	mg/kg	-	-	27,500	25,000	36,500
Lead (Pb)	mg/kg	35	91.3	6.8	7.1	15.3
Manganese (Mn)	mg/kg	-	-	3,050	3,700	6,308
Zinc (Zn)	mg/kg	123	315	**144.0**	**170**	**143.8**

Notes:
CEQG - Canadian Environmental Quality Guideline
ISQG - Interim Sediment Quality Guideline
PEL – Probable Effect Level
Bold font denotes concentrations that exceed an applicable guideline (either/or ISQG, PEL)

Table IR-41.5 Sediment Chemistry Predictions for Sedimentation Pond Discharges (mg/kg)

Final Discharge Point	Discharge Location	Al	As	Cd	Cu	Fe	Mn	Pb	Zn
MA-FDP-01	Valentine Lake	6,533	1.10	0.150	26.6	11,976	401	2.6	12.0
MA-FDP-02/03		6,892	0.82	0.024	13.8	17,350	528	1.6	20.2
MA-FDP-04	Victoria River	9,454	1.22	0.045	23.8	19,369	736	2.7	32.2
LP-FDP-01/02	Victoria Lake Reservoir	7,030	2.19	0.046	9.7	4,716	594	11.2	41.8
LP-FDP-03/05		7,559	2.69	0.064	12.2	6,430	651	11.0	49.8

Table IR-41.6 Sediment Chemistry Load Predictions for Contact Areas Discharging from Sedimentation Ponds (kg/year)

Sedimentation Pond	Al	As	Cd	Cu	Fe	Mn	Pb	Zn
MA-SP-01A/B	55.7	0.009	0.0013	0.227	102.1	3.42	0.022	0.102
MA-SP-01C	20.5	0.002	0.0001	0.041	51.7	1.57	0.005	0.060
MA-SP-02	20.2	0.002	0.0001	0.041	50.8	1.55	0.005	0.059
MA-SP-03	19.2	0.002	0.0001	0.038	48.3	1.47	0.004	0.056
MA-SP-04	51.4	0.006	0.0002	0.103	129.5	3.94	0.012	0.150
MA-SP-05	45.7	0.006	0.0002	0.115	93.7	3.56	0.013	0.156
LP-SP-01A	4.8	0.001	0.0000	0.007	3.2	0.40	0.008	0.028
LP-SP-01B	11.3	0.004	0.0001	0.016	7.6	0.96	0.018	0.067
LP-SP-02A	63.3	0.020	0.0004	0.087	42.5	5.35	0.101	0.377
LP-SP-03A	214.2	0.067	0.0014	0.295	143.7	18.11	0.343	1.275
LP-SP-03C	126.8	0.040	0.0008	0.174	85.1	10.73	0.203	0.755
LP-SP-05	208.8	0.074	0.0018	0.338	177.6	17.98	0.304	1.375

Table IR-41.7 Sediment Chemistry Load Predictions for Non-Contact Areas (kg/year)

Final Discharge Point	Discharge Location	Al	As	Cd	Cu	Fe	Mn	Pb	Zn
MA-FDP-01	Valentine Lake	95.5	0.724	0.005	0.136	159.2	17.66	0.039	0.834
MA-FDP-02		11.0	0.083	0.0006	0.016	18.3	2.03	0.005	0.096
MA-FDP-03/04	Victoria River	363.7	2.425	0.0303	0.465	505.1	74.76	0.143	3.435
LP-FDP-01	Victoria Lake Reservoir	12.3	0.064	0.0004	0.017	20.3	3.51	0.009	0.080
LP-FDP-02		1.9	0.010	0.0001	0.003	3.1	0.53	0.001	0.012
LP-FDP-03/05		27.7	0.144	0.0009	0.039	46.0	7.96	0.019	0.181

Table IR-41.8 Sediment Chemistry Load Predictions at FDP (kg/year)

Final Discharge Point	Discharge Location	Al	As	Cd	Cu	Fe	Mn	Pb	Zn
MA-FDP-01	Valentine Lake	171.7	0.736	0.0063	0.404	313.0	22.65	0.066	0.996
MA-FDP-02		31.2	0.086	0.0006	0.056	69.2	3.58	0.009	0.155
MA-FDP-03/04	Victoria River	480.1	2.439	0.0308	0.722	776.6	83.73	0.173	3.797
LP-FDP-01	Victoria Lake Reservoir	28.3	0.069	0.0005	0.039	31.1	4.87	0.034	0.176
LP-FDP-02		65.2	0.029	0.0005	0.090	45.5	5.89	0.103	0.389
LP-FDP-03/05		577.5	0.325	0.0049	0.846	452.4	54.77	0.869	3.587

RESPONSE TO IR-54

ID:	**IR-54**
Expert Department or Group:	ECCC-10-CWS- 04MFN-41
Guideline Reference:	Section 7.3.2
EIS Reference:	Section 10.4-Avifauna Mitigation and Management Measures Section 10.5-Assessment of Environmental Effects on Avifauna Section 10.9-Follow-up and Monitoring
Context and Rationale:	The EIS Guidelines require information on the deposit of harmful substances in waters that are frequented by migratory birds. In Section 10.5.2.2 of the EIS, the Proponent states that "A change in mortality risk may result from possible ingestion and/or absorption of water in the tailings and/or polishing ponds, with potential exceedances in POPC as outlined under the Metal and Diamond Mining Effluent Regulations, specifically for total cyanide, unionized ammonia (product of cyanide decomposition) and Copper (added as catalysis during cyanide destruction or leached from the ore). Wildlife, including avifauna, have been reported drinking from ponds associated with tailings management facilities (Eisler and Wiemeyer 2004; Donato et al. 2007) and could also be exposed by ingesting aquatic flora and fauna within the TMF." The proponent proposes to monitor avifauna use of these project features and implement adaptive management measures (e.g., deterrents and/or exclusionary measures) as required. Mitigation measures to mitigate the potential risks to migratory birds using the tailings and/or polishing ponds are not clearly outlined in the EIS. This information is needed for a complete assessment of effects on migratory birds including species at risk (SAR).
Original Information Request:	Provide any plans or mitigation measures to deter migratory birds including SAR from tailings management facilities and settling ponds, including beneficial management practices and/or the development of an avifauna management and follow-up monitoring plan. Provide adaptive management measures in the event that adverse effects to migratory birds are expected.
Original Response:	In review of the above context and rationale, it appears the focus of this IR is the tailings management facility (TMF) which would include the polishing pond. Water quality within 'settling ponds', which are designed and located across the site to manage and treat contact water (not process water) are expected to contain sediment and minor dissolved metals and other potential constituents like ammonia at very low concentrations. As a result, avifauna or other wildlife that may contact or ingest this water or adjacent

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	vegetation would not be at an increased mortality risk. Information regarding the TMF is provided below. While exposure to the tailings pond could pose a threat to migratory birds, this risk is reduced through the cyanide detoxification process within the mill. Using the sulphur dioxide / air oxidation process will result in the degradation of cyanide and precipitation of metals, prior to tailings being discharged into the TMF. The International Cyanide Code guideline for Weak Acid Dissociable (WAD) cyanide is 50 mg/L for protection of birds and wildlife. WAD cyanide remaining in the tailings following cyanide detoxification (prior to discharge into the TMF) will be below 1 mg/L (destruction target). Any excess water in the tailings pond that is not reclaimed to the process plant will be treated in the water treatment plant and polishing pond prior to being discharged to the environment, with maximum concentrations in compliance with the new authorized limits as per the *Metal and Diamond Mining Effluent Regulations* (MDMER). As the polishing pond receives effluent post-treatment plant, the water within the polishing pond will not pose a threat to migratory birds. Mitigation measures to deter birds from entering the tailings and polishing ponds are included in Section 10.4. Embankments of the TMF and polishing ponds will be maintained free of vegetation. This will limit the attraction of waterfowl and/or wildlife to these ponds for foraging or breeding. Avifauna use of the ponds will be monitored (primarily targeting waterfowl but also other wildlife species). If problematic avifauna use occurs, additional mitigation measures will be implemented and adapted if required. The Avifauna Management Plan to be developed and implemented for this Project will outline the adaptative management strategies to be employed and thresholds for triggering adaptive measures, which may include deterrents and exclusionary measures. Bird deterrents may include visual deterrents such as scarecrows, falcon effigies, kites or eye-safe lasers, and auditory deterrents such as noise cannons, wailers or other noise makers. Since birds become habituated to deterrents (e.g., Andelt et al 1997; Whisson and Takekawa 2000; Ronconi and Cassady St. Clair 2006), these must be regularly relocated and switched out. If bird use of the TMF or polishing ponds continues after the implementation of these deterrent measures, additional mitigation measures may be required. These may include exclusionary measures, which could include the use of bird deterrent floating balls, which cover the water's surface, thus preventing birds from landing and interacting with the effluent. Another option could

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	involve the installation of bird netting over ponds, which also prevents waterfowl from landing on these (Martin and Hager 1990). References: Andelt, W.F., T.P. Woolley and S.N. Hopper. 1997. Effectiveness of barriers, pyrotechnics, flashing lights, and Scarey Man for deterring heron predation on fish. Wildlife Society Bulletin, 25, 686–694 Martin, L.R. and Hagar, S. 1990. Bird control on containment pond sites. Proceedings of the Fourteenth Vertebrate Pest Conference. 60. Available online at: https://digitalcommons.unl.edu/cgi/ viewcontent.cgi?article=1059&context=vpc14 Ronconi, R.A. and C. Cassady St. Clair. 2006. Efficacy of a radar-activated on-demand system for deterring waterfowl from oil sands tailings ponds. Journal of Applied Ecology, 43: 111-119. Whisson, D.A. and J.Y. Takekawa. 2000. Testing the effectiveness of an aquatic hazing device on waterbirds in the San Francisco Bay estuary of California. Waterbirds, 23, 56–63.
Missing Information / Conformity Issue:	The proponent indicated in its response that “Water quality within “settling ponds”, which are designed and located across the site to manage and treat contact water (not process water) are expected to contain sediment and minor dissolved metals and other potential constituents like ammonia at very low concentrations. As a result, avifauna or other wildlife that may contact or ingest this water or adjacent vegetation would not be at an increased mortality risk.” The proponent has not provided any evidence to support the conclusion that “avifauna or other wildlife that may contact or ingest settling pond water/adjacent vegetation would not be at an increased mortality risk”. Without this information a complete technical review of this response is not possible. The proponent must provide a rationale or evidence to support its determination that the effects of tailings management facilities and settling ponds would be minimal or provide mitigations on how to prevent those effects.
Response:	Additional information is provided below to support the conclusions that avifauna or other wildlife that may contact or ingest water from the sedimentation pond or adjacent vegetation would not be at an increased mortality risk. This includes additional details on the predicted water quality inflows to the sedimentation ponds, how risks are reduced through sedimentation pond (referred to as settling pond in the IR) design, and mitigation and monitoring programs to reduce adverse effects to avifauna

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	and other wildlife. Supplementary information has also been provided with respect to risk to avifauna from exposure to the tailings management facility (TMF). <u>Potential Effects to Avifauna and Other Wildlife from Exposure to Sedimentation Ponds</u> As described in Chapter 7 (Surface Water) and the Water Management Plan (Appendix 2A) of the EIS, sedimentation ponds within the Project Area are required to manage surface runoff and seepage collection at the Leprechaun and Marathon Complexes and the Process Plant site. The ponds provide controlled release of contact water and are designed to provide adequate residence time for settling of suspended solids. The sedimentation ponds provide flood and erosion control, as well as water quality management functions. As summarized in Section 7.5.2.1 of the EIS and detailed in Section 6 of Appendix 7A of the EIS (Water Quantity and Water Quality Modelling Report: Leprechaun Complex and Processing Plant & TMF Complex) and Section 6 of EIS Appendix 7B (Water Quantity and Water Quality Modelling Report: Marathon Complex), the water quality model shows that no exceedance of the *Metal and Diamond Mining Effluent Regulations* (MDMER) are predicted at facilities and discharges in the Leprechaun and Marathon Complexes (waste rock pile, topsoil and overburden stockpiles, open pit, ponds) during all mine phases, at a 95th percentile confidence level. This means that all **influent** water runoff and seepage to the sedimentation ponds is predicted to meet MDMER limits (i.e., water meets the limits for discharge before entering the sedimentation ponds). As the influent or inflow to the sedimentation ponds is predicted to meet MDMER through all mine life phases, water retained in the ponds will meet effluent discharge criteria. As per *Regulations Amending the Metal Mining Effluent Regulations*: SOR/2018-99 (Canada Gazette, Part II, Volume 152, Number 11) Section 4(1) (c): *(c) the effluent is not acutely lethal.* MDMER limits are defined as being not acutely lethal. Water quality monitoring and reporting for MDMER includes acute lethality testing on rainbow trout, threespine stickleback and *Daphnia magna,* aquatic organisms, whereby these specimens reside in the sample mine effluent and are exposed to this water for 100% of the test duration. There are no Canadian MDMER effluent criteria for the protection of non-aquatic wildlife that use water. However, it is reasonable to conclude that effluent that meets MDMER criteria (and is therefore not acutely toxic to aquatic life at

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	100% exposure) would not pose a toxicity risk to avifauna or other wildlife that ingest or are exposed to the effluent less than 100% of the time. Additionally, design criteria were developed to mitigate possible effects of the Project on surface water resources and are based on Project-specific guidance and industry best practices. Sedimentation pond design (summarized in Section 7.4.1.1 and the Water Management Plan (Appendix 2A) of the EIS) incorporates a permanent pool, drawdown and sedimentation residence time to remove a target of 80% of suspended solids. A submerged, reversed slope, low flow outlet pipe is proposed to discharge water from below the water surface reducing potential effects of discharging thermally charged surface water. <u>Potential Effects to Avifauna from Exposure to the TMF</u> As noted in the original response, the tailings pond could pose a threat to avifauna and other wildlife through exposure or ingestion of cyanide; however, this risk will be mitigated through the cyanide detoxification process within the mill. Cyanide has been identified as the primary gold-mining-related contaminant responsible for wildlife mortality (Donato et al. 2007; Henny et al. 1994), with effective management of cyanide concentration in tailings being identified as the primary mechanism for protecting wildlife during operation of tailings facilities (Griffiths et al. 2009). The International Cyanide Code guideline for Weak Acid Dissociable (WAD) cyanide is 50 mg/L for protection of avifauna and wildlife. The level of WAD cyanide remaining in the tailings pond for this Project following cyanide detoxification is expected to be below 1 mg/L. Marathon is committed to being a signatory to the International Cyanide Management Code and is ensuring that the process facility and process water management system is designed in this context. Henny et al. (1994) in studying the effects of cyanide on migratory birds in Nevada, USA, documented waterfowl, shorebirds, perching birds and gulls as potentially being at-risk to exposure to cyanide in tailings facilities. The identified species at risk in Australia include waders, waterbirds, ducks, pratincoles, terns and raptors (Donato et al. 2007). Other studies have shown that waders are most likely to come into contact with tailings facilities (Hudson and Bouwman 2008). Donato et al. 2007 reported no avifauna mortalities from two mining operations that consistently discharged below the International Cyanide Code guideline for WAD cyanide over a two-year period. Research from a gold mine in South Africa found no avifauna mortality following contact with the tailing storage facility (TSF), which had a WAD cyanide level of less than 50 mg/L (Hudson and Bouwman 2008). The only species observed

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	contacting the TSF were wading birds, which may have been feeding on flying insects that landed on the water's surface (Hudson and Bouwman 2008). Several waterfowl species were observed using the return water dams (RWDs), which contained reed beds (Hudson and Bouwman 2008). No mortalities were observed following use of the RWDs (Hudson and Bouwman 2008), which had cleaner water than the TSF. <u>Mitigation and Management Measures to Reduce Adverse Effects to Avifauna and Other Wildlife from Tailings and Sedimentation Ponds</u> The tailings and sedimentation ponds for the Project will be designed and maintained in a manner that will deter use by avifauna and other wildlife. As vegetation that naturally regenerates around sedimentation ponds could potentially attract wildlife, vegetation will be removed from the embankments of the sedimentation ponds through a vegetation control program. As previously indicated, embankments of the TMF and polishing ponds will also be maintained free of vegetation. This is anticipated to reduce the attraction of wildlife, and avifauna in particular, to these areas for foraging or breeding and is consistent with recommendations provided by Donato et al. (2007). Removal of vegetation is also a requirement for proper maintenance and inspection of embankments and dams in accordance with the Canadian Dam Association Guidelines. Further, dams impounding the sedimentation ponds will be of rockfill construction and lined on their upstream slope with impermeable membrane liners, which will limit vegetation colonization and deter use by avifauna. From an exposure perspective, ingestion of food items, such as invertebrates, fish and plants, provide higher exposure risk to contaminants in sediment and surface water than does ingestion of water. The tailings and sedimentation ponds will not contain fish, and the continuous deposition of tailings (in the tailings pond) will limit the likelihood that invertebrates will be present within the tailings impoundment. Similarly, routine maintenance (clearing out sediment build-up) in the sedimentation ponds will likely reduce the potential presence of invertebrates. There could be some use of the tailings and sedimentation ponds for resting or foraging of flying insects on the water surface (Hudson and Bouwman 2008). However, the water ingestion rate for avifauna and other wildlife is relatively low and risk from this exposure pathway is considered low compared to risk from other pathways. Hudson and Bouwman (2008) observed only a few occasions of birds drinking from the TMF. Additionally, considering the high level of human activity and sensory disturbance at the mine site, avifauna and other wildlife would be expected to spend limited time in the area.

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	Summary As originally described in the response to IR-54, the worst-case exposure scenario is associated with the TMF pond, where exceedances of select MDMER parameter limits are predicted and where excess water treatment through a water treatment plant and polishing pond are planned. As the predicted WAD cyanide concentration within the tailings will be below 1 mg/L and given the measures described in the initial IR response to monitor for and deter problematic avifauna use of the TMF, the TMF is not anticipated to represent a source of increased mortality for avifauna or other wildlife. The sedimentation ponds are expected to receive influent water that meets MDMER limits, and thus the standing water in the sedimentation ponds meets MDMER; therefore, exposure to this water should not pose an increased mortality risk to avifauna or other wildlife that may frequent the ponds. Given the above, the EIS determination of a low magnitude residual adverse effect on increased mortality risk for avifauna or other wildlife during all Project phases is considered valid. References: Donato, D.B., O. Nichols, H. Possingham, M. Moore, P.F. Ricci, and B.N. Noller. 2007. A critical review of the effects of gold cyanide-bearing tailings solutions on wildlife. Environment International 33 (2007) 974–984. Griffiths, S.R., G.B. Smith, D.B. Donato, and C.G. Gillespie. 2009. Factors influencing the risk of wildlife cyanide poisoning on a tailings storage facility in the Eastern Goldfields of Western Australia. Ecotoxicol Environ Saf. 72(5):1579-86. Henny C.J., R. J. Hallock, and E.F. 1994. Hill EF. Cyanide and migratory birds at gold-mines in Nevada, USA. Ecotoxicology 3: 45–58. Hudson, A., and H. Bouwman. 2008. Birds associated with a tailings storage facility and surrounding areas from a South African gold mine. African Journal of Ecology 46: 276-281.
Appendix:	None

RESPONSE TO IR-70

ID:	**IR-70**
Expert Department or Group:	-
Guideline Reference:	Section 7.6.1
EIS Reference:	Section 21.5.4.4 (p.21.43)
Context and Rationale:	The EIS guidelines state the proponent will identify the accident and malfunction events that would potentially result in an adverse environmental effect as defined in section 5 of CEAA 2012. However, there is no discussion of effects of an accidental release of contact water on migratory birds and species at risk, and Indigenous use of lands and health. This information is needed for assessing the effects of an accident or malfunction and determining significance.
Original Information Request:	Provide an assessment of the potential residual adverse effects of an accidental release of contact water on migratory birds and species at risk and on Indigenous use of lands and health. Provide measures to mitigate adverse effects of contact water on the Valued Components above and applicable follow-up monitoring.
Original Response:	An unplanned release of contact water could result from the malfunction of catchment sumps, ditches and channels, and sedimentation ponds, including embankment / dam failure. There is also potential for accidental seepage wherever contact water is stored. For example, excess seepage could result from a damaged Tailings Management Facility (TMF) dam liner (due to improper construction or installation, or damage during operation), which could overwhelm the downstream sumps and cause uncontrolled discharge to the environment (note that a TMF malfunction, including a dam breach, is assessed separately in Section 21.5.1 of the EIS). In Section 21.5.4.4 of the EIS, an environmental effects assessment for an unplanned release of contact water was conducted for Groundwater Resources, Surface Water Resources, Fish and Fish Habitat and Vegetation, Wetlands, Terrain and Soils. These Valued Components (VCs) were selected for assessment as there is a potential for the accidental event to interact with the VC (i.e., Project-effect pathway). The effect pathways of an accidental release of contact water on migratory birds, species at risk and Indigenous use of lands and health are primarily related to the quality of water released. Untreated / contaminated water can be ingested by wildlife or people, or receptors can be exposed through dermal contact. For wildlife, release of untreated / contaminated water could also affect prey species and habitat.

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	While a release of untreated contact water may result in ingestion or uptake of contaminants by wildlife, this potential is limited as adverse effects to water quality are mainly localized to the Project Area and there is anticipated to be a relatively low level of wildlife activity expected in the immediate areas of Project activities (Section 12.5.2 of the EIS). As discussed in Section 21.5.4.4, adverse effects to water quality are predicted to be low in magnitude, localized, short-term and reversible. As indicated in response to IR-54, water quality, or contact water quality within the water management systems designed for the Project is predicted to contain sediment and minor dissolved metals and other potential constituents like ammonia at very low concentrations. As a result, avifauna or other wildlife that may contact or ingest this water (if an unplanned release occurred) or adjacent vegetation would not be at an increased mortality risk. While exposure to the tailings pond could pose a threat to migratory birds, this risk is reduced through the cyanide detoxification process within the mill. As the polishing pond receives effluent post-treatment plant, the water within the polishing pond will not pose a threat to migratory birds. Therefore, in the event of an unplanned release of contact water, it is similarly not anticipated to pose a threat to migratory birds. The water quality monitoring program (Water Management Plan, Appendix 2A) to be implemented during normal operating conditions would detect exceedances of water quality guidelines in the event of an unplanned release of contact water (e.g., through seepage). If exceedances are detected, either through visual observations or results from water quality monitoring, remedial steps will be taken to reduce and eliminate the release through repairs to the drainage ditches and water management systems. A release of untreated water would also be addressed through requirements under *Metals and Diamond Mining Effluent Regulations* (MDMER) which identify the need for a tailings / effluent emergency response plan (see IR-66). The plan is required to use a risk-based approach to address the personnel, equipment, and procedures required to react to an unplanned release of tailings and/or effluent. Given the above, adverse effects to migratory birds, species at risk and Indigenous use of lands and resources are anticipated to be negligible. Given the limited interaction with wildlife, health risks for people who eat country foods are not anticipated.
Missing Information / Conformity Issue:	The response does not provide evidence to support the conclusion that avifauna or other wildlife that may contact or ingest settling pond water (if an unplanned release occurred) or adjacent vegetation would not be at an increased mortality risk.

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	Similarly, the proponent does not provide adequate information or evidence related to the effect of an unplanned release of contact water on Indigenous land use or health, specifically to conclude that adverse effects would be negligible. Either evidence to support these conclusions or mitigations to prevent potential effects is required to complete the technical review.
Response:	The mechanisms for a release of contact water from a sedimentation pond (referred to as a 'settling pond' in the IR) that could potentially impact avifauna, other wildlife, or vegetation include: • Blockage / malfunction of the pond outflow or an extreme flooding event which leads to overtopping of the containment dams. • An unexpected failure and subsequent breach of the containment dam due to extreme flooding or earthquake. The potential pathways for effects to avifauna, other wildlife, or vegetation relate to chemical / exposure effects from contact with, or ingestion of, contact water released from the sedimentation pond and exposure to sediments contained within the sedimentation pond or to dam materials released via a breach, as well as physical effects from the scouring of natural soils / sediments downstream of the flooding / breach event. Effects from these pathways have the potential to result in a change in habitat or change in mortality risk to avifauna, other wildlife, and vegetation. The following sections address the potential adverse effects related to each of these pathways. Additional information is also provided below to support the conclusion that an unplanned release of contact water is not anticipated to result in adverse effects to Indigenous land use or health. <u>Chemical / Exposure Effects to Avifauna, Other Wildlife and Vegetation</u> As noted above, chemical or exposure effects could occur from coming into contact with or ingesting contact water released in an unplanned event. As detailed in the response to Conformity IR-54, contact with or ingestion of sedimentation pond water or adjacent vegetation would not present an increased mortality risk to avifauna and other wildlife. The information presented in the response to Conformity IR-54 would also apply in the event of an unplanned release of Project sedimentation pond water. As indicated in Chapter 7 of the EIS and EIS Appendices (7A, 7B and 7C), the influent (inflow) to the sedimentation ponds, and therefore the standing water in the sedimentation ponds, is not predicted to exceed *Metals and Diamond Mining Effluent Regulations* (MDMER) limits and is acceptable for discharge to the environment. Therefore, there is no increased mortality risk to avifauna or other wildlife that may absorb or ingest the water from the sedimentation pond, either within the pond or in the surrounding

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	environment, were the stored contact water to be released as a result of an accident or malfunction. A breach of the sedimentation ponds may result in the release of the stored contact water to receiving watercourses, wetlands, and downstream ultimate receivers (i.e., Valentine Lake, Victoria Lake Reservoir, and Victoria River). As described above, the water in the sedimentation ponds is not acutely lethal and does not have the potential to be acid generating or metal leaching (see Appendix 7A and 7B of the EIS). Chemical / exposure effects may also occur from exposure to sediments contained within the sedimentation pond or to dam materials released via a breach. A breach of a sedimentation pond is expected to release a low volume of sediment given that sediment accumulated in the ponds will be routinely cleaned-out as part of pond maintenance to maintain the ponds' inactive storage capacity. Approximately half of the sedimentation ponds have pond storage above the base of the dam with the potential for accumulated sediment to be released with a breach flood wave. In the other half of the sedimentation ponds, the excavation bathymetry is such that the sediment will accumulate below the base of the dam. Therefore, accumulated sediment from these is unlikely to be released as a result of a dam breach. Please refer to the original response to IR-41 regarding sediment quality in sedimentation ponds and in effluent from the ponds. Sediment quality was assessed using geochemical source terms and sediment inflow rates compared against baseline sediment quality to understand potential effects of the sedimentation ponds on sediment quality in the receiving environment. Baseline sediment chemistry exceeds Canadian Environmental Quality Guidelines (CEQG) for sediment including the interim sediment quality guidelines (ISQG) for arsenic, cadmium and zinc and exceeds CEQG probable effects levels (PEL) for arsenic. However, no CEQG ISQG and CEQG PEL exceedances are predicted in sediments from contact areas discharging from Project sedimentation ponds. Therefore, as no CEQG ISQG/PEL exceedances are predicted in sedimentation pond sediment quality, no risk is posed to avifauna, other wildlife or nearby vegetation that may be exposed to sediments as a result of an unplanned release from a sedimentation pond. Therefore, as sedimentation pond water quality meets MDMER limits and sediment quality does not exceed CEQG ISQG/PEL thresholds (original response to IR-41), neither of these pathways is anticipated to pose a risk to avifauna or other wildlife that may be exposed due to an unplanned release from a sedimentation pond, or to nearby vegetation.

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	Physical Effects to Avifauna, Other Wildlife, and Vegetation Physical effects have the potential to occur from the scouring of natural soils / sediments downstream of the flooding / breach event. An unplanned, accidental release or malfunction from the sedimentation ponds could: • affect downstream flow paths via the deposit of entrained sediment and dam construction rockfill • result in erosion • spread released water and sediment across the inundation floodplain The above could cause localized burial and loss of vegetation from rock and sediment or result in mortality of wildlife that may be present downstream of the release. There would also be potential for short-term losses of fish and fish habitat and food sources that support life processes within the headwater streams within the breach outflow path. These losses would be associated with scour and erosion caused by the initial flood wave and the initial infilling from the slumping of dam rockfill material. As the breach volumes in the sedimentation ponds are small relative to the size of the catchments draining to the outflow path, the sediment load in the watercourse would be reduced (relative to that in the sedimentation pond) and assimilated. Once the breach flood wave was to reach the ultimate receivers of Victoria Lake, Valentine Lake and Victoria River, the breach flow would be further assimilated and likely be indistinguishable from no-breach conditions. As the sedimentation pond dams will be of rockfill construction and lined with an upstream impermeable membrane, the dam construction material itself would not contribute measurable "sediment" to downstream receivers in the event of a breach. Adverse effects from scouring are anticipated to be localized at the site of the breach and would be short-term in duration following the implementation of response measures. Potential mortality to wildlife and would also be limited to individuals that may be directly in the downstream path. Potential Effects to Indigenous Groups Effects to Indigenous Groups could occur as a result of a change in access (e.g., due to area closure to allow for clean-up) or loss of resources (e.g., loss or contamination of vegetation, wildlife or fish available for harvesting) and potential for resulting effects on Indigenous health. Access to lands in a breach inundation zone may be restricted during the rehabilitation / recovery period. Downstream flow paths (i.e., the area between the water management pond where the breach occurred and the ultimate receiver of

ID:	IR-70
	Victoria Lake Reservoir, Valentine Lake or Victoria River) would be largely contained within the mine site, which would already be subject to restricted public access. While not anticipated, if some portion of the affected area were to coincide with an area used for harvesting activities, effects to Indigenous groups are anticipated to be temporary in nature and limited geographically. With respect to the potential loss or contamination of resources, as indicated above, it is expected that sedimentation pond water quality will meet MDMER limits when it enters the ponds, and that sediment quality will not exceed CEQG ISQG/PEL thresholds (original response to IR-41). Given the limited potential for water discharges to interact with country foods such that the quality of foods could be affected, combined with the limited indication of harvesting activities immediately downstream of the mine site that has been provided by Indigenous groups, it is anticipated that the potential for adverse effects on Indigenous health would be negligible. Summary Flooding, sedimentation deposition and erosional effects would be short term in duration, and it is expected that the receiving environment would recover naturally following the repair of the sedimentation pond and clean-up of any sediment or dam debris carried downstream of the sedimentation pond. As described above, the quality of the water and sediment contained in the sedimentation ponds meets regulatory guidelines, and potential chemical and physical exposures are not anticipated to pose a risk to avifauna or other wildlife that may frequent the sedimentation ponds, or nearby vegetation. The potential for the quality of fish, berries, and edible and medicinal plants to be adversely affected by exposure to the water and sediment is also considered low, and therefore, there is negligible potential for Indigenous health to be adversely affected through consumption of country foods and medicinal plants.
Appendix:	None

APPENDIX IR-08.A
IR-08 FIGURE AND TABLE

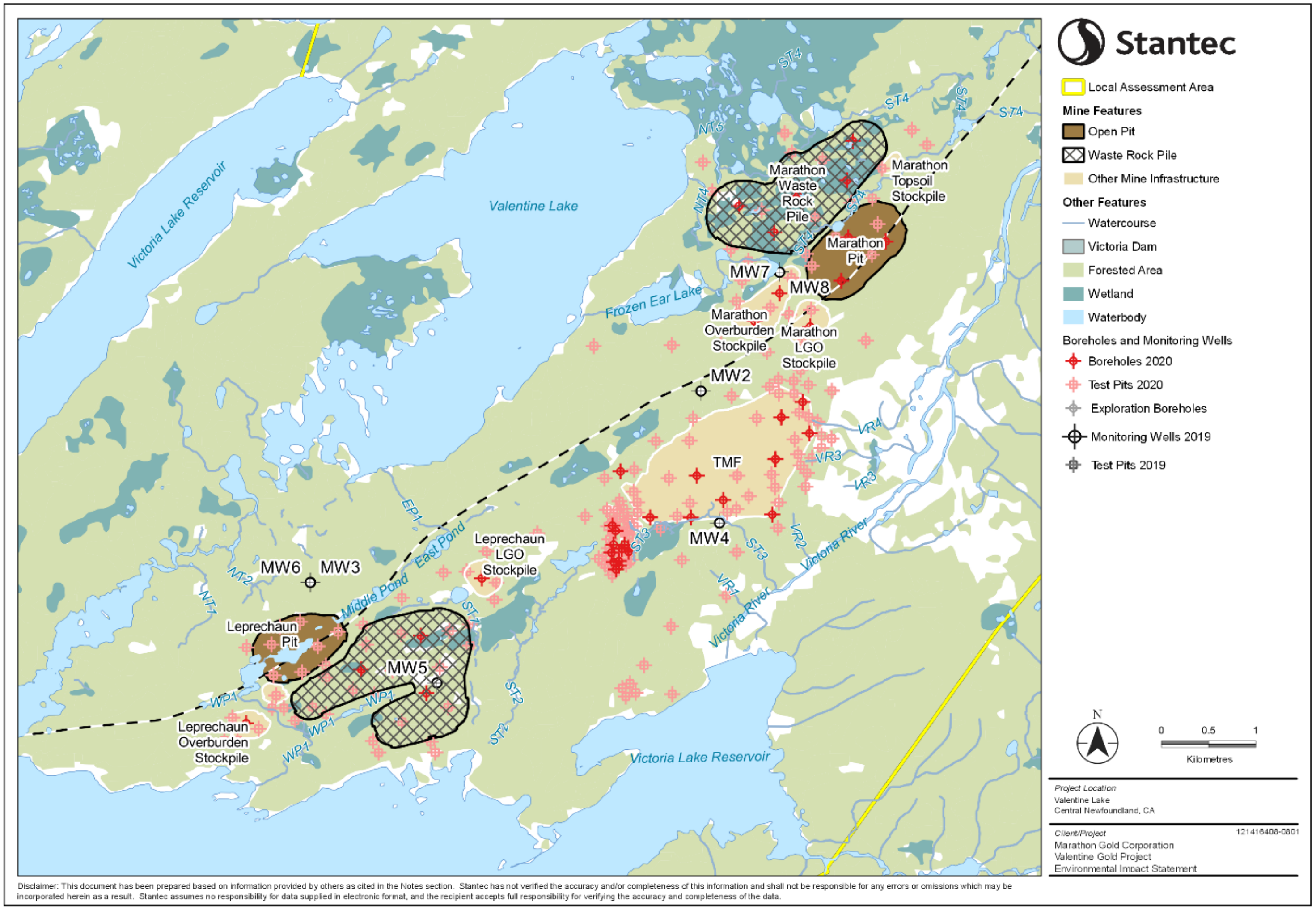


Figure IR-08.1 Groundwater Monitoring Wells, Boreholes, and Test Pits at the Valentine Gold Project

Table IR-08.1 Water Level Data

Test Hole ID	Easting (m NAD83 UTM Zone 21)	Northing (m NAD83 UTM Zone 21)	Elevation (m)	Test Hole Depth (m)	Depth to Water Level (m)	Type
20BH-01	489928.4	5357325	384.522	12.27	0.858	Borehole
20BH-02	489963.7	5357270	382.543	13.79	0.353	Borehole
20BH-03	489942.2	5357124	380.135	9.5	0.034	Borehole
20BH-04	490059.8	5357123	380.624	16.08	0.334	Borehole
20BH-05A	490031.1	5357082	380.815	30.4	0.336	Borehole
20BH-05B	490031.4	5357080	380.903	6.4	0.248	Borehole
20BH-06	490094.7	5357089	379.956	9.14	0.498	Borehole
20BH-07	490102.4	5357047	378.923	9.14	0.308	Borehole
20BH-08	489920.2	5357038	380.927	12.19	0.158	Borehole
20BH-09	489944.5	5356940	385.101	9.78	2.739	Borehole
20BH-10	489997.8	5356950	382.165	9.55	0.294	Borehole
20BH-11	489998.6	5356901	383.53	24.54	0.533	Borehole
20BH-12	489967.8	5356862	384.13	18.52	0.5	Borehole
20BH-13	492477.5	5361402	331.826	7.92	0.187	Borehole
20BH-14	492416.4	5360986	332.774	9.6	0.37	Borehole
20BH-15A	491896.1	5360819	339.801	30.63	0.336	Borehole
20BH-15B	491896.1	5360819	339.801	4.57	0.248	Borehole
20BH-16	491272	5360713	334.803	7.52	-0.085	Borehole
20BH-17	491643.1	5360434	345.62	6.4	0.431	Borehole
20BH-18	492430.8	5360379	342.767	12.19	0.474	Borehole
20BH-19	492826.3	5360337	359.195	6.37	0.925	Borehole
20BH-20	492354.9	5359920	362.146	6.33	1.544	Borehole
20BH-21	491701.4	5359788	350.944	10.97	0.398	Borehole
20BH-22	491438.7	5359491	369.825	9.34	0.356	Borehole
20BH-23	492026	5359434	386.363	6.61	0.613	Borehole
20BH-24	491946.3	5358636	361.834	7.86	0.492	Borehole
20BH-25	492019.8	5358304	353.821	6.15	0.298	Borehole
20BH-26A	491720.8	5358475	367.748	30.48	-0.551	Borehole
20BH-26B	491718.3	5358473	367.829	5.77	-0.57	Borehole
20BH-27	491659.7	5358030	357.076	9.24	-0.056	Borehole
20BH-27A	491657.2	5358029	357.236	29.08	-0.133	Borehole
20BH-28	490823.8	5357855	384.545	12.34	0.54	Borehole
20BH-29	491624.6	5357443	340.688	10.97	0.028	Borehole
20BH-30	490762.4	5357410	372.332	10.71	1.115	Borehole
20BH-31	490329.7	5357412	377.465	9.14	0.248	Borehole

Table IR-08.1 Water Level Data

Test Hole ID	Easting (m NAD83 UTM Zone 21)	Northing (m NAD83 UTM Zone 21)	Elevation (m)	Test Hole Depth (m)	Depth to Water Level (m)	Type
20BH-32	490015.1	5357901	414.861	10.57	0.323	Borehole
20BH-33	488545.7	5356767	386.934	10.87	0.592	Borehole
20BH-34	487898.8	5356158	380.224	15.37	0.115	Borehole
20BH-35A	487266.3	5355802	378.359	30.61	0.996	Borehole
20BH-35B	487270.3	5355801	378.25	7.87	0.059	Borehole
20BH-36	487957.2	5355551	362.377	4.67	0.585	Borehole
20BH-37	486046.7	5355231	348.831	7.75	0.689	Borehole
20BH-GLDR-01	491104.1	5357597	368.218	18.31	0.525	Borehole
20TP-01	490003.4	5357586	397.911	2.2	0.3	Test Pit
20TP-02	489872.4	5357491	398.142	2.1	1.1	Test Pit
20TP-03	489980.8	5357490	393.262	2	0.5	Test Pit
20TP-04	490047.5	5357505	390.215	2.2	1.5	Test Pit
20TP-05	489938.1	5357428	391.483	2.3	2.2	Test Pit
20TP-06	490043.9	5357425	385.348	2.6	2	Test Pit
20TP-07	489946.5	5357365	385.964	3.1	0.4	Test Pit
20TP-08	489883.4	5357319	384.667	2.5	2	Test Pit
20TP-09	489970.4	5357312	382.393	3.2	1.5	Test Pit
20TP-10	489920.4	5357274	382.867	2.5	0.5	Test Pit
20TP-100	489641.1	5357423	401.567	3.1	0.6	Test Pit
20TP-101	490389.3	5358221	423.335	0.9	0.4	Test Pit
20TP-102	490785.1	5358461	419.703	0.2	0.1	Test Pit
20TP-103	491192	5358699	407.327	0.3	0.1	Test Pit
20TP-104	490666.9	5356961	379.498	3	0.9	Test Pit
20TP-105	490551.6	5356258	380.565	3.8	1	Test Pit
20TP-106	490265.7	5355844	370.296	4.3	2.9	Test Pit
20TP-107	490563.1	5355538	354.376	2.1		Test Pit
20TP-108	491137.8	5356588	324.519	4.2		Test Pit
20TP-109	491248.3	5357045	344.598	3.4	2.9	Test Pit
20TP-11	490091.6	5357302	380.941	2.85	0.3	Test Pit
20TP-110	491681.7	5357301	328.332	4.1		Test Pit
20TP-111	491976.5	5357738	336.677	2.9	1.1	Test Pit
20TP-112	492251.2	5358248	339.738	2.2	0.6	Test Pit
20TP-113	492256.4	5358754	352.04	4.65	0.6	Test Pit
20TP-114	492615.8	5359287	370.846	4.9	2.5	Test Pit
20TP-115	491925.7	5358975	384.648	1.7	1.1	Test Pit

Table IR-08.1 Water Level Data

Test Hole ID	Easting (m NAD83 UTM Zone 21)	Northing (m NAD83 UTM Zone 21)	Elevation (m)	Test Hole Depth (m)	Depth to Water Level (m)	Type
20TP-116	491569.1	5359163	395.917	2.9	1.6	Test Pit
20TP-117	491081.7	5359247	382.373	2.7	1.5	Test Pit
20TP-118	490559.4	5359238	370.754	3.6		Test Pit
20TP-119	491803.3	5359560	374.458	4.6		Test Pit
20TP-12	490054.2	5357250	381.227	3.9	0.3	Test Pit
20TP-120	491980.6	5360205	344.05	3.25	2	Test Pit
20TP-121	492461.7	5360749	334.004	2.8	0.6	Test Pit
20TP-122	492787.2	5361113	328.906	2.43	0.5	Test Pit
20TP-123	490746.9	5358225	406.353	0.4		Test Pit
20TP-13	490112	5357228	380.685	4.8	0.5	Test Pit
20TP-14	490156.9	5357319	380.325	1.85		Test Pit
20TP-15	490142.2	5357151	379.762	4.9	2.5	Test Pit
20TP-16	489900.1	5357182	380.877	2.7	0.3	Test Pit
20TP-17	489892.1	5357087	379.607	4.2	1.3	Test Pit
20TP-18	489864.3	5357004	380.383	3.5	1.4	Test Pit
20TP-19	489784.6	5356976	380.76	3.4	1.8	Test Pit
20TP-20	489853.1	5356913	381.66	3.5	3.4	Test Pit
20TP-21	489882.5	5356881	383.023	4.3	1.7	Test Pit
20TP-22	489926.4	5356803	384.547	4.6	2.5	Test Pit
20TP-23	490074.7	5356910	382.219	4.8	2.5	Test Pit
20TP-24	490127.7	5356965	379.677	2.8	1.5	Test Pit
20TP-25	490041.5	5357009	380.953	4.8	2.5	Test Pit
20TP-26	489979.1	5357007	385.032	5.2	4	Test Pit
20TP-27	489732.5	5359229	357.388	1.5		Test Pit
20TP-28	490034	5355603	350.103	3.9	2.3	Test Pit
20TP-29	490114.3	5355651	354.409	4.2	1.1	Test Pit
20TP-30	490072.3	5355515	344.99	4.2	1	Test Pit
20TP-31	490174.8	5355555	349.215	4.3	3.5	Test Pit
20TP-32	490099.6	5357395	382.045	2.2	0.7	Test Pit
20TP-33	492159	5361201	333.987	2.5	0.7	Test Pit
20TP-34	491512.2	5360668	335.775	2.1	0.35	Test Pit
20TP-35	492074.7	5360588	340.625	2.1	1.6	Test Pit
20TP-36	492741.4	5360522	344.476	3.93	3.1	Test Pit
20TP-37	492680.3	5360195	356.502	0.85	0.2	Test Pit
20TP-38	492296.9	5360387	334.751	3.2	1.5	Test Pit

Table IR-08.1 Water Level Data

Test Hole ID	Easting (m NAD83 UTM Zone 21)	Northing (m NAD83 UTM Zone 21)	Elevation (m)	Test Hole Depth (m)	Depth to Water Level (m)	Type
20TP-39	492042.9	5360080	345.198	3.8	1.2	Test Pit
20TP-40	491826.3	5359953	344.058	2.2	1.2	Test Pit
20TP-41	491603.7	5359637	358.837	3.2	0.4	Test Pit
20TP-42	491273.3	5359582	351.768	4.9	0.3	Test Pit
20TP-43	492036.4	5359612	375.331	1.5	0.1	Test Pit
20TP-44	491939.2	5359272	388.515	4.5	0.5	Test Pit
20TP-45	491594.4	5358799	391.215	1.7	0.7	Test Pit
20TP-46	491695.5	5358728	381.772	4.7	1.1	Test Pit
20TP-47	491855.2	5358724	372.779	4.3	1.8	Test Pit
20TP-48	491909.5	5358527	360.782	4.8	0.65	Test Pit
20TP-49	492012.3	5358476	357.313	1.2	1.2	Test Pit
20TP-50	491460.4	5358463	383.27	3	1	Test Pit
20TP-51	492103.8	5358428	353.098	2.4	1	Test Pit
20TP-52	491861.2	5358239	358.088	2	0.3	Test Pit
20TP-53	491896.9	5358081	353.737	1.2	1.6	Test Pit
20TP-54	491924.9	5357964	349.413	1.2	0.2	Test Pit
20TP-55	491618.7	5357867	356.639	1.1	0.1	Test Pit
20TP-56	491251.6	5357853	369.049	1.3	0.3	Test Pit
20TP-57	490529.2	5357829	394.874	1.4	0.4	Test Pit
20TP-58	491652.4	5357731	351.118	2.4	0.2	Test Pit
20TP-59	490153.1	5357684	398.901	1.5	0.7	Test Pit
20TP-60	490191.4	5357573	388.457	0.95	0.5	Test Pit
20TP-61	490194	5357465	384.143	3.1	0.4	Test Pit
20TP-62	490440	5357292	375.341	2.1	0.6	Test Pit
20TP-63	490615.4	5357427	375.865	3.2	0.5	Test Pit
20TP-64	490749.8	5357565	375.431	5.1	1.4	Test Pit
20TP-65	491145.6	5357467	366.418	4.2	1.2	Test Pit
20TP-66	491242	5357500	362.26	2.7	2.2	Test Pit
20TP-67	491375.6	5357637	363.097	2.1	1.3	Test Pit
20TP-68	491694.6	5357571	342.388	2.5	1.2	Test Pit
20TP-69	490160	5357919	409.883	0.4	0.1	Test Pit
20TP-70	489846.2	5357828	421.585	0.6	0.2	Test Pit
20TP-71	488384.6	5356839	392.615	1.6	0.5	Test Pit
20TP-72	488700.3	5356722	384.758	1.9	1.2	Test Pit
20TP-73	488202.4	5356208	375.953	3.1	1.3	Test Pit

Table IR-08.1 Water Level Data

Test Hole ID	Easting (m NAD83 UTM Zone 21)	Northing (m NAD83 UTM Zone 21)	Elevation (m)	Test Hole Depth (m)	Depth to Water Level (m)	Type
20TP-74	487690.7	5356178	385.475	4.3	0.8	Test Pit
20TP-75	487318.7	5356065	389.193	1.8	1.6	Test Pit
20TP-76	488099.9	5355824	364.985	3.7	0.7	Test Pit
20TP-77	487596.6	5355790	366.922	3.8	2.5	Test Pit
20TP-78	486890.6	5355715	375.308	3.5	2	Test Pit
20TP-79	487179.3	5355588	364.791	3.4	2	Test Pit
20TP-80	486750.3	5355402	356.527	1.7	0.3	Test Pit
20TP-81	488186.4	5355399	350.406	2.9	1.3	Test Pit
20TP-82	487696.8	5355246	348.229	4.5	0.9	Test Pit
20TP-83	486616.8	5356305	404.321	0.6	0.3	Test Pit
20TP-84	486406	5356253	398.283	0.4		Test Pit
20TP-85	486804.5	5356047	391.6	0.8	0.1	Test Pit
20TP-86	486335.5	5355739	385.001	2.7	1.4	Test Pit
20TP-87	486366.1	5355525	373.952	2.8	0.7	Test Pit
20TP-88	485899.9	5355291	365.5	1.2	0.7	Test Pit
20TP-89	486177.7	5355172	346.456	2.2	1.3	Test Pit
20TP-90	487019	5356201	402.174	1	0.2	Test Pit
20TP-91	486313.4	5356065	388.018	2.4	0.7	Test Pit
20TP-92	486639.4	5355774	387.044	3.5	0.6	Test Pit
20TP-93	486321.5	5355393	358.805	3.3	0.5	Test Pit
20TP-94	486891	5355843	395.207	0.9	0.5	Test Pit
20TP-95	487287.1	5356273	399.401	1.2	0.6	Test Pit
20TP-96	487697.9	5356560	390.067	2.2	0.3	Test Pit
20TP-97	488138.7	5356826	391.657	0.8	0.3	Test Pit
20TP-98	488595.6	5357051	399.783	4.3	0.8	Test Pit
20TP-99	489133	5357244	401.87	2.8	0.8	Test Pit
20TP-GLDR-01	491993.5	5357882	343.385	2.7	0.8	Test Pit
20TP-GLDR-02	492048.2	5358044	344.699	1.9	0.6	Test Pit
20TP-GLDR-03	492146	5358149	341.983	2.3	0.9	Test Pit
20TP-GLDR-04	492147	5358275	348.649	1.8	0.8	Test Pit
20TP-GLDR-05	492007.8	5358814	370.563	5.3	1.4	Test Pit
20TP-GLDR-06	491849.4	5358860	380.933	2.7	1.8	Test Pit
20TP-GLDR-07	491688.7	5358871	389.709	2.6	0.3	Test Pit
20TP-STAN-01	490889.9	5361176	327.881	5.3	1	Test Pit
20TP-STAN-02	490988.1	5360867	329.812	4.6		Test Pit

Table IR-08.1 Water Level Data

Test Hole ID	Easting (m NAD83 UTM Zone 21)	Northing (m NAD83 UTM Zone 21)	Elevation (m)	Test Hole Depth (m)	Depth to Water Level (m)	Type
20TP-STAN-03	491756.8	5361485	327.724	5.1		Test Pit
20TP-STAN-04	491834.5	5361280	328.991	3		Test Pit
20TP-STAN-05	493105.3	5361521	317.703	2.5		Test Pit
20TP-STAN-06	493264.8	5361359	313.155	2.2		Test Pit
20TP-STAN-07	492686.9	5360795	330.672	4.3		Test Pit
20TP-STAN-08	491245.9	5359704	345.342	3.9		Test Pit
20TP-STAN-09	491305.5	5359922	338.473	4.9		Test Pit
20TP-STAN-10	491372.7	5360132	338.687	3.5		Test Pit
20TP-STAN-11	491182.9	5360254	338.343	2		Test Pit
20TP-STAN-12	488678.3	5356539	378.298	1.1		Test Pit
20TP-STAN-13	488416.6	5356281	372.951	2.6		Test Pit
20TP-STAN-14	488419.9	5356057	369.081	4.5		Test Pit
20TP-STAN-15	488050.5	5354921	326.089	4.2		Test Pit
20TP-STAN-16	488002.8	5355036	336.671	4.2		Test Pit
20TP-STAN-17	487449.9	5354920	342.002	0.9		Test Pit
20TP-STAN-18	487391.9	5355042	349.28	4.6		Test Pit
20TP-STAN-19	487406.4	5355535	354.682	1.7		Test Pit
20TP-STAN-20	486894.6	5355327	355.892	0.9		Test Pit
20TP-STAN-21	486564.3	5355258	343.848	1.3		Test Pit
20TP-STAN-22	486447.5	5355392	355.017	4.1		Test Pit
20TP-STAN-23	485957.2	5355050	341.244	4.1		Test Pit
20TP-STAN-24	485814.6	5355046	342.2	3.3		Test Pit
20TP-STAN-25	486050.5	5356035	386.646	3.5		Test Pit

APPENDIX IR-08.B HYDROGEOLOGY BASELINE CHARACTERIZATION REPORT

GEMTEC Consulting Engineers and Scientists Limited
10 Maverick Place
Paradise, NL, Canada
A1L 0J1
709.722.2275
nl@gemtec.ca
www.gemtec.ca

March 2, 2021

File: 80018.05 – REV0

Marathon Gold Corporation
10 King Street East, Suite 501
Toronto, ON
M5C 1C3

Attention: Mr. James Powell, M.Eng. P.Eng.
Vice President, Regulatory and Government Affairs

Re: Hydrogeology Baseline Characterization - Update on Long-Term Groundwater Level Monitoring, Marathon Valentine Gold Project, Central Newfoundland

This letter report was prepared by GEMTEC Consulting Engineers and Scientists Limited (GEMTEC) in response to a request for additional long-term groundwater level monitoring data available at the Marathon Valentine Gold Project Site. This letter provides an update on the groundwater level monitoring data that has been collected since February 2020 when the final data was collected for GEMTEC's Hydrogeological Baseline Report (GEMTEC, 2020).

BACKGROUND

During the October 2019 field program in support of the Hydrogeological Baseline Report a total of eight groundwater monitoring wells were installed. Groundwater levels in the monitoring wells were measured manually with a Solinst® water level meter immediately before slug testing and sampling. After sampling was complete, a Solinst® Levelogger® set to record water levels every 24 hours was installed in each well for long-term monitoring purposes. A Solinst® Barologger® was also placed outdoors at a central location on the Site to allow barometric correction of the long-term Levelogger® data. During the follow-up baseline sampling program in February 2020 groundwater levels were measured manually again, and the levelogger and barologger data were downloaded from wells MW2, MW3, MW6, MW7, and MW8; frozen groundwater conditions prevented the collection of groundwater level measurements and the removal of the leveloggers for data retrieval in monitoring wells MW1, MW4, and MW5 at this time. The leveloggers in MW2, MW3, MW6, MW7, and MW8 were not re-deployed after data download in February 2020, but are planned to be re-installed during this upcoming field season. The locations of the baseline 2019 monitoring wells are shown on Figure 1, attached.

During recent site visits in September 2020 and October 2020, monitoring wells MW1, MW4, and MW5 were visited, and manual water level measurements were taken as well as the data downloaded from the leveloggers. Specifically on September 7, 2020 the most recent data download was carried out for monitoring wells MW1 and MW5, and on October 29, 2020 the most recent data download was carried out on monitoring well MW4.

SUMMARY OF RESULTS

The current long-term groundwater level monitoring data set for the Site spans a 12 month period from October 09, 2019 to October 29, 2020 based on measurements collected in monitoring well MW4. A slightly shorter 11 month monitoring period from October 8, 2019 to September 6, 2020 is available for MW1, and a similar 11 month period from October 10, 2019 to September 7, 2020 is available for MW5. A summary of the manual groundwater level measurements collected from monitoring wells MW1, MW4, and MW5 over their monitoring periods is presented below in Table 1, and the groundwater level data recorded by the leveloggers in the three monitoring wells are presented on time series groundwater level hydrographs (attached). Daily total precipitation data was taken from the closest weather station at Burnt Pond (Environment and Climate Change Canada, 2020), located approximately 24 kilometers southwest of the Project site. Each groundwater level hydrograph also contains this daily total precipitation data presented in a millimeter equivalent of rain to identify possible correlation between groundwater levels and precipitation.

Table 1 Summary of Manual Groundwater Level Measurements

Well ID	Surface Elevation (masl)	October 2019		September 2020		October 2020	
		Groundwater Level (mbgs)	Groundwater Elevation (masl)	Groundwater Level (mbgs)	Groundwater Elevation (masl)	Groundwater Level (mbgs)	Groundwater Elevation (masl)
MW1	309.88	-0.23	310.10	-0.13	310.01	-	-
MW4	364.08	-0.04	364.12	-0.28	364.36	-0.41	364.49
MW5	362.76	0.26	362.50	0.26	362.50	-	-

mbgs – meters below ground surface; masl – meters above sea level.

A summary of the groundwater level data collected from the leveloggers over the monitoring period are presented below in Table 2.

Table 2 Summary of Groundwater Level Monitoring (Oct 2019 – Sept/Oct 2020)

Well ID	Highest Observed Groundwater Elevation			Lowest Observed Groundwater Elevation			Mean Groundwater Elevation		Observed Groundwater Elevation Variability (m)
	Depth (mbgs)	Elevation (masl)	Date	Depth (mbgs)	Elevation (masl)	Date	Depth (mbgs)	Elevation (masl)	
MW1	-0.28	310.16	May 2, 2020	0.32	309.56	Aug 25, 2020	-0.17	310.04	0.60
MW4	-0.42	364.50	June 02, 2019	0.35	363.73	Aug 25, 2020	-0.20	364.28	0.77
MW5	-0.06	362.82	Nov 13, 2020	1.06	361.70	Aug 28, 2020	0.17	362.58	1.12

Over the monitoring period, the depth to shallow groundwater as recorded in MW1, MW4, and MW5 ranged from -0.42 mbgs (MW4) to 1.06 mbgs (MW5). Shallow, above ground surface water level readings were recorded in all three wells. While these measurements likely in part reflect near surface water table conditions and levelogger and barologger sensitivities, slight upward hydraulic vertical gradients have been identified in the Site Marathon and Leprechaun deposit areas, and may also be present at these monitoring well locations resulting in artesian conditions. The monitoring well with the highest observed mean groundwater elevation during the monitoring period was MW4 (364.28 masl), while the lowest was observed at MW1 (310.04 masl).

The 11 to 12 month monitoring periods depicted on the groundwater level hydrographs capture a full range of seasonal groundwater level fluctuations, and indicate a transient groundwater system. For all three monitoring wells groundwater levels were typically lower during the winter months prior to spring run-off and in the mid- to late-summer corresponding to a period of relatively lower precipitation. The highest groundwater levels were recorded during spring run-off and during the fall rainy period. Seasonal fluctuations in groundwater levels ranged from 0.6 m in MW1 to 1.12 m in MW5; reflecting typical seasonal groundwater level fluctuations observed in water table aquifers in the region.

Observed day-to-day variability in groundwater levels and the apparent coincidence of these variations with rainfall events at all three monitoring well locations supports the concept that the Site overburden and shallow bedrock aquifer is an unconfined system.

CONCLUSIONS

The long-term monitoring data collected to date span an 11 to 12 month monitoring period, providing a good record of seasonal groundwater level fluctuations at the Site. The monitoring results from the 2019 long-term groundwater monitoring well network have allowed for reasonable spatial characterization of natural conditions at the Site. As long-term groundwater level monitoring in the 2019 monitoring wells continues through Project development, groundwater level patterns and trends observed in the current data set will be better defined and understood. In addition, the Site's long-term monitoring well network was recently expanded to include an additional five monitoring wells equipped with leveloggers installed during the fall 2020 feasibility-level site-wide geotechnical and hydrogeological program. Going forward these new 2020 monitoring wells will enhance the spatial coverage of the long-term groundwater level monitoring data set, and allow for further characterization of groundwater conditions at the Site.

This letter was prepared by Candice Williams, B.A.Sc., and was reviewed by Carolyn Anstey-Moore, M.Sc., M.A.Sc., P.Geo. We trust that this report meets your present requirements. If you have any questions or require additional information, please contact our office at your convenience.

Respectfully submitted,

GEMTEC Consulting Engineers and Scientist Limited

Carolyn Anstey-Moore, M.Sc., M.A.Sc., P.Geo.

REGISTERED PROFESSIONAL GEOSCIENTIST
CAROLYN ANSTEY-MOORE
SIGNATURE
03/02/2021
DATE
NEWFOUNDLAND & LABRADOR

PROVINCE OF NEWFOUNDLAND AND LABRADOR
pegnl GEOSCIENCE PERMIT N0563
GEMTEC Consulting Engineers and Scientists Limited
Signature or Member Number
(Member-in-Responsible Charge)

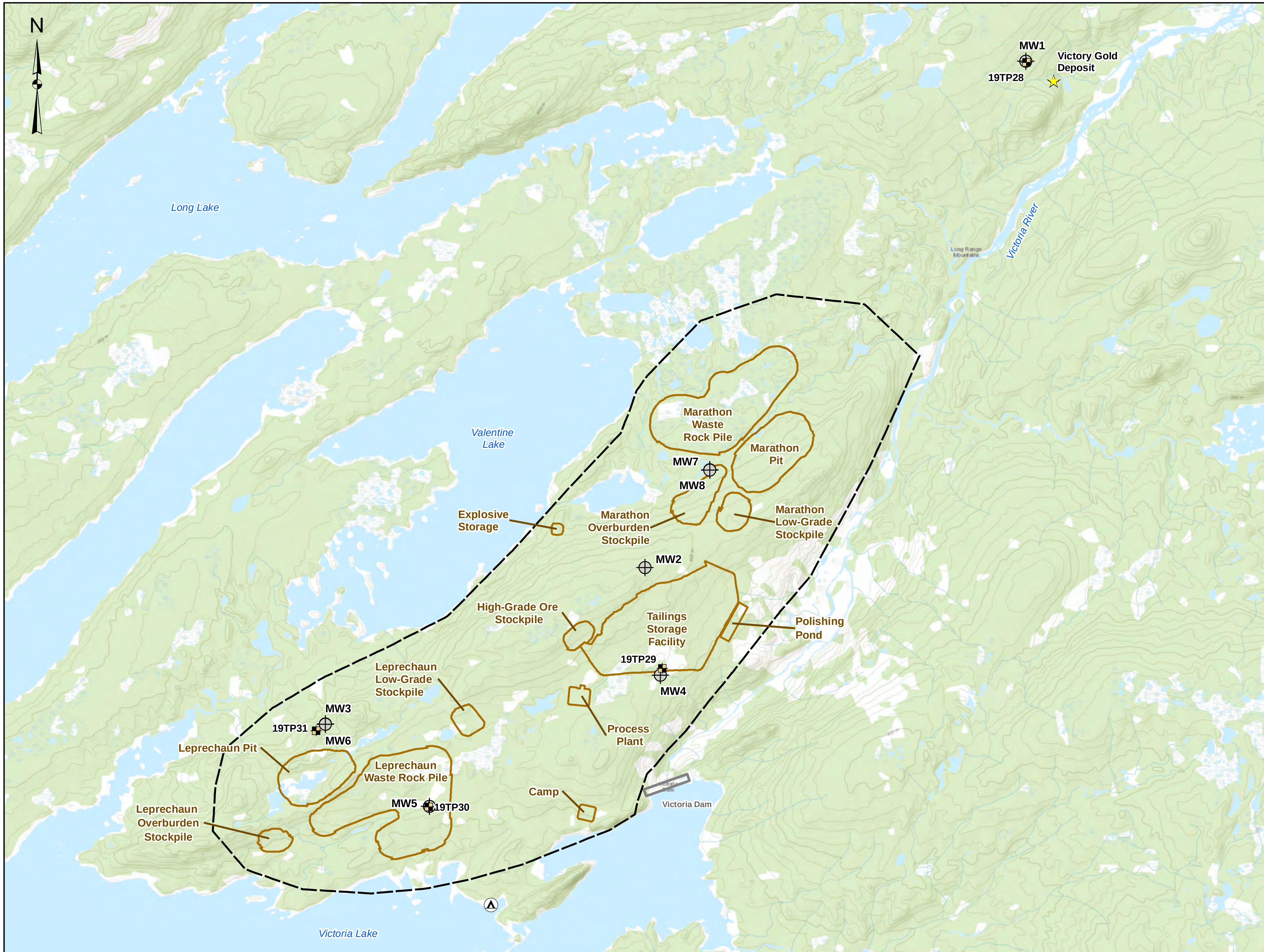
REFERENCES

Environment and Climate Change Canada, 2021. Historical Weather Daily for La Scie, NL weather station. Accessed online on 02/26/2020 at https://climate.weather.gc.ca/historical_data/search_historic_data_e.html.

GEMTEC, 2020. Hydrogeology Baseline Report, Marathon Valentine Gold Project, Central Newfoundland. Final report, dated March 18, 2020. GEMTEC Project: 80018.05.

ATTACHMENTS

Figure 1: Site Plan
Time Series Groundwater Level Hydrographs



GEMTEC 2019 Monitoring Well

GEMTEC 2019 Geotechnical Test Pit

Mine Site

Proposed Mine Site Infrastructure (previous, since revised)

Gold Deposit

Existing Exploration Camp

Note

1. This drawing is a schematic representation. Sizes, locations and dimensions are approximate.
2. Coordinate system: NAD83 CSRS UTM Zone 21 North.
3. Mine site layout provided by Marathon Gold Corporation.
4. Basemap: ESRI ArcGIS Online basemaps.

Drawn By: MC	Checked By: CAM
Date: March 2020	

Project

Hydrogeology Baseline Characterization - Update on Long-Term Groundwater Level Monitoring, Marathon Valentine Gold Project, Central Newfoundland

Drawing

Site Plan

Scale

1:50,000

0 1,250 2,500

(meters)

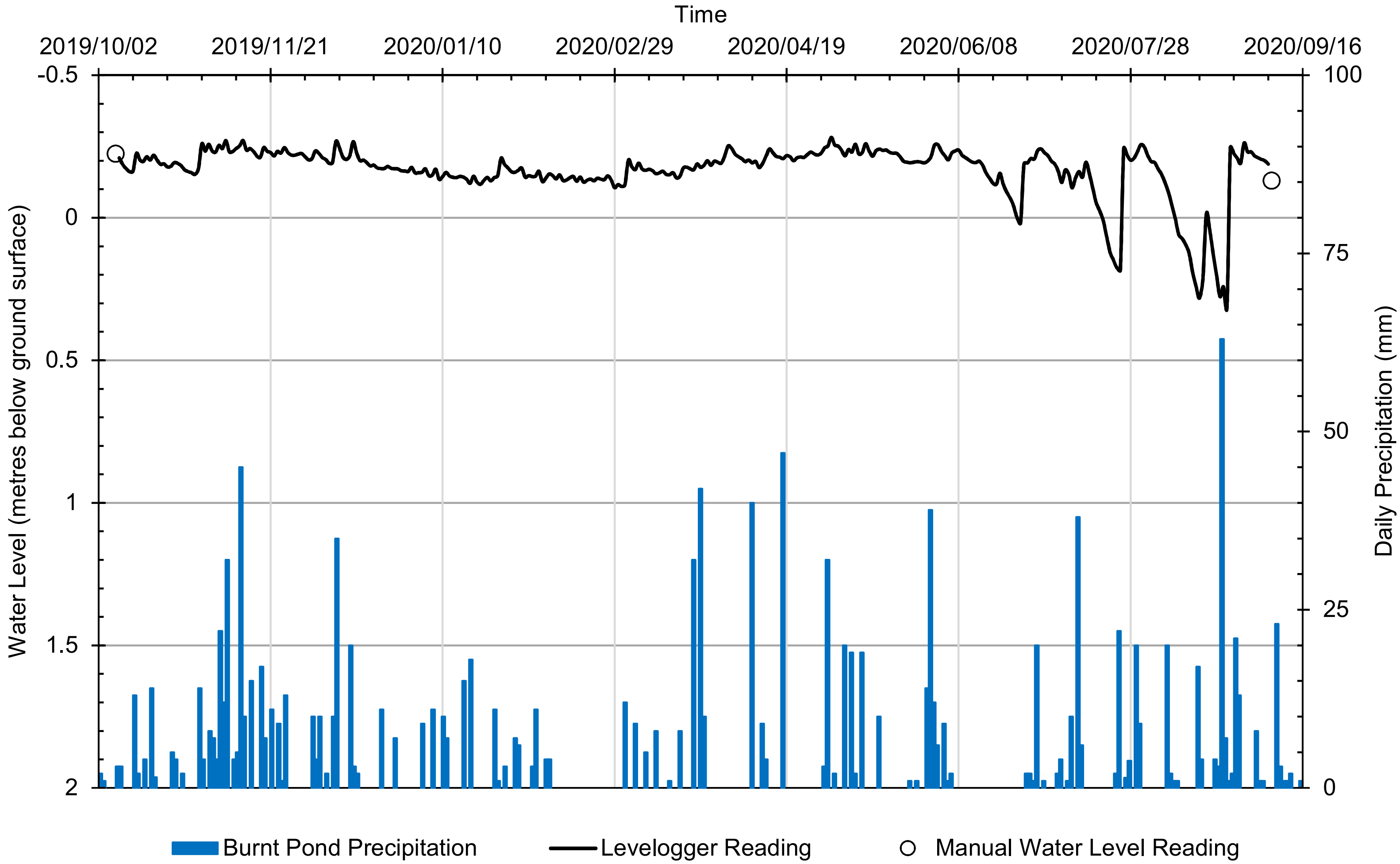
NAD83/ UTM Zone 21N

File No.: 80018.05	Drawing: Figure 1

GEMTEC
CONSULTING ENGINEERS AND SCIENTISTS

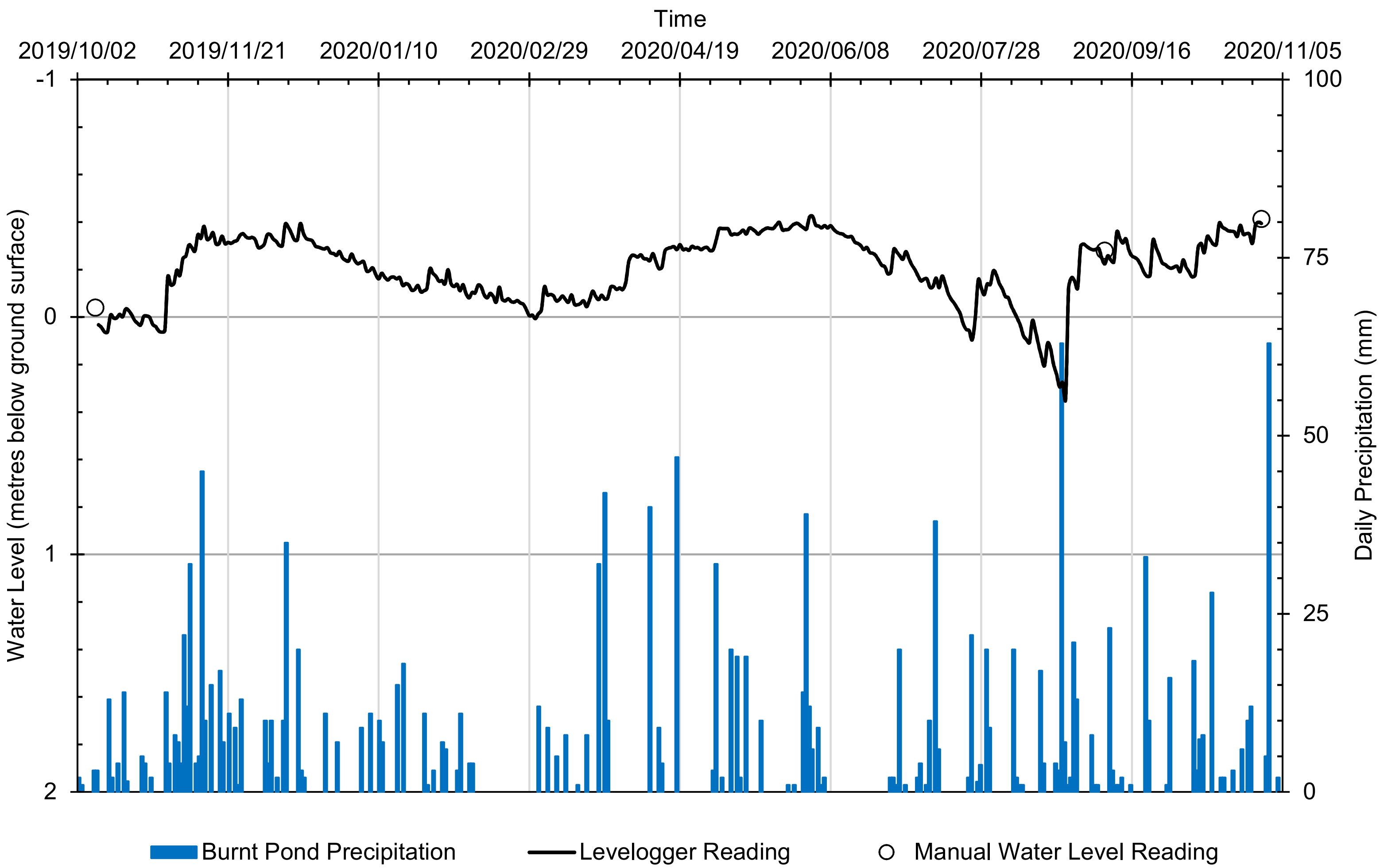
Title: **MW1 Long-Term Water Level Data**

Project: Long-term Groundwater Level Monitoring: October 2019 to September 2020
Marathon Valentine Gold Project, Central Newfoundland



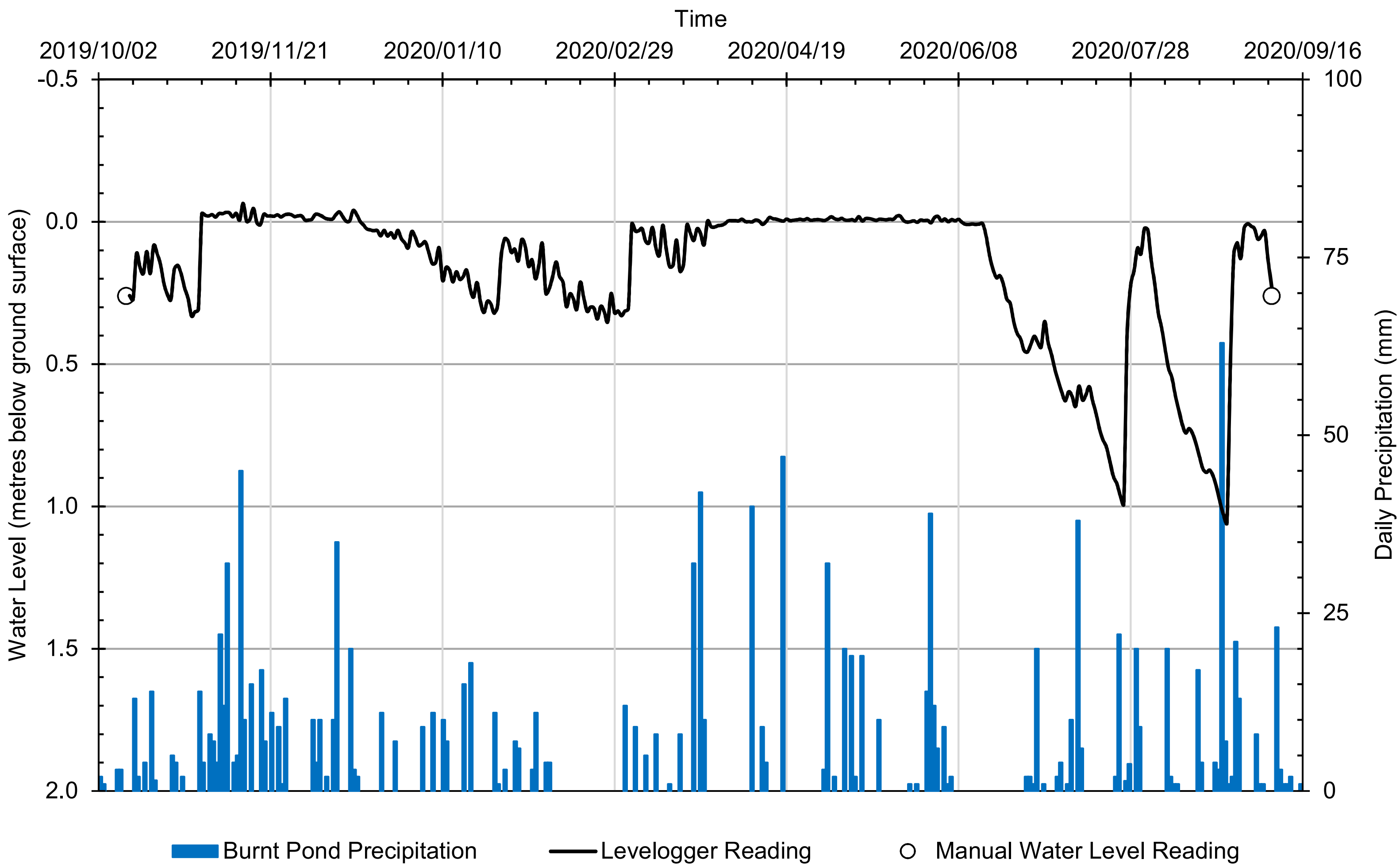
Title: **MW4 Long-Term Water Level Data**

Project: Long-term Groundwater Level Monitoring: October 2019 to October 2020
Marathon Valentine Gold Project, Central Newfoundland



Title: **MW5 Long-Term Water Level Data**

Project: Long-term Groundwater Level Monitoring: October 2019 to September 2020
Marathon Valentine Gold Project, Central Newfoundland



APPENDIX IR-09.A
SUMMARY OF PACKER TESTING, 2020 FS-LEVEL GEOTECHNICAL PIT DESIGN PROGRAM

GEMTEC
CONSULTING ENGINEERS AND SCIENTISTS

GEMTEC Consulting Engineers and Scientists Limited
10 Maverick Place
Paradise, NL, Canada
A1L 0J1
709.722.2275
nl@gemtec.ca
www.gemtec.ca

May 31, 2021 File: 80047.03 – REV0

Marathon Gold Corporation
10 King Street East, Suite 501
Toronto, ON
M5C 1C3

Attention: Mr. James Powell, M.Eng. P.Eng.
Vice President, Regulatory and Government Affairs

Re: Summary of Packer Testing, 2020 FS-Level Geotechnical Pit Design Program, Marathon Valentine Gold Project, Central Newfoundland

This letter report was prepared by GEMTEC Consulting Engineers and Scientists Limited (GEMTEC) and summarizes the packer testing program completed as part of the 2020 Feasibility Study (FS)-Level Geotechnical Pit Design Program completed for the Marathon Valentine Gold Project Site, as documented in Terrane (2021). This letter report provides a detailed description of the field testing and data analysis methods used for the packer testing program, and presents the estimates of hydraulic conductivity determined through packer testing for the various lithologies and structural features (e.g. faults, fractures, shear zones) identified in the proposed Marathon and Leprechaun pit areas.

2020 PACKER TESTING PROGRAM

Packer Testing Methods

Packer testing was carried out concurrently with the 2020 geotechnical drilling program in the proposed Marathon and Leprechaun pit areas. Nine of the 13 geotechnical drill holes completed as part of the 2020 field program were packer tested. The locations of these are shown on the drill hole plans for each proposed pit (attached), and included:

- Five drill holes at Marathon (MA-GT-20-01, MA-GT-20-02, MA-GT-20-03, MA-GT-20-04, and MA-GT-20-06); and,
- Four drill holes at Leprechaun (VL-GT-20-01, VL-GT-20-02, VL-GT-20-04, VL-GT-20-05).

Of these, three drill holes from each area were packer tested with continuous intervals covering the full drilled depths (MA-GT-20-01, MA-GT-20-03, MA-GT-20-04 at Marathon, and VL-GT-20-01, VL-GT-20-02, and VL-GT-20-05 at Leprechaun). Packer testing in the remaining drill holes was carried out on discrete intervals to characterize specific zones of interest. The packer tests were conducted using a Standard Wireline Packer System (SWiPS) manufactured by Inflatable

Packers International (IPI) and were performed using a constant head (Lugeon) packer injection test method.

Several approaches were used to isolate the desired packer testing interval:

1. Single packer testing to isolate a discrete interval as the hole was advanced with the bottom of the test interval bounded by the bottom of the drill hole;
2. Cumulative single packer testing performed from the bottom up following completion of the total or a portion of the drilled hole, with the bottom of the test interval bounded by the bottom of the drilled portion of the hole, and with overlapping and increased test interval lengths as the single packer was progressively advanced up the hole; and,
3. Double packer testing to isolate a discrete interval in the hole following completion of drilling.

A detailed description of the methods used for packer testing is attached. The packer test results for the Marathon pit area and Leprechaun pit area are provided in Tables 1 and 2 (attached), respectively, along with individual analysis reports for each packer test.

A total of 94 packer tests were completed for this program. Of these, 89 packer tests (95%) were successfully completed and were used for hydraulic conductivity characterization. Five packer tests were not considered reliable and were rejected from the analysis. These tests were rejected either due to:

1. Testing issues (i.e., difficulty maintaining constant test pressures; for example, test MA-GT-20-03 PT4); or,
2. During cumulative single packer testing, where a relatively higher hydraulic conductivity interval situated below masked the hydraulic conductivity for the desired test interval, returning unrealistic negative hydraulic conductivity values (for example, tests MA-GT-20-03 PT2, VL-GT-220-02 PT11 and PT18, and VL-GT-20-05 PT15).

Packer Testing Results

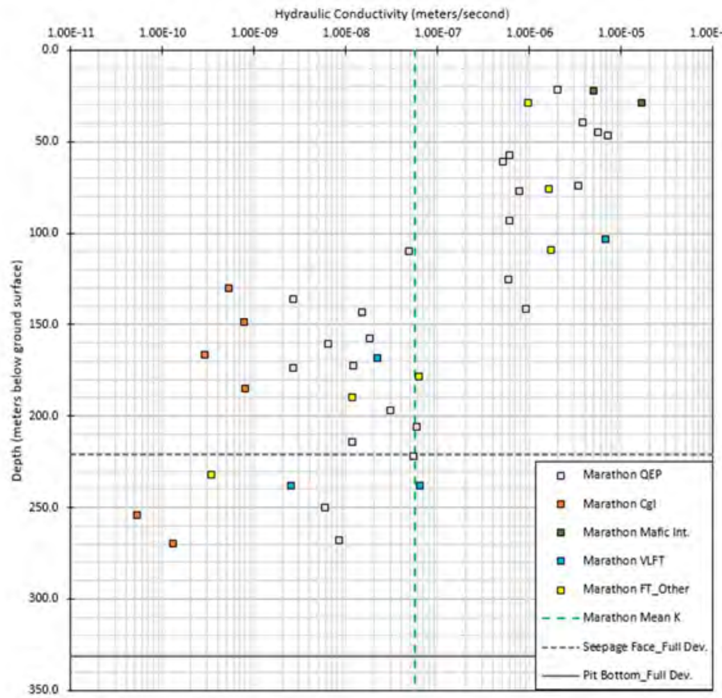
The hydraulic conductivity for each test interval was determined based on the analysis of the packer test data using the software AquiferTest® Version 10 (Waterloo Hydrogeologic, Waterloo, ON). Hydraulic conductivity values were derived directly from analysis of the discrete single and double packer test data. Since the cumulative single packer tests involved advancing the packer upwards over a progressively expanding test interval, the determined hydraulic conductivity result required mathematical processing to remove the influence of the over-lapping previously tested portion of the drill hole and to determine a unique hydraulic conductivity value for the discrete test interval. A description of the mathematical method used to process the cumulative single packer test data is attached.

A summary of the calculated hydraulic conductivity values for Marathon and Leprechaun are provided in Table 3 below, and plots of hydraulic conductivity versus depth separated by rock type for each deposit is presented in Figure 1.

Table 3 - Summary of Calculated Hydraulic Conductivity Values for Major Rock Types and Structures in the proposed Marathon and Leprechaun Pit Areas

Deposit	Rock/ Structure Type	Number of Packer Tests	Hydraulic Conductivity (m/s)		
			Minimum	Maximum	Geometric Mean
Marathon	Quartz-Eye Porphyry	24	5.80E-09	3.76E-06	1.15E-07
	Conglomerate	6	5.20E-11	7.85E-10	2.92E-10
	Mafic Intrusive	2	5.00E-06	1.67E-05	9.13E-06
	Valentine Lake Thrust Fault	5	2.53E-09	6.71E-06	6.96E-08
	Modelled Faults/Other	6	3.42E-10	1.69E-06	9.25E-08
	All Rock/Structure Types	**43**	**5.20E-11**	**1.67E-05**	**5.57E-08**
Leprechaun	Trondhjemite	29	4.79E-11	1.80E-06	5.69E-08
	Conglomerate	5	2.84E-10	2.60E-09	1.10E-09
	Valentine Lake Thrust Fault	1			1.37E-09
	Modelled Faults / Other	11	8.60E-10	1.69E-06	4.75E-08
	All Rock/Structure Types	**46**	**4.79E-11**	**1.80E-06**	**3.26E-08**

(a)



(b)

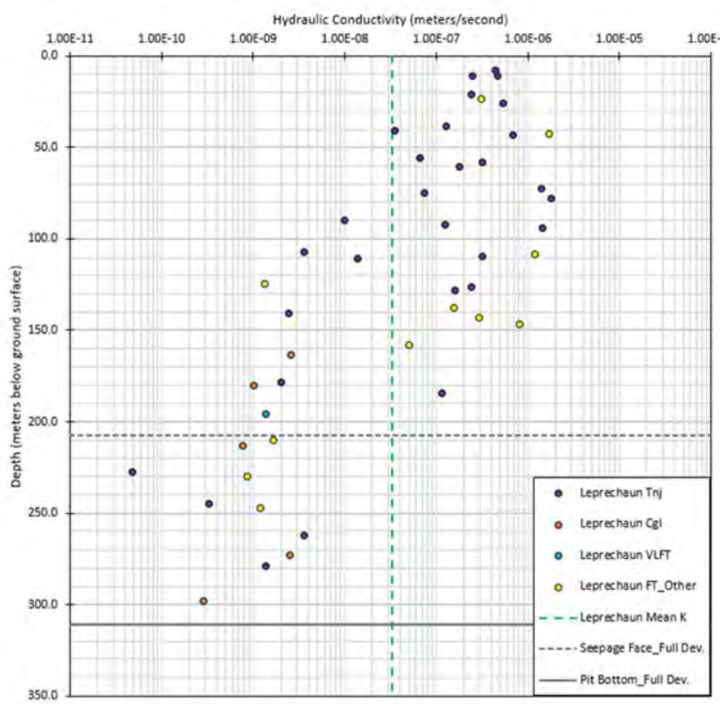


Figure 1 Hydraulic conductivity vs Depth by Rock Type and Structural Feature for (a) Marathon, and (b) Leprechaun deposit.

For the Marathon deposit, a broad range in hydraulic conductivity values were calculated spanning six orders of magnitude from 5.20E-11 m/s to 1.67E-05 m/s, with a geometric mean value for all the packer tests of 5.57E-08 m/s.

The hydraulic conductivity of specific rock types at the Marathon deposit is summarized below:

- The quartz eye porphyry, which is the dominant rock type within the Marathon open pit and represents approximately 55% of all the packer tested intervals, had a geometric mean hydraulic conductivity of 1.17E-07 m/s;
- The conglomerate, which makes up a smaller, but main rock type in the Marathon deposit area had a geometric mean hydraulic conductivity of 2.92E-10 m/s. The conglomerate had the lowest hydraulic conductivity, and was approximately three orders of magnitude less than that determined for the quartz eye porphyry;
- The mafic intrusive, a minor rock type in the Marathon deposit area had the highest hydraulic conductivity with a calculated mean value of 9.13E-06 m/s;
- Tests within the quartz-eye porphyry, were conducted over a wide range of depths (from near surface to full depth) and the resulting range of hydraulic conductivity values spanned three to five orders of magnitude.
- In contrast, the hydraulic conductivity values for both the mafic intrusive and conglomerate are based on a relatively low number of tests over a limited range in depths (i.e., two tests at shallow depths < 50 mbgs for the mafic intrusive, and six tests at deep depths >100 mbgs for the conglomerate). Given the few tests and limited range of testing depth, the hydraulic conductivities determined for these rock types may not be fully representative of their bulk values over the full depth of the proposed open pit. This interpretation is supported by the much higher hydraulic conductivity value for conglomerate (1.93E-06 m/s) for shallow test intervals from 30 – 50 m during previous investigations, which suggests that the full range of conglomerate hydraulic conductivity values from near surface to full pit depth may span five orders of magnitude; and,
- The hydraulic conductivity for the Valentine Lake thrust fault ranged from 2.53E-09 m/s to 6.71E-06 m/s, with a geometric mean of 6.96E-08 m/s. Similar results were also obtained for the other Marathon deposit faults, which had a combined geometric mean of 9.25E-08 m/s. Overall, the hydraulic conductivities determined for the Marathon deposit faults (including the Valentine Lake thrust fault) were within the range of values for the various rock types, and were not found to be hydraulically distinct from the surrounding rock mass. This means the faults in the proposed open pit are not expected to be substantial preferred pathways for groundwater flow, or constitute problem areas for seepage control.

For the Leprechaun deposit, a broad range in hydraulic conductivity values were determined and spanned five orders of magnitude from 4.79E-11 m/s to 1.80E-06 m/s. The geometric mean for all the packer tests was 3.26E-08 m/s.

The hydraulic conductivity of specific rock types at the Leprechaun deposit is summarized below:

- Trondhjemite is the dominant rock type within the Leprechaun deposit open pit and represents approximately 63% of the packer tested intervals and had a geometric mean hydraulic conductivity of 5.69E-08 m/s;
- The conglomerate, which makes up a smaller, but main rock type in the Leprechaun deposit area, had a geometric mean hydraulic conductivity of 1.10E-09 m/s. This value is approximately one order of magnitude higher than that determined for the conglomerate at Marathon but, like Marathon, represents the lowest hydraulic conductivity rock type around the Leprechaun deposit area, and was approximately three orders of magnitude less than that determined for the trondhjemite;
- A similar depth bias exists for the conglomerate hydraulic conductivity dataset at the Leprechaun deposit as for the Marathon deposit, with the mean hydraulic conductivity for this rock type based on only five packer tests all completed below 150 m depth;
- Only one packer test was completed for the Valentine Lake thrust fault, with a hydraulic conductivity value of 1.37E-09 m/s. This value is approximately one order of magnitude lower than that determined for the Valentine Lake thrust fault at the Marathon deposit. The combined mean for the other Leprechaun deposit faults was higher than that determined for the Valentine Fault by an approximate factor of four, with a geometric mean of 4.75E-08 m/s; and,
- Similar to the Marathon deposit, the hydraulic conductivities determined for the Leprechaun deposit faults (including the Valentine Lake thrust fault) were within the range of values for the various rock types, and were not found to be hydraulically distinct from the surrounding rock mass. Similarly, this means the faults in the proposed open pit are not expected to be substantial preferred pathways for groundwater flow, or constitute problem areas for seepage control.

In general, the 2020 hydraulic conductivity values determined for the Marathon and Leprechaun deposits were in good agreement with previous hydrogeological investigations at the site, and are within the typical range of values for similar intact and fractured rock types. Overall, the results for both deposits indicate a generally low permeability rock mass, with no significantly distinct increase in permeability associated with the tested faults and fault zones.

A similar general trend in the hydraulic conductivity distributions for both the Marathon and Leprechaun deposits is visible from Figure 1 (a and b), with hydraulic conductivities generally decreasing with depth for all rock types, as well as tested faults. The highest hydraulic conductivities were measured in shallow bedrock close to surface, and generally, hydraulic conductivity results 10^{-7} m/s and higher were measured above 150 mbgs. This observed decrease in hydraulic conductivity is attributed to closure of fracture apertures with depth due to lithostatic stress.

CONCLUSIONS

This summary letter report was prepared by Carolyn Anstey-Moore, M.Sc., M.A.Sc., P.Geo. We trust that this report meets your present requirements. If you have any questions or require additional information, please contact our office at your convenience.

Respectfully submitted,

GEMTEC Consulting Engineers and Scientist Limited

Carolyn Anstey-Moore, M.Sc., M.A.Sc., P.Geo.

REFERENCES

Beale, G. and Read, J. 2013. Guidelines for Evaluating Water in Pit Slope Stability, CSIRO Publishing, Melbourne, Australia. 600p.

Terrane Geoscience Inc. 2021. Feasibility Geotechnical Investigation: Marathon and Leprechaun Deposits. Final Report, March 23, 2021. 414p

ATTACHMENTS

2020 Geotechnical Drill Hole Plans – Marathon and Leprechaun

Packer Testing Methods & Data Analysis

Table 1 Summary of Packer Testing – Marathon Pit

Table 2 Summary of Packer Testing – Leprechaun Pit

Packer Test Analysis Reports

(Figure taken directly from Terrane, 2021)

MARATHON GOLD

VALENTINE GOLD PROJECT
FEASIBILITY
GEOTECHNICAL INVESTIGATION

FIGURE 6 - Terrane 2019 -2020 Geotechnical Drillhole Location Map - Marathon Deposit

Scale: 1:10,000	Date: Jan. 07, 2021
Drawn: ACH	Checked: AG
Approved: TLG	Figure 6

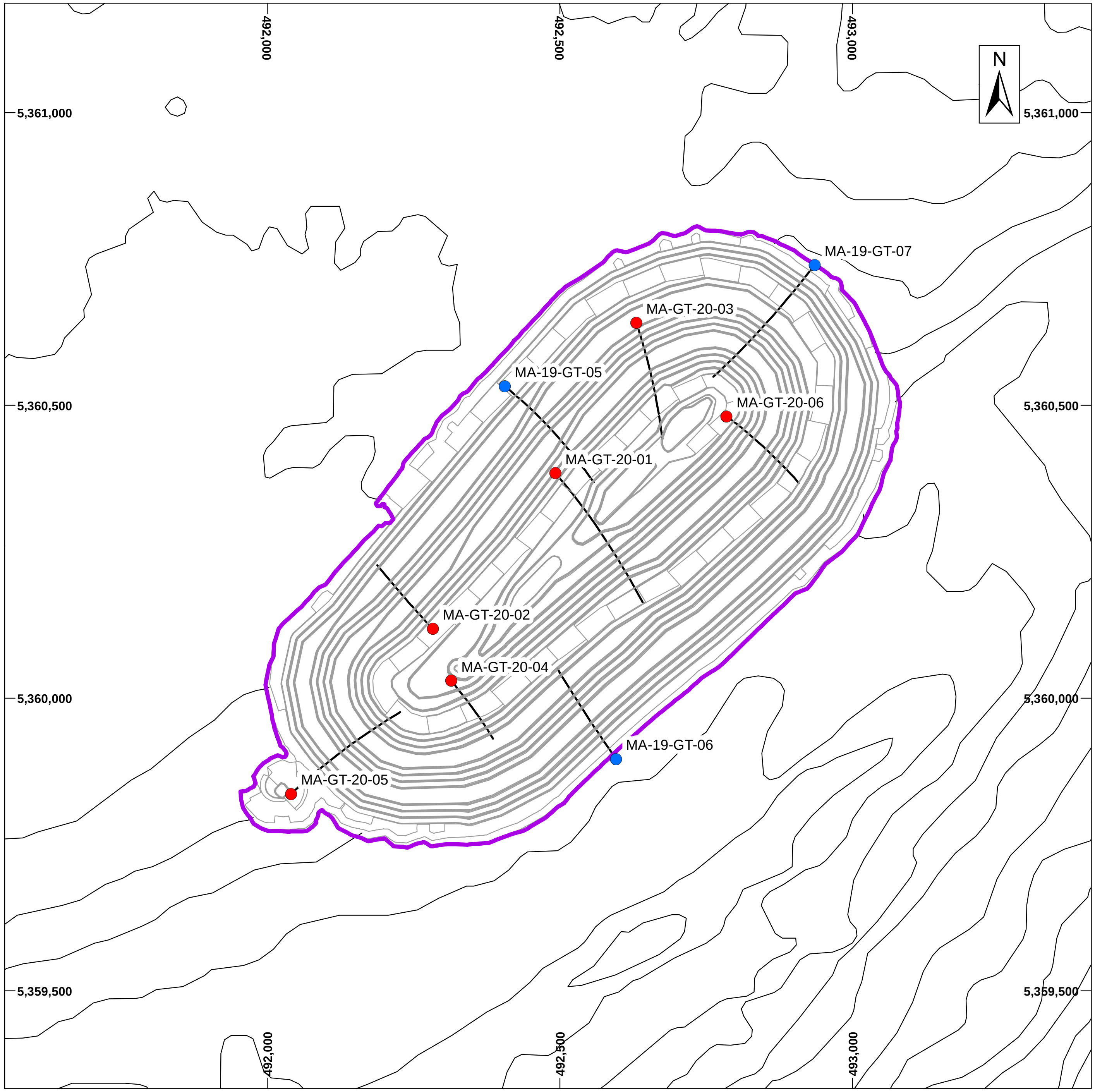
LEGEND

- Terrane 2020 Geotechnical Drillhole
- Terrane 2019 Geotechnical Drillhole
- 10 m Topographic Contours
- Proposed Pit Contours
- Marathon Pit Outline

0 175 350
Meters

TERRANE
GEOSCIENCE INC.
www.terranegeoscience.com

Notes
1) Marathon feasability open pit shape provided by Marathon (Dec. 2020)
2) NAD83 UTM Z21N



(Figure taken directly from Terrane, 2021)

MARATHON GOLD

VALENTINE GOLD PROJECT
FEASIBILITY
GEOTECHNICAL INVESTIGATION

FIGURE 7 - Terrane 2019 -2020 Geotechnical Drillhole Location Map - Leprechaun Deposit

Scale: 1:7,500	Date: Jan. 07, 2021
Drawn: ACH	Checked: AG
Approved: TLG	Figure 7

LEGEND

- Terrane 2020 Geotechnical Drillhole
- Terrane 2019 Geotechnical Drillhole
- 10 m Topographic Contours
- Leprechaun Pit Contours
- Leprechaun Pit Outline

0 125 250 Meters

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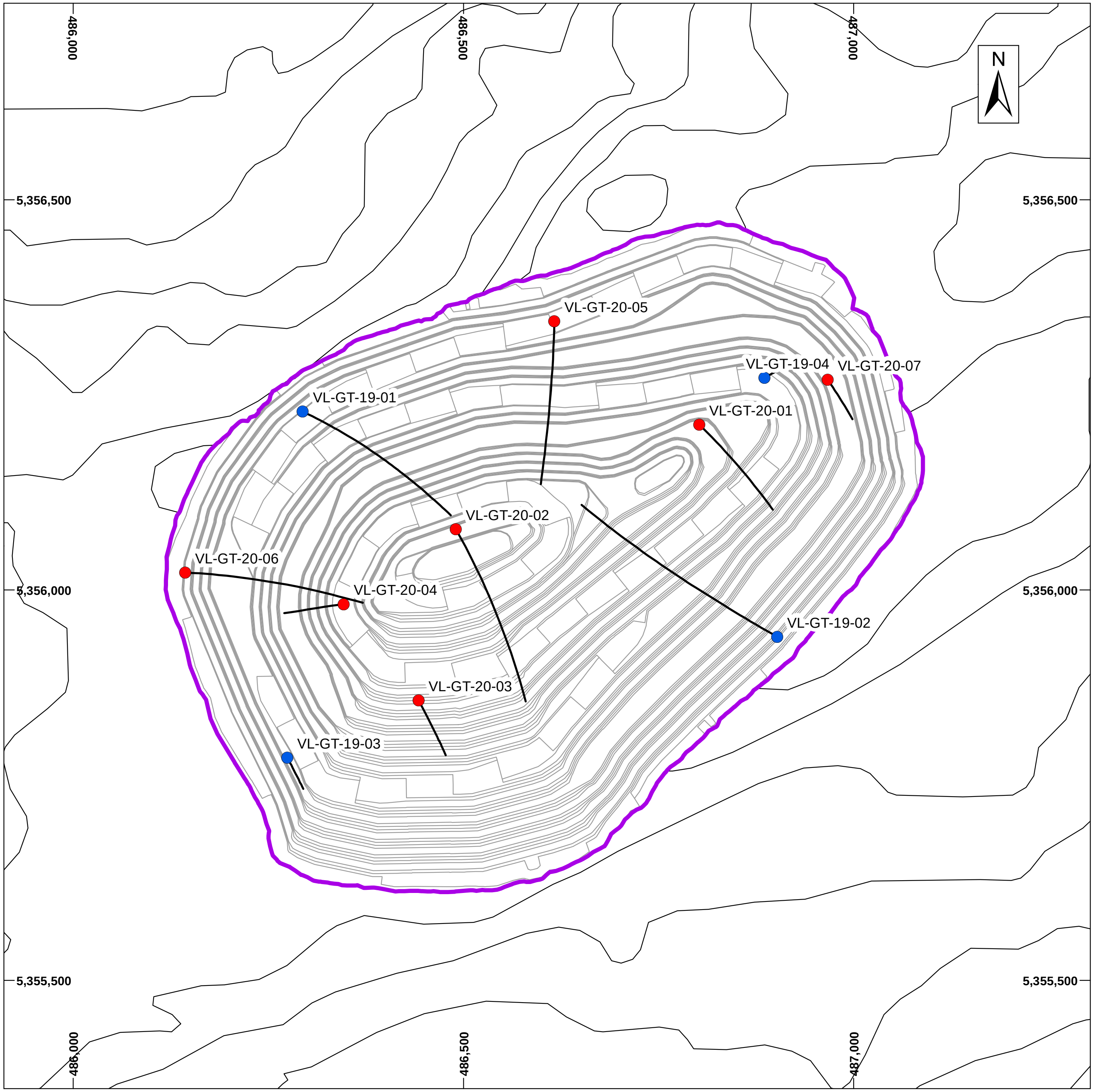
Notes
1) Leprechaun feasability open pit shape provided by Marathon (Dec. 2020)
2) NAD83 UTM Z21N



PACKER TESTING METHODS & ANALYSIS

PACKER TESTING METHODS

A total of 94 packer tests were completed for this program. Of these, 89 packer tests (95%) were successfully completed and were used here for hydraulic conductivity characterization. Several approaches were used to isolate the desired packer test intervals, including:

1. Single packer testing to isolate a discrete interval as the hole was advanced with the bottom of the test interval bounded by the bottom of the hole;
2. Cumulative single packer testing performed from the bottom up following completion of the total or a portion of the drilled hole, with the bottom of the test interval bounded by the bottom of the drilled section of the hole, and with overlapping and increased test interval lengths as the single packer was progressively advanced up the hole; and,
3. Double packer testing to isolate a discrete interval in the hole following completion of drilling.

The packer tests were conducted using a Standard Wireline Packer System (SWiPS) manufactured by Inflatable Packers International (IPI), and were performed using a constant head (Lugeon) packer injection test method.

Single packer tests were conducted as follows:

- A borehole was advanced to the bottom of a chosen test interval and the hole was flushed with clean water through the drill rod until the return water was clear. The water source used for packer testing was obtained from nearby surface water sources, and was pumped into an on-site water tank so use during testing.
- The drill rods were then withdrawn to the desired test depth, and a single-element packer assembly was lowered inside the drill rods to the top of the test interval with the wireline. The packer bladder was then inflated (using pressurized water) to isolate the test interval; the bottom of which was bounded by the bottom of the drilled section of the borehole. Test intervals were generally 21 m (along hole (AH) in length), corresponding to an approximately 16 m vertical length for the Leprechaun drill holes and an 18 m vertical length for the slightly steeper drill holes at Marathon. For cumulative single packer tests at Marathon and Leprechaun, the test interval was generally expanded by moving the single packer progressively up the hole by these test interval lengths for each sequential test.
- Once a successful seal was established, water was pumped into the isolated test interval through the injection pipe until a constant differential head and inflow rate were established. A total of three ascending and two descending water pressure steps were applied for each interval with regulated constant head achieved by controlling the injection flow rate using a bypass valve.
- For each test step, the water injection rate was observed until it had stabilized (generally up to 10 minutes). During this observation period, the pressure and injected quantity of water was recorded at one-minute intervals. The stabilized flow rate was used to calculate the bulk hydraulic conductivity of the rock mass over the tested interval. Pressure was measured using

a 10 psi or 100 psi gauge, depending on the required test pressures, and the water injection rate was measured using a flow meter totalizer and stopwatch.

Double packer tests were conducted as follows. The test interval was sealed at either end with a hydraulically inflated packer bladder, and water was injected through a section of perforated pipe located between the two packers. The same constant head injection test procedures were applied to the double packer test section as that described above for single packer testing. Double packer test interval lengths varied from 1 m to 24 m vertical length, depending on the length of the zone of interest.

2. PACKER TESTING DATA ANALYSIS

The hydraulic conductivity for each test interval was determined based on the analysis of the packer test data using the software AquiferTest® Version 10 (Waterloo Hydrogeologic, Waterloo, ON). Hydraulic conductivity values for single- and double-packer tests were calculated directly from the packer test data. In contrast, since the cumulative single packer tests involved raising the packer assembly upwards over a progressively longer test interval, the calculated hydraulic conductivity result for the test interval required mathematical processing to remove the influence of the over-lapping previously tested portion of the drill hole in order to determine a specific hydraulic conductivity value for the uppermost, incremental part of the overall test interval.

The hydraulic conductivity of the discrete test intervals for the cumulative single packer tests were determined by applying the basic theory of parallel groundwater flow through a layered bedrock system (e.g., Beale and Read, 2013). The total effective hydraulic conductivity (K_x) of a layered bedrock system is equal to the summation of the hydraulic conductivities of the individual layers, weighted based on layer thickness, as given by:

$$K_x = \frac{\sum_{i=1}^{n} K_i\, b_i}{\sum_{i}^{n} b_i} = \frac{K_1\, b_1 + K_2\, b_2 + K_3\, b_3 + \cdots + K_n\, b_n}{b_1 + b_2 + b_3 + \cdots + b_n}$$

where

- K_x = total effective hydraulic conductivity of the layered bedrock system (m/s)
- K_i = hydraulic conductivity of layer (m/s)
- b_i = thickness of layer *i* (m)
- i = number of layer
- n = total number of layers

Applying the layered bedrock system analog to the cumulative single packer tests, each discrete test interval in the cumulative tested section was assumed to be equivalent to a bedrock layer in the above equation with its own unique hydraulic conductivity and thickness (i.e., test length AH).

PACKER TESTING METHODS & ANALYSIS

The figure below illustrates the overlapping sequencing of the cumulative single packer testing carried out as part of the current program and how hydraulic conductively values were derived using the above equation for a layered bedrock system.

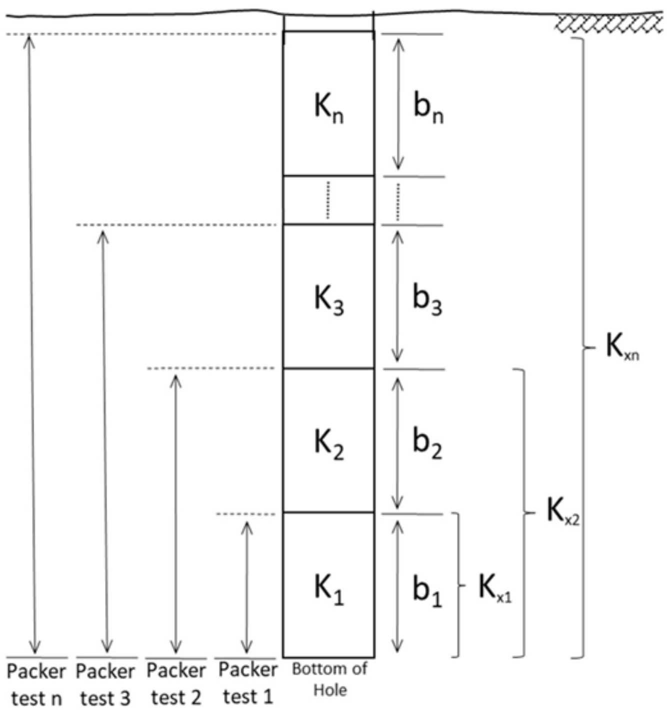


Illustration of cumulative single packer testing using parallel groundwater flow through a layered bedrock system analog.

As illustrated above, each cumulative packer test interval was incrementally longer than for the previous test, and encompassed a new upper interval for which a specific hydraulic conductivity value was to be determined. The packer test completed on the lowermost interval (Packer test 1) directly provided the specific hydraulic conductivity value for this first test interval. For the next sequential packer test (Packer test 2), the hydraulic conductivity value for the upper discrete interval (K_2) was determined by simplifying and rearranging the general layered system hydraulic conductivity equation as follows:

$$K_2 = \frac{K_{x2}(b_1 + b_2) - K_1 \, b_1}{b_2}$$

In this equation the "$K_{x2}(b_1 + b_2)$" term represents the hydraulic conductivity packer test result and test length for the entire test interval (i.e., Packer test 2), and the "$K_1 \, b_1$" term represents the results for the previous test interval (i.e., Packer test 1). Carrying on with this approach, the hydraulic conductivity value for each subsequent discrete test interval was determined by subtracting the product of the K value and test interval length for the current and previous packer tests and dividing by the length of the uppermost discrete test interval.

Table 1 Summary of Packer Testing - Marathon Pit

Borehole ID	Packer Test ID	Packer Test Type	Test Interval (m ID)				Discrete Test Interval							
			From	To	Test Length	Hydraulic Conductivity (m/sec)	From (m ID)	To (m ID)	From (m VD)	To (m VD)	Average Depth (m VD)	Test Length (m)	Hydraulic Conductivity (m/sec)	Lithology/Structure
MA-GT-20-01	PT17	SPT	27.33	362.00	334.67	7.39E-07	27.33	48.33	20.94	37.02	28.98	16.09	9.48E-07	QEP/MD. Modelled_Fault 6 @ 35 m ID; ~0.07 m zone. Also a number of other narrow (<0.1 m thick) rubble zones in test interval.
MA-GT-20-01	PT16	CSPT	48.33	362.00	313.67	7.25E-07	48.33	69.33	37.02	53.11	45.07	16.09	5.56E-06	QEP/MD
MA-GT-20-01	PT15	CSPT	69.33	362.00	292.67	3.78E-07	69.33	90.33	53.11	69.20	61.15	16.09	5.07E-07	QEP/MD
MA-GT-20-01	PT14	CSPT	90.33	362.00	271.67	3.68E-07	90.33	111.33	69.20	85.28	77.24	16.09	7.62E-07	QEP/MD. Modelled_Fault 12 @ 107 m ID (very subtle in core)
MA-GT-20-01	PT13	CSPT	111.33	362.00	250.67	3.35E-07	111.33	132.33	85.28	101.37	93.33	16.09	5.97E-07	QEP/MD
MA-GT-20-01	PT12	CSPT	132.33	362.00	229.67	3.11E-07	132.33	153.33	101.37	117.46	109.41	16.09	1.69E-06	QEP/MD. Modelled_Fault 3 @ 145 m ID; 10 cm rubble zone.
MA-GT-20-01	PT11	CSPT	153.33	362.00	208.67	1.72E-07	153.33	174.33	117.46	133.54	125.50	16.09	5.92E-07	QEP/MD. A number of 0.1 - 0.2 m thick rubble zones in test interval.
MA-GT-20-01	PT10	CSPT	174.33	362.00	187.67	1.25E-07	174.33	195.33	133.54	149.63	141.59	16.09	9.08E-07	QEP/MD. Modelled_Fault 13 @ 183 m ID (very subtle in core)
MA-GT-20-01	PT9	CSPT	195.33	362.00	166.67	2.64E-08	195.33	216.33	149.63	165.72	157.67	16.09	1.78E-08	QEP/MD
MA-GT-20-01	PT8	CSPT	216.33	362.00	145.67	2.76E-08	216.33	237.33	165.72	181.81	173.76	16.09	2.67E-09	QEP/MD
MA-GT-20-01	PT7	CSPT	237.33	362.00	124.67	3.18E-08	237.33	258.33	181.81	197.89	189.85	16.09	1.16E-08	QEP/MD. Modelled_Fault 4 @ 245 m ID (very subtle in core)
MA-GT-20-01	PT6	CSPT	258.33	362.00	103.67	3.59E-08	258.33	279.33	197.89	213.98	205.94	16.09	5.87E-08	QEP/MD
MA-GT-20-01	PT5	CSPT	279.33	362.00	82.67	3.01E-08	279.33	300.33	213.98	230.07	222.02	16.09	5.45E-08	QEP/MD
MA-GT-20-01	PT4	CSPT	300.33	362.00	61.67	2.18E-08	300.33	321.33	230.07	246.15	238.11	16.09	6.38E-08	Cgl/Phyl. Modelled_Fault 1 (VLFT) @ 308 - 314 m ID.
MA-GT-20-01	PT3	DPT	308.33	312.81	4.48	2.53E-09	308.33	312.81	236.19	239.63	237.91	3.43	2.53E-09	Modelled_Fault 1 (VLFT) @ 308 - 314 m ID; observed in core as multiple rubble and gouge zones.
MA-GT-20-01	PT2	CSPT	321.33	362.00	40.67	9.00E-11	321.33	342.18	246.15	262.13	254.14	15.97	5.20E-11	Cgl
MA-GT-20-01	PT1	CSPT	342.18	362.00	19.82	1.30E-10	342.18	362.00	262.13	277.31	269.72	15.18	1.30E-10	Cgl/MD
MA-GT-20-02	PT1	DPT	186.33	215	28.67	2.17E-08	186.33	215.00	156.27	180.31	168.29	24.04	2.17E-08	MD/QEP. Modelled_Fault 1 (VLFT) with multiple fault/rubble zones with gouge infill (up to 0.8 m thick).
MA-GT-20-03	PT7	CSPT	24.33	170.00	145.67	4.32E-06	24.33	44.00	20.63	37.31	28.97	16.68	1.67E-05	Gab. Modelled Fault_2 @ 48 m; subtle in core. Several narrow (up to 0.05 m) rubble zones within test interval.
MA-GT-20-03	PT6	CSPT	44.00	170.00	126.00	2.39E-06	44.00	66.33	37.31	56.25	46.78	18.94	7.08E-06	Gab/QEP. A number of narrow (<0.15 m) fault and rubble zones within test interval.
MA-GT-20-03	PT5	CSPT	66.33	170.00	103.67	1.38E-06	66.33	108.33	56.25	91.87	74.06	35.62	3.36E-06	QEP/MD. Fault from 66.06 - 66.49 m (0.43 m thick); and a number of narrow rubble zones (up to 0.05 m thick) over 18 m from 75.22 to 93.35 m.
MA-GT-20-03	PT4	CSPT	87.33	170.00	82.67	ND	87.33	108.33	74.06	91.87	82.96	17.81	ND	QEP/MD
MA-GT-20-03	PT3	CSPT	108.33	170.00	61.67	3.41E-08	108.33	150.33	91.87	127.49	109.68	35.62	4.88E-08	QEP/MD
MA-GT-20-03	PT2	CSPT	129.33	170.00	40.67	3.26E-10	129.33	150.33	109.68	127.49	118.58	17.81	-	QEP/MD
MA-GT-20-03	PT1	SPT	150.33	170.00	19.67	2.65E-09	150.33	170.00	127.49	144.17	135.83	16.68	2.65E-09	QEP/MD
MA-GT-20-03	PT15	CSPT	158.33	326.00	167.67	1.78E-08	158.33	179.33	134.27	152.08	143.18	17.81	1.47E-08	QEP/MD
MA-GT-20-03	PT14	CSPT	179.33	326.00	146.67	1.82E-08	179.33	199.33	152.08	169.04	160.56	16.96	6.32E-09	QEP. Narrow fault (0.02 m) with gouge infill @ 197.3 m ID.

Table 1 Summary of Packer Testing - Marathon Pit - cont.

Borehole ID	Packer Test ID	Packer Test Type	Test Interval (m ID)				Discrete Test Interval							
			From	To	Test Length	Hydraulic Conductivity (m/sec)	From (m ID)	To (m ID)	From (m VD)	To (m VD)	Average Depth (m VD)	Test Length (m)	Hydraulic Conductivity (m/sec)	Lithology/Structure
MA-GT-20-03	PT13	CSPT	199.33	326.00	126.67	2.01E-08	199.33	221.33	169.04	187.70	178.37	18.66	6.18E-08	QEP. Modelled Fault_12 @ 216 m. A number of narrow (<0.13 m) rubble zones over test interval.
MA-GT-20-03	PT12	CSPT	221.33	326.00	104.67	1.13E-08	221.33	242.33	187.70	205.51	196.60	17.81	3.04E-08	QEP/MD. Several narrow fault zones (up to 0.09 m thick) with gouge infill within test interval.
MA-GT-20-03	PT11	CSPT	242.33	326.00	83.67	6.51E-09	242.33	263.33	205.51	223.32	214.41	17.81	1.16E-08	QEP. A 0.03 m rubble zone encountered at 256.9 m ID.
MA-GT-20-03	PT10	CSPT	263.33	326.00	62.67	4.82E-09	263.33	284.33	223.32	241.13	232.22	17.81	3.42E-10	QEP/MD. Modelled Fault_3 @ 266.4 m (0.14 m rubble zone).
MA-GT-20-03	PT9	CSPT	284.33	326.00	41.67	7.08E-09	284.33	305.33	241.13	258.93	250.03	17.81	5.80E-09	QEP/MD. Narrow (0.07 m) fault zone at 289.47m, gouge/broken rock filled.
MA-GT-20-03	PT8	SPT	305.33	326.00	20.67	8.37E-09	305.33	326.00	258.93	276.46	267.70	17.53	8.37E-09	QEP
MA-GT-20-04	PT1	SPT	15.33	35.00	19.67	2.01E-06	15.33	35.00	13.28	30.31	21.79	17.03	2.01E-06	QEP
MA-GT-20-04	PT2	SPT	35.00	56.00	21.00	3.76E-06	35.00	56.00	30.31	48.50	39.40	18.19	3.76E-06	QEP/MD. A ~0.3 m fault zone at 54.65 m ID with iron-stained gouge and rubble.
MA-GT-20-04	PT3	SPT	56.00	77.00	21.00	6.09E-07	56.00	77.00	48.50	66.68	57.59	18.19	6.09E-07	QEP/MD. A number of narrow (<0.11 m thick) rubble zones within test interval.
MA-GT-20-04	PT4	SPT	77.00	98.00	21.00	1.60E-06	77.00	98.00	66.68	84.87	75.78	18.19	1.60E-06	QEP/MD. Modeled_Fault_3 @ 79 m ID; associated with a number of rubble zones (<0.1 m thick) from 80 - 96 m.
MA-GT-20-04	PT5*	SPT	98.00	119.00	21.00	1.33E-05	98.00	140.00	84.87	121.24	103.06	36.37	6.71E-06	QEP/Phyl-Cgl (contact). Modelled Fault_1 (VLFT) from 118 to 125.7 m ID with numerous zones of rubble and gouge infill. Also a number of narrow (<0.06 m thick) rubble zones within test interval. PT5/6 K values combined to represent VLFT K.
MA-GT-20-04	PT6*	SPT	119.00	140.00	21.00	1.44E-07								
MA-GT-20-04	PT7	SPT	140.00	161.00	21.00	5.32E-10	140.00	161.00	121.24	139.43	130.34	18.19	5.32E-10	Cgl
MA-GT-20-04	PT8	SPT	161.00	182.00	21.00	7.63E-10	161.00	182.00	139.43	157.62	148.52	18.19	7.63E-10	Cgl
MA-GT-20-04	PT9	SPT	182.00	203.00	21.00	2.87E-10	182.00	203.00	157.62	175.80	166.71	18.19	2.87E-10	Cgl
MA-GT-20-04	PT10	SPT	203.00	224.00	21.00	7.85E-10	203.00	224.00	175.80	193.99	184.90	18.19	7.85E-10	Cgl. Narrow (0.005 m) fault zone at 219.34 m.
MA-GT-20-06	PT2	DPT	23.85	25.10	1.25	5.00E-06	23.85	25.10	21.62	22.75	22.18	1.13	5.00E-06	MD
MA-GT-20-06	PT1	DPT	183.30	197.00	13.70	1.18E-08	183.30	197.00	166.13	178.54	172.33	12.42	1.18E-08	QEP

Notes:

CSPT	Cumulative Single Packer Test	Cgl	Conglomerate
DPT	Double Packer Test	Phyl	Phyllite
SPT	Single Packer Test	VLFT	Valentine Lake Fault
ID	Inclined Depth	Gab	Gabbro
VD	Vertical Depth	ND	Not determined; test results not reliable
QEP	Quartz Eye Porphyry	"-"	Test results returned a negative K value for discrete interval
MD	Mafic Dyke	*	MA-GT-20-04: PT5 and PT6 spanned the VLFT at the QEP/Phyl-Cgl contact. Hydraulic conductivity (K) values combined to derive represented K for the VLFT.

Table 2 Summary of Packer Testing - Leprechaun Pit

Borehole ID	Packer Test ID	Packer Test Type	Test Interval (m ID)				Discrete Test Interval							
			From	To	Test Length	Hydraulic Conductivity (m/sec)	From (m ID)	To (m ID)	From (m VD)	To (m VD)	Average Depth (m VD)	Test Length (m)	Hydraulic Conductivity (m/sec)	Lithology/Structure
VL-GT-20-01	PT6	CSPT	5.33	125.00	119.67	8.31E-07	5.33	21.33	4.37	17.47	10.92	13.11	2.46E-07	Tnj/MD
VL-GT-20-01	PT5	CSPT	21.33	125.00	103.67	9.21E-07	21.33	42.33	17.47	34.67	26.07	17.20	5.33E-07	Tnj/MD; a number of contact discontinuities
VL-GT-20-01	PT4	CSPT	42.33	125.00	82.67	1.02E-06	42.33	63.33	34.67	51.88	43.28	17.20	6.97E-07	Tnj. A number of rubble zones up to 0.3 m thick within test interval.
VL-GT-20-01	PT3	CSPT	63.33	125.00	61.67	1.13E-06	63.33	84.33	51.88	69.08	60.48	17.20	1.81E-07	Tnj. Two narrow (<0.05 m thick) fault zones (gouge filled) within test interval.
VL-GT-20-01	PT2	CSPT	84.33	125.00	40.67	1.62E-06	84.33	105.33	69.08	86.28	77.68	17.20	1.80E-06	Tnj
VL-GT-20-01	PT1	SPT	105.33	125.00	19.67	1.43E-06	105.33	125.00	86.28	102.39	94.34	16.11	1.43E-06	Tnj
VL-GT-20-01	PT11	CSPT	125.33	230.00	104.67	2.00E-07	125.33	145.33	102.66	119.05	110.86	16.38	1.37E-08	Tnj. Modelled_Fault_2 (very suble in core)
VL-GT-20-01	PT10	CSPT	145.33	230.00	84.67	2.44E-07	145.33	168.33	119.05	137.89	128.47	18.84	1.58E-07	Tnj
VL-GT-20-01	PT9	CSPT	168.33	230.00	61.67	2.76E-07	168.33	189.33	137.89	155.09	146.49	17.20	8.07E-07	Cgl. Modelled_Fault 6 is present within test interval; encountered narrow (0.005 m) fault with clay infill @ 156 m, and 0.02 m brittle shear zone at 181 m.
VL-GT-20-01	PT8	CSPT	189.33	230.00	40.67	1.83E-09	189.33	210.33	155.09	172.29	163.69	17.20	2.60E-09	Cgl
VL-GT-20-01	PT7	SPT	210.33	230.00	19.67	1.01E-09	210.33	230.00	172.29	188.40	180.35	16.11	1.01E-09	Cgl
VL-GT-20-02	PT9	CSPT	8	185.00	177.00	2.31E-07	8	18.33	6.55	15.02	10.78	8.46	4.73E-07	Tnj/MD
VL-GT-20-02	PT8	CSPT	18.33	185.00	166.67	2.16E-07	18.33	39.33	15.02	32.22	23.62	17.20	3.13E-07	Tnj/MD. Modelled_Fault 6 @ 26.8 m ID (0.36 m thick withrubble and gouge infill). Also a number of narrow rubble zones (<0.4 m thick) in test interval.
VL-GT-20-02	PT7	CSPT	39.33	185.00	145.67	2.02E-07	39.33	60.33	32.22	49.42	40.82	17.20	3.58E-08	Tnj/MD. A narrow (0.06 m thick) rubble zone at 52.4 m.
VL-GT-20-02	PT6	CSPT	60.33	185.00	124.67	2.30E-07	60.33	81.33	49.42	66.62	58.02	17.20	3.19E-07	Tnj/MD
VL-GT-20-02	PT5	CSPT	81.33	185.00	103.67	2.12E-07	81.33	102.33	66.62	83.82	75.22	17.20	7.42E-08	Tnj/MD
VL-GT-20-02	PT4	CSPT	102.33	185.00	82.67	2.47E-07	102.33	123.33	83.82	101.03	92.42	17.20	1.27E-07	Tnj
VL-GT-20-02	PT3	CSPT	123.33	185.00	61.67	2.88E-07	123.33	144.33	101.03	118.23	109.63	17.20	3.23E-07	Tnj
VL-GT-20-02	PT2	CSPT	144.33	185.00	40.67	2.70E-07	144.33	164.00	118.23	134.34	126.28	16.11	2.45E-07	Tnj. Narrow fault zone (0.005 m thick) with gouge infill @ 154.3 m ID.
VL-GT-20-02	PT1	SPT	164.00	185.00	21.00	2.93E-07	164.00	185.00	134.34	151.54	142.94	17.20	2.93E-07	Tnj. Modelled_Fault 4 @ 176.2 m ID (0.4 m thick with gouge infill).
VL-GT-20-02	PT18	CSPT	185.00	374.00	189.00	1.03E-09	185.00	207.33	151.54	169.83	160.69	18.29	-	Tnj/MD
VL-GT-20-02	PT17	CSPT	207.33	374.00	166.67	1.45E-09	207.33	228.33	169.83	187.04	178.44	17.20	2.00E-09	Tnj/MD

Table 2 Summary of Packer Testing - Leprechaun Pit - cont.

Borehole ID	Packer Test ID	Packer Test Type	Test Interval (m ID)				Discrete Test Interval							
			From	To	Test Length	Hydraulic Conductivity (m/sec)	From (m ID)	To (m ID)	From (m VD)	To (m VD)	Average Depth (m VD)	Test Length (m)	Hydraulic Conductivity (m/sec)	Lithology/Structure
VL-GT-20-02	PT16	CSPT	228.33	374.00	145.67	1.37E-09	228.33	249.33	187.04	204.24	195.64	17.20	1.37E-09	Tnj/Cgl. Modelled_Fault 1 (VLFT). Very subtle in core.
VL-GT-20-02	PT15	CSPT	249.33	374.00	124.67	1.37E-09	249.33	270.33	204.24	221.44	212.84	17.20	7.78E-10	Cgl
VL-GT-20-02	PT14	CSPT	270.33	374.00	103.67	1.49E-09	270.33	291.33	221.44	238.64	230.04	17.20	8.60E-10	Cgl. Modelled_Fault 9 @ 274.4 m ID (0.03 m zone with gouge infill). Also narrow rubble zone (0.05 m thick) within test interval.
VL-GT-20-02	PT13	CSPT	291.33	374.00	82.67	1.65E-09	291.33	312.33	238.64	255.85	247.24	17.20	1.21E-09	Cgl. Modelled_Fault 10 @ 307.6 m ID (0.11 cm thick with gouge infill). Several other narrow (<0.0005 m thick) fault zones within test interval.
VL-GT-20-02	PT12	CSPT	312.33	374.00	61.67	1.80E-09	312.33	354.33	255.85	290.25	273.05	34.40	2.51E-09	Cgl/MD. A number of narrow (<0.05 m thick) fault/rubble zones with some gouge infill from 321.8 to 326.6 m ID.
VL-GT-20-02	PT11	CSPT	333.33	374.00	40.67	-	333.33	354.33	273.05	290.25	281.65	17.20	-	Cgl/MD
VL-GT-20-02	PT10	SPT	354.33	374.00	19.67	2.84E-10	354.33	374.00	290.25	306.36	298.31	16.11	2.84E-10	Cgl
VL-GT-20-04	PT1	DPT	38.33	53.00	14.67	1.69E-06	38.33	53	36.02	49.80	42.91	13.79	1.69E-06	Tnj. Modelled_Fault 5 @ 49. 2 m ID (0.32 m zone with rubble and gouge). Also, 0.15 m rubble zone @ 39.6 m ID with iron-staining
VL-GT-20-04	PT2	DPT	105.33	125	19.67	1.21E-06	105.33	125	98.98	117.46	108.22	18.48	1.21E-06	Tnj. Modelled_Fault 4 from 106.5 m to 118 m ID (with a number of discrete narrow fault zones up to 0.12 m thick with rubble and gouge infill).
VL-GT-20-04	PT3	DPT	145.33	147.82	2.49	1.55E-07	145.33	147.82	136.57	138.91	137.74	2.34	1.55E-07	Tnj. Narrow (0.08 m thick) fault at 146.8 m ID with iron-stained gouge infill.
VL-GT-20-05	PT9	CSPT	4.33	182.00	177.67	2.50E-07	4.33	15.33	3.55	12.56	8.05	9.01	4.47E-07	Tnj
VL-GT-20-05	PT8	CSPT	15.33	182.00	166.67	2.37E-07	15.33	36.33	12.56	29.76	21.16	17.20	2.44E-07	Tnj/MD
VL-GT-20-05	PT7	CSPT	36.33	182.00	145.67	2.36E-07	36.33	57.33	29.76	46.96	38.36	17.20	1.29E-07	Tnj/MD
VL-GT-20-05	PT6	CSPT	57.33	182.00	124.67	2.54E-07	57.33	78.33	46.96	64.16	55.56	17.20	6.64E-08	Tnj
VL-GT-20-05	PT5	CSPT	78.33	182.00	103.67	2.92E-07	78.33	99.33	64.16	81.37	72.77	17.20	1.42E-06	Tnj. Several narrow fault/rubble zones (up to 0.11 m thick with some gouge infill) from 82.4 m to 94.8 m ID.
VL-GT-20-05	PT4	CSPT	99.33	182.00	82.67	4.36E-09	99.33	120.33	81.37	98.57	89.97	17.20	9.94E-09	Tnj/MD
VL-GT-20-05	PT3	CSPT	120.33	182.00	61.67	2.46E-09	120.33	141.33	98.57	115.77	107.17	17.20	3.60E-09	Tnj/MD
VL-GT-20-05	PT2	CSPT	141.33	182.00	40.67	1.87E-09	141.33	162.33	115.77	132.97	124.37	17.20	1.34E-09	Tnj. Modelled_Fault 2 @ 151.2 m ID (0.09 m zone with 0.2 m brittle sheared section above). Narrow (0.08 m) rubble zone @ 161 m ID.
VL-GT-20-05	PT1	SPT	162.33	182.00	19.67	2.44E-09	162.33	182.00	132.97	149.09	141.03	16.11	2.44E-09	Tnj
VL-GT-20-05	PT17	CSPT	182.00	350.00	168.00	3.66E-08	182.00	204.33	149.09	167.38	158.23	18.29	5.03E-08	Tnj. Modelled_Fault 7 (joint zone from 191 - 197 m ID).

Table 2 Summary of Packer Testing - Leprechaun Pit - cont.

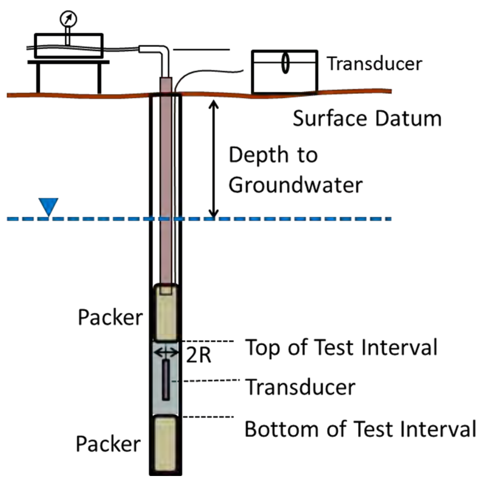
Borehole ID	Packer Test ID	Packer Test Type	Test Interval (m ID)				Discrete Test Interval							
			From	To	Test Length	Hydraulic Conductivity (m/sec)	From (m ID)	To (m ID)	From (m VD)	To (m VD)	Average Depth (m VD)	Test Length (m)	Hydraulic Conductivity (m/sec)	Lithology/Structure
VL-GT-20-05	PT16	CSPT	204.33	350.00	145.67	3.45E-08	204.33	246.33	167.38	201.78	184.58	34.40	1.16E-07	Tnj/MD
VL-GT-20-05	PT15	CSPT	225.33	350.00	124.67	-	225.33	246.33	184.58	201.78	193.18	17.20	-	Tnj
VL-GT-20-05	PT14	CSPT	246.33	350.00	103.67	1.41E-09	246.33	267.33	201.78	218.98	210.38	17.20	1.69E-09	Tnj. Modelled_Fault 6 @ 256.8 m ID (0.01 m zone with gouge infill).
VL-GT-20-05	PT13	CSPT	267.33	350.00	82.67	1.34E-09	267.33	288.33	218.98	236.19	227.59	17.20	4.79E-11	Tnj
VL-GT-20-05	PT12	CSPT	288.33	350.00	61.67	1.78E-09	288.33	309.33	236.19	253.39	244.79	17.20	3.28E-10	Tnj
VL-GT-20-05	PT11	CSPT	309.33	350.00	40.67	2.53E-09	309.33	330.33	253.39	270.59	261.99	17.20	3.63E-09	Tnj/MD. Narrow (0.003 m thick) fault zone at 324.8 m ID with clay infill.
VL-GT-20-05	PT10	SPT	330.33	350.00	19.67	1.36E-09	330.33	350.00	270.59	286.70	278.65	16.11	1.36E-09	Tnj/MD

Notes:

CSPT	Cumulative Single Packer Test	Cgl	Conglomerate
DPT	Double Packer Test	Phyl	Phyllite
SPT	Single Packer Test	VLFT	Valentine Lake Fault
ID	Inclined Depth	ND	Not determined; test results not reliable
VD	Vertical Depth	"-"	Test results not reliable
Tnj	Trondhjemite		
MD	Mafic Dyke		

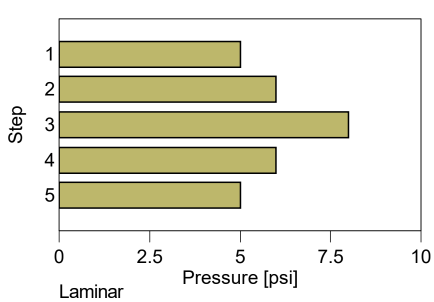
GEMTEC Consulting Engineers and Scientists	**Lugeon Test Analysis Report**
	Project: Valentine Gold Feasibility Geotechnical Investigation
	Number: 80047.03
	Client: Terrane Geoscience Inc.

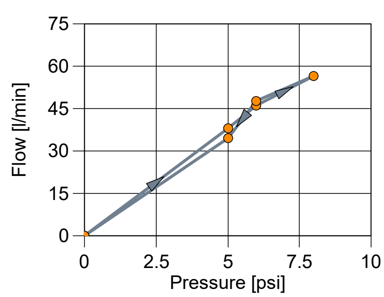
Location: Valentine Lake, NL	Lugeon Test: PT17	Tested bore: MA-GT-20-01
Test Conducted by: Terrane Geoscience Inc.		Test Date: 7/7/2020
Analysis Performed by: C. Anstey-Moore		Analysis Date: 10/27/2020
Lithology:		

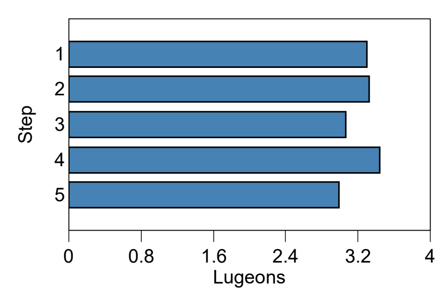


Top of Test Interval: 27.33 m
Bottom of Test Interval: 362.00 m
Length of Test Interval: 334.67 m
Depth to Groundwater: 0.00 m
Radius of Test Section: 0.05 m
Dip of bore: 40° from vertical
Vertical Top of Test Interval: 20.94 m
Vertical Bottom of Test Interval: 277.31 m

Step	Pressure [psi]	Flow Meter Readings [l]										Average Flow Rate [l/min]	Hydraulic Conductivity		
		1	2	3	4	5	6	7	8	9	10		[m/s]	[m/d]	Lugeon
1	5	400.00	438.50	476.50	514.50	552.50	590.50					38.10	7.57×10^{-7}	6.54×10^{-2}	3.3
2	6	614.00	660.00	706.50	752.50	798.00	844.50	890.00	936.00	981.50	1028.00	46.00	7.61×10^{-7}	6.58×10^{-2}	3.3
3	8	124.00	181.00	237.50	294.00	350.50						56.63	7.03×10^{-7}	6.07×10^{-2}	3.1
4	6	389.00	437.00	484.50	532.00	579.50	627.00					47.60	7.88×10^{-7}	6.81×10^{-2}	3.4
5	5	686.20	720.60	755.00	789.60	824.00	858.40	892.90	927.50	961.70	996.30	34.46	6.84×10^{-7}	5.91×10^{-2}	3.0
												Average	7.39×10^{-7}	6.38×10^{-2}	3.2







Laminar
Lugeon: 3.2
Hydraulic Conductivity: 7.39E-7 m/s
Hydraulic Conductivity: 6.38E-2 m/d

Performed using a single packer test assembly as the borehole was advanced, with the bottom of the test interval bounded by the bottom of the drilled section of the borehole.

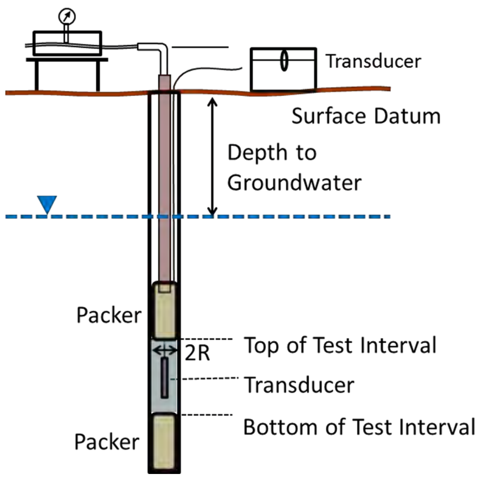
No leaks were noticed during packer inflation or testing. Test pressures based on transducer data.

Hydraulic conductivity value for test interval derived based on flow classification: Laminar (average for all steps).

Lugeon Test Analysis Report	
Project:	Valentine Gold Feasibility Geotechnical Investigation
Number:	80047.03
Client:	Terrane Geoscience Inc.

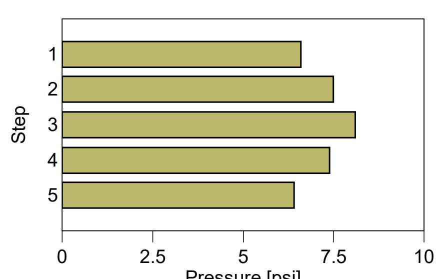
GEMTEC Consulting Engineers and Scientists

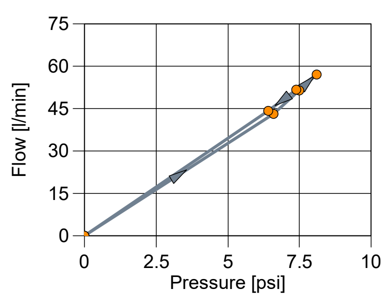
Location: Valentine Lake, NL	Lugeon Test: PT16	Tested bore: MA-GT-20-01
Test Conducted by: Terrane Geoscience Inc.		Test Date: 7/7/2020
Analysis Performed by: C. Anstey-Moore		Analysis Date: 10/27/2020
Lithology:		

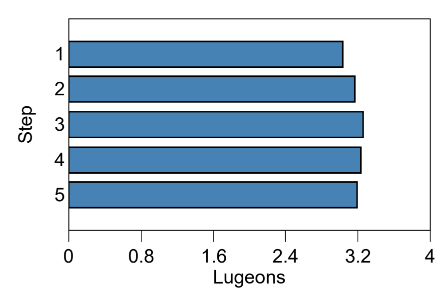


Top of Test Interval: 48.33 m
Bottom of Test Interval: 362.00 m
Length of Test Interval: 313.67 m
Depth to Groundwater: 0.00 m
Radius of Test Section: 0.05 m
Dip of bore: 40° from vertical
Vertical Top of Test Interval: 37.02 m
Vertical Bottom of Test Interval: 277.31 m

Step	Pressure [psi]	Flow Meter Readings [l]										Average Flow Rate [l/min]	Hydraulic Conductivity		
		1	2	3	4	5	6	7	8	9	10		[m/s]	[m/d]	Lugeon
1	7	374.00	417.00	460.00	503.00	546.50	590.00	633.50				43.25	6.92×10^{-7}	5.98×10^{-2}	3.0
2	8	673.00	724.50	775.50	827.00	878.00	929.50	981.00	1032.00	1083.50	1135.00	51.33	7.23×10^{-7}	6.25×10^{-2}	3.2
3	8	166.00	223.50	280.00	337.00	394.00	451.00					57.00	7.44×10^{-7}	6.42×10^{-2}	3.3
4	7	486.00	538.00	589.50	641.50	693.00	745.00	796.50	848.00	899.50		51.69	7.38×10^{-7}	6.38×10^{-2}	3.2
5	6	930.00	974.50	1018.50	1062.50	1107.00	1151.00	1195.50	1239.50	1283.50	1327.50	44.17	7.29×10^{-7}	6.30×10^{-2}	3.2
												Average	7.25×10^{-7}	6.27×10^{-2}	3.2







Laminar
Lugeon: 3.2
Hydraulic Conductivity: 7.25E-7 m/s
Hydraulic Conductivity: 6.27E-2 m/d

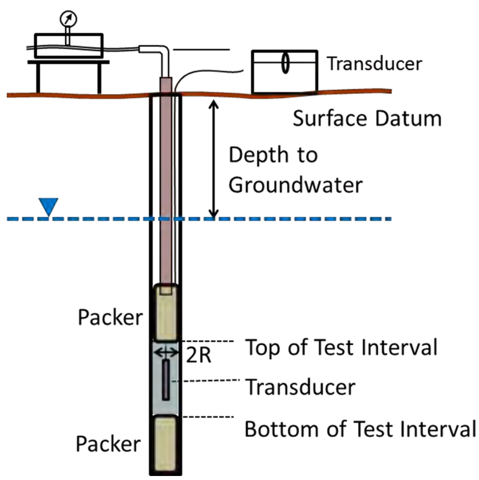
Performed using a single packer test assembly as the borehole was advanced, with the bottom of the test interval bounded by the bottom of the drilled section of the borehole.

~0.11 L/min system losses at 35 psi (during packer inflation); considered negligible in comparison to test flows. At pump maximum output only 20 psi attainable pressure (due to large test interval). Test pressures based on transducer data.

Hydraulic conductivity value for test interval derived based on flow classification: Laminar (average for all steps).

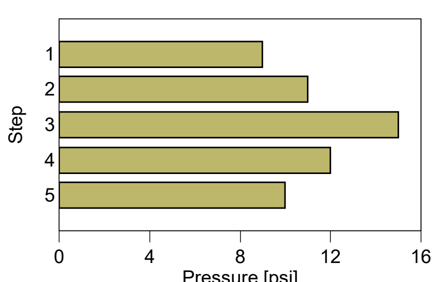
GEMTEC Consulting Engineers and Scientists	**Lugeon Test Analysis Report**
	Project: Valentine Gold Feasibility Geotechnical Investigation
	Number: 80047.03
	Client: Terrane Geoscience Inc.

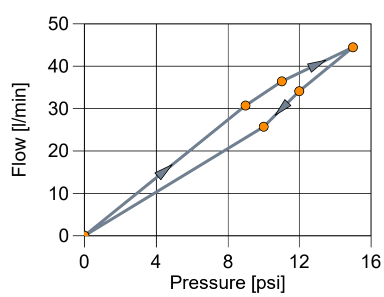
Location: Valentine Lake, NL	Lugeon Test: PT15	Tested bore: MA-GT-20-01
Test Conducted by: Terrane Geoscience Inc.		Test Date: 7/7/2020
Analysis Performed by: C. Anstey-Moore		Analysis Date: 10/27/2020
Lithology:		

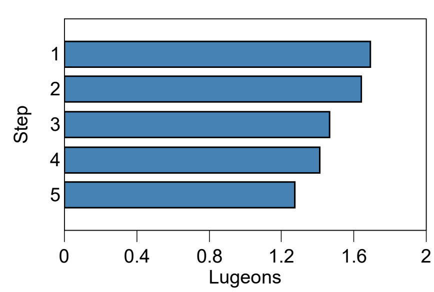


Top of Test Interval: 69.33 m
Bottom of Test Interval: 362.00 m
Length of Test Interval: 292.67 m
Depth to Groundwater: 0.00 m
Radius of Test Section: 0.05 m
Dip of bore: 40° from vertical
Vertical Top of Test Interval: 53.11 m
Vertical Bottom of Test Interval: 277.31 m

Step	Pressure [psi]	Flow Meter Readings [l]										Average Flow Rate [l/min]	Hydraulic Conductivity		
		1	2	3	4	5	6	7	8	9	10		[m/s]	[m/d]	Lugeon
1	9	489.00	520.50	551.00	581.50	612.50	643.00	674.00	704.50	735.00	765.50	30.72	3.84×10^{-7}	3.31×10^{-2}	1.7
2	11	828.50	865.50	901.80	938.00	974.50	1011.00	1047.00	1083.50	1120.00	1156.50	36.44	3.72×10^{-7}	3.22×10^{-2}	1.6
3	15	193.00	237.50	282.00	326.00	370.50	415.00	459.50				44.42	3.33×10^{-7}	2.87×10^{-2}	1.5
4	12	485.00	519.50	553.50	587.50	621.50						34.13	3.20×10^{-7}	2.76×10^{-2}	1.4
5	10	673.00	698.70	724.30	749.90	775.70	801.40	827.20	852.80	878.50	904.30	25.70	2.89×10^{-7}	2.49×10^{-2}	1.3
												Average	3.39×10^{-7}	2.93×10^{-2}	1.5







Void filling
Lugeon: 1.3
Hydraulic Conductivity: 2.89E-7 m/s
Hydraulic Conductivity: 2.49E-2 m/d

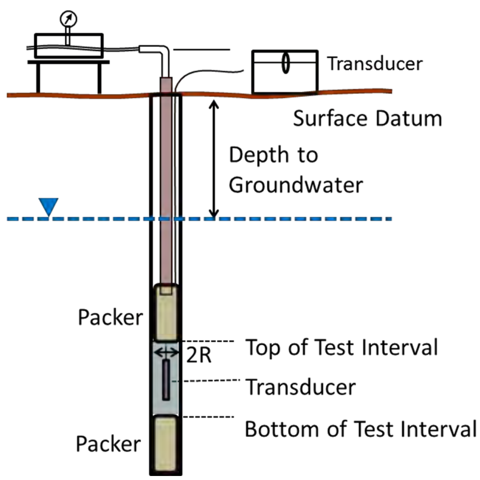
Performed using a single packer test assembly as the borehole was advanced, with the bottom of the test interval bounded by the bottom of the drilled section of the borehole.

~0.07 L/min system losses at 35 psi (during packer inflation); considered negligible in comparison to test flows. At pump maximum output only 20 psi attainable pressure (due to large test interval). Test pressures based on transducer data.

Although pressure-flow step profile suggests a Void Filling classification, the arithmetic mean (average) of the hydraulic conductivity (K) values determined for steps 1 and 2 used to calculate the representative K value for the test interval - K = 3.78E-07 m/s.

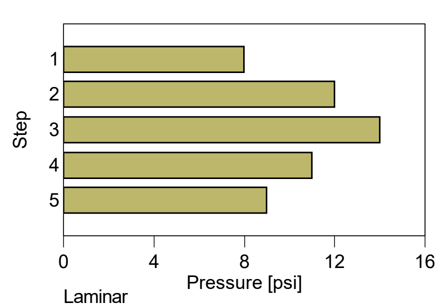
GEMTEC Consulting Engineers and Scientists	**Lugeon Test Analysis Report**
	Project: Valentine Gold Feasibility Geotechnical Investigation
	Number: 80047.03
	Client: Terrane Geoscience Inc.

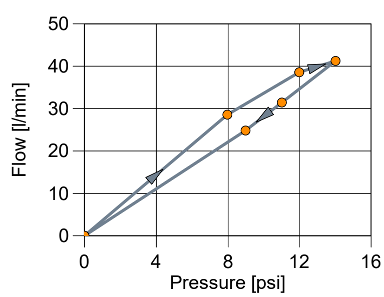
Location: Valentine Lake, NL	Lugeon Test: PT14	Tested bore: MA-GT-20-01
Test Conducted by: Terrane Geoscience Inc.		Test Date: 7/7/2020
Analysis Performed by: C. Anstey-Moore		Analysis Date: 10/27/2020
Lithology:		

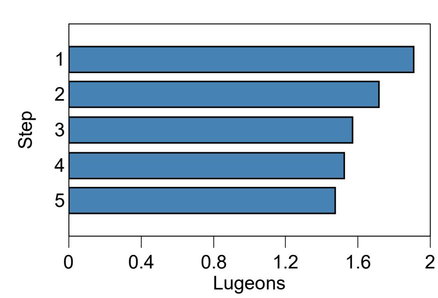


Top of Test Interval: 90.33 m
Bottom of Test Interval: 362.00 m
Length of Test Interval: 271.67 m
Depth to Groundwater: 0.00 m
Radius of Test Section: 0.05 m
Dip of bore: 40° from vertical
Vertical Top of Test Interval: 69.20 m
Vertical Bottom of Test Interval: 277.31 m

Step	Pressure [psi]	Flow Meter Readings [l]										Average Flow Rate [l/min]	Hydraulic Conductivity		
		1	2	3	4	5	6	7	8	9	10		[m/s]	[m/d]	Lugeon
1	8	899.50	927.50	956.50	985.30	1013.70	1042.40	1071.00	1099.50	1128.20	1156.70	28.58	4.29×10^{-7}	3.70×10^{-2}	1.9
2	12	200.00	238.50	277.50	315.50	354.50	393.00	431.50	470.00			38.57	3.86×10^{-7}	3.33×10^{-2}	1.7
3	14	550.00	591.50	632.50	673.50	715.00	756.50	797.50	838.50	879.50		41.19	3.53×10^{-7}	3.05×10^{-2}	1.6
4	11	940.00	971.40	1002.80	1034.10	1065.50	1096.90					31.38	3.42×10^{-7}	2.96×10^{-2}	1.5
5	9	174.90	199.80	224.50	249.30	274.00	298.90	323.80	348.60	373.50	398.30	24.82	3.31×10^{-7}	2.86×10^{-2}	1.5
												Average	3.68×10^{-7}	3.18×10^{-2}	1.6







Laminar
Lugeon: 1.6
Hydraulic Conductivity: 3.68E-7 m/s
Hydraulic Conductivity: 3.18E-2 m/d

Performed using a single packer test assembly as the borehole was advanced, with the bottom of the test interval bounded by the bottom of the drilled section of the borehole.

~0.005 L/min system losses at 50 psi (during packer inflation); considered negligible in comparison to test flows. At pump maximum output only 20 psi attainable pressure (due to large test interval). Test pressures based on transducer data.

Hydraulic conductivity value for test interval derived based on flow classification: Laminar (average for all steps).

GEMTEC
Consulting Engineers and Scientists

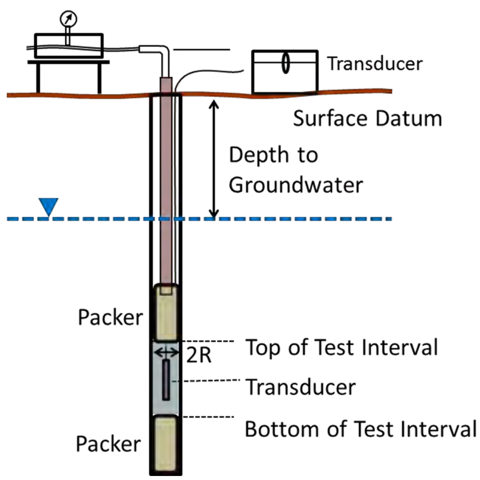
Lugeon Test Analysis Report

Project: Valentine Gold Feasibility Geotechnical Investigation

Number: 80047.03

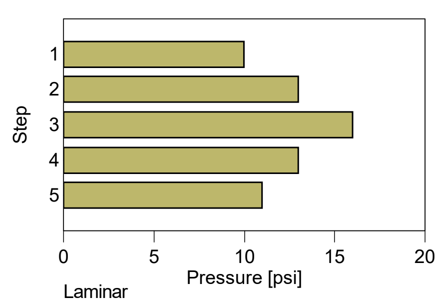
Client: Terrane Geoscience Inc.

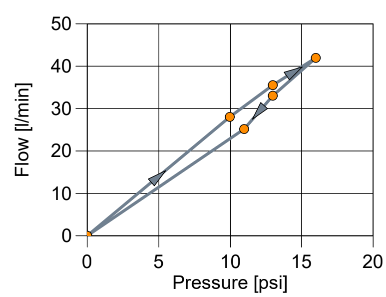
Location: Valentine Lake, NL	Lugeon Test: PT13	Tested bore: MA-GT-20-01
Test Conducted by: Terrane Geoscience Inc.		Test Date: 7/7/2020
Analysis Performed by: C. Anstey-Moore		Analysis Date: 10/27/2020
Lithology:		

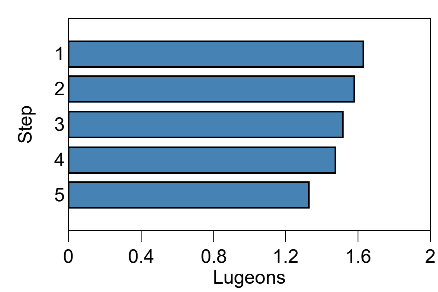


Top of Test Interval: 111.33 m
Bottom of Test Interval: 362.00 m
Length of Test Interval: 250.67 m
Depth to Groundwater: 0.00 m
Radius of Test Section: 0.05 m
Dip of bore: 40° from vertical
Vertical Top of Test Interval: 85.28 m
Vertical Bottom of Test Interval: 277.31 m

Step	Pressure [psi]	Flow Meter Readings [l]										Average Flow Rate [l/min]	Hydraulic Conductivity		
		1	2	3	4	5	6	7	8	9	10		[m/s]	[m/d]	Lugeon
1	10	650.00	678.10	706.60	734.60	762.60	790.60					28.12	3.62×10^{-7}	3.13×10^{-2}	1.6
2	13	860.00	895.50	931.50	966.50	1002.00	1037.50	1073.00	1108.50			35.50	3.52×10^{-7}	3.04×10^{-2}	1.6
3	16	180.00	222.00	263.50	305.50	347.50	389.50					41.90	3.37×10^{-7}	2.92×10^{-2}	1.5
4	13	450.00	483.50	516.50	549.50	582.50	615.50					33.10	3.28×10^{-7}	2.83×10^{-2}	1.5
5	11	660.00	685.20	710.40	735.70	761.00	786.30					25.26	2.96×10^{-7}	2.56×10^{-2}	1.3
												Average	3.35×10^{-7}	2.90×10^{-2}	1.5







Laminar
Lugeon: 1.5
Hydraulic Conductivity: 3.35E-7 m/s
Hydraulic Conductivity: 2.90E-2 m/d

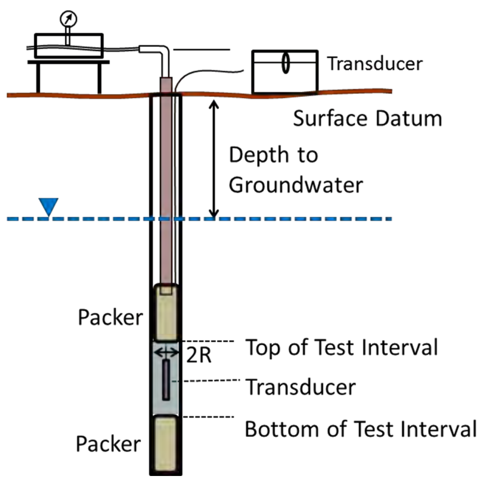
Performed using a single packer test assembly as the borehole was advanced, with the bottom of the test interval bounded by the bottom of the drilled section of the borehole.

No leaks were noticed during packer inflation or testing. At pump maximum output only 20 psi attainable pressure (due to large test interval). Test pressures based on transducer data. Flow reading difficult due to high flows.

Hydraulic conductivity value for test interval derived based on flow classification: Laminar (average for all steps).

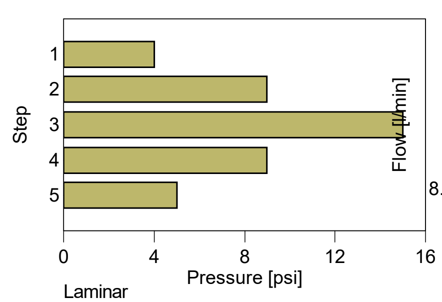
GEMTEC Consulting Engineers and Scientists	**Lugeon Test Analysis Report**
	Project: Valentine Gold Feasibility Geotechnical Investigation
	Number: 80047.03
	Client: Terrane Geoscience Inc.

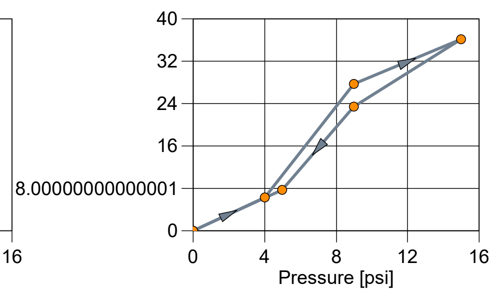
Location: Valentine Lake, NL	Lugeon Test: PT12	Tested bore: MA-GT-20-01
Test Conducted by: Terrane Geoscience Inc.		Test Date: 7/7/2020
Analysis Performed by: C. Anstey-Moore		Analysis Date: 10/27/2020
Lithology:		

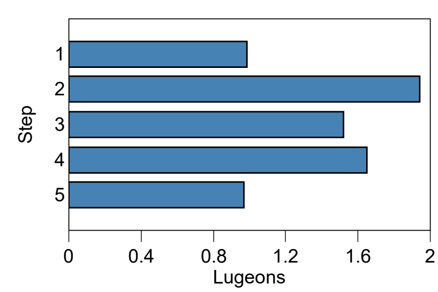


Top of Test Interval: 132.33 m
Bottom of Test Interval: 362.00 m
Length of Test Interval: 229.67 m
Depth to Groundwater: 0.00 m
Radius of Test Section: 0.05 m
Dip of bore: 40° from vertical
Vertical Top of Test Interval: 101.37 m
Vertical Bottom of Test Interval: 277.31 m

Step	Pressure [psi]	Flow Meter Readings [l]										Average Flow Rate [l/min]	Hydraulic Conductivity		
		1	2	3	4	5	6	7	8	9	10		[m/s]	[m/d]	Lugeon
1	4	360.00	366.20	372.45	378.75	385.00	391.25	397.50				6.25	2.17×10^{-7}	1.88×10^{-2}	1.0
2	9	617.00	644.80	672.50	700.00	727.60						27.65	4.28×10^{-7}	3.69×10^{-2}	1.9
3	15	1099.00	1131.00	1168.50	1206.00	1243.50						36.13	3.35×10^{-7}	2.90×10^{-2}	1.5
4	9	360.00	383.60	407.00	430.50	454.00	477.50					23.50	3.63×10^{-7}	3.14×10^{-2}	1.6
5	5	500.00	507.60	515.30	523.00	530.70						7.68	2.14×10^{-7}	1.85×10^{-2}	1.0
												Average	3.11×10^{-7}	2.69×10^{-2}	1.4







Laminar
Lugeon: 1.4
Hydraulic Conductivity: 3.11E-7 m/s
Hydraulic Conductivity: 2.69E-2 m/d

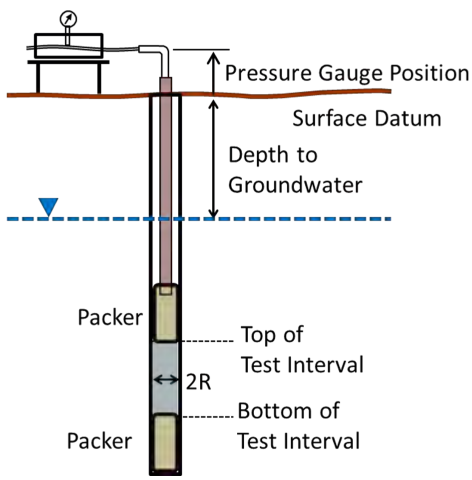
Performed using a single packer test assembly as the borehole was advanced, with the bottom of the test interval bounded by the bottom of the drilled section of the borehole.

No leaks were noticed during packer inflation or testing. At pump maximum output only 20 psi attainable pressure (due to large test interval). Prior to test, surface gauge read 5 psi with release valve fully opened. Test pressures based on transducer data.

Hydraulic conductivity value for test interval derived based on flow classification: Laminar (average all steps).

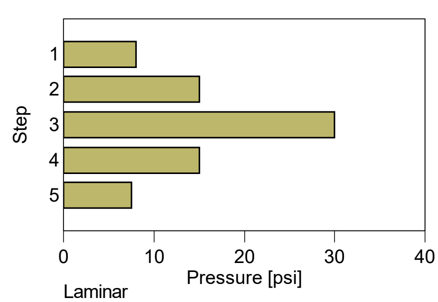
Lugeon Test Analysis Report	
Project:	Valentine Gold Feasibility Geotechnical Investigation
Number:	80047.03
Client:	Terrane Geoscience Inc.

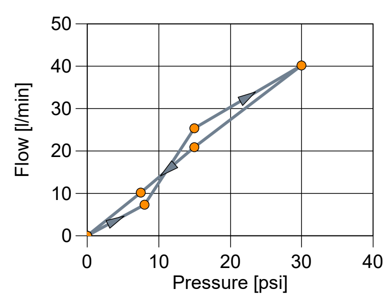
Location: Valentine Lake, NL	Lugeon Test: PT11	Tested bore: MA-GT-20-01
Test Conducted by: Terrane Geoscience Inc.		Test Date: 7/6/2020
Analysis Performed by: C. Anstey-Moore		Analysis Date: 10/27/2020
Lithology:		

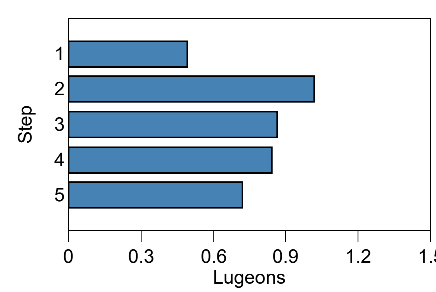


Top of Test Interval: 153.33 m
Bottom of Test Interval: 362.00 m
Length of Test Interval: 208.67 m
Gauge Position: 1.60 m
Depth to Groundwater: 0.00 m
Radius of Test Section: 0.05 m
Dip of bore: 40° from vertical
Vertical Top of Test Interval: 117.46 m
Vertical Bottom of Test Interval: 277.31 m

Step	Pressure [psi]	Flow Meter Readings [l]										Average Flow Rate [l/min]	Hydraulic Conductivity		
		1	2	3	4	5	6	7	8	9	10		[m/s]	[m/d]	Lugeon
1	8	64.00	71.30	78.60	85.85	93.10	100.35					7.27	1.07×10^{-7}	9.26×10^{-3}	0.49
2	15	210.80	236.50	261.90	287.20	312.70	338.00	363.10	388.50	413.50	438.60	25.31	2.22×10^{-7}	1.92×10^{-2}	1.02
3	30	649.00	693.00	733.00	773.00	812.00	852.00	892.00	931.50	971.00	1010.50	40.17	1.89×10^{-7}	1.63×10^{-2}	0.86
4	15	80.00	101.00	121.90	142.80	163.80	184.80	205.80				20.97	1.84×10^{-7}	1.59×10^{-2}	0.84
5	8	240.00	250.00	260.10	270.30	280.50	290.70					10.14	1.57×10^{-7}	1.36×10^{-2}	0.72
												Average	1.72×10^{-7}	1.48×10^{-2}	0.79







Laminar
Lugeon: 0.788
Hydraulic Conductivity: 1.72E-7 m/s
Hydraulic Conductivity: 1.48E-2 m/d

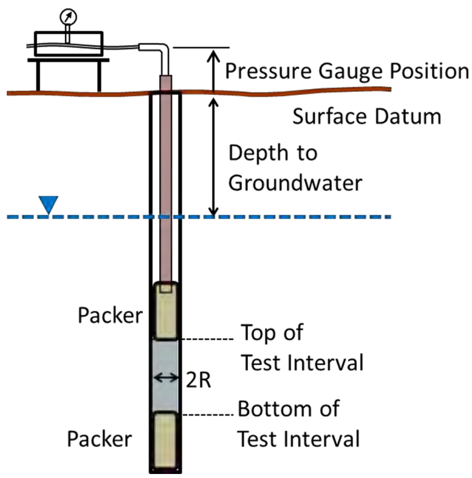
Performed using a single packer test assembly as the borehole was advanced, with the bottom of the test interval bounded by the bottom of the drilled section of the borehole.

No leaks were noticed during packer inflation or testing.

Hydraulic conductivity value for test interval derived based on flow classification: Laminar (average all steps).

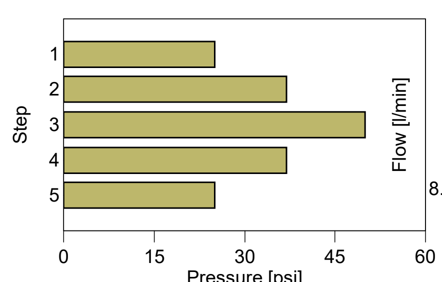
GEMTEC Consulting Engineers and Scientists	**Lugeon Test Analysis Report**
	Project: Valentine Gold Feasibility Geotechnical Investigation
	Number: 80047.03
	Client: Terrane Geoscience Inc.

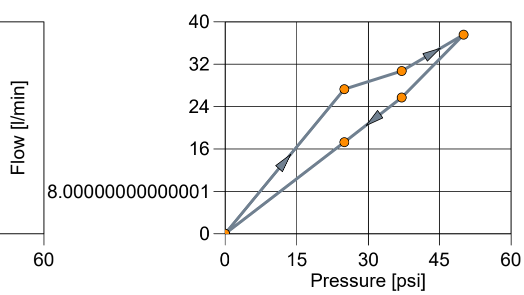
Location: Valentine Lake, NL	Lugeon Test: PT10	Tested bore: MA-GT-20-01
Test Conducted by: Terrane Geoscience Inc.		Test Date: 7/6/2020
Analysis Performed by: C. Anstey-Moore		Analysis Date: 10/27/2020
Lithology:		

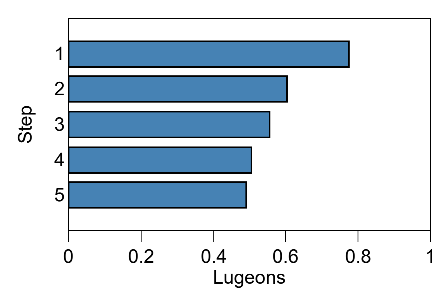


Top of Test Interval: 174.33 m
Bottom of Test Interval: 362.00 m
Length of Test Interval: 187.67 m
Gauge Position: 1.60 m
Depth to Groundwater: 0.00 m
Radius of Test Section: 0.05 m
Dip of bore: 40° from vertical
Vertical Top of Test Interval: 133.54 m
Vertical Bottom of Test Interval: 277.31 m

Step	Pressure [psi]	Flow Meter Readings [l]										Average Flow Rate [l/min]	Hydraulic Conductivity		
		1	2	3	4	5	6	7	8	9	10		[m/s]	[m/d]	Lugeon
1	25	597.70	625.60	653.30	680.80	708.20	735.30	762.30	789.30	816.30		27.32	1.66×10^{-7}	1.43×10^{-2}	0.77
2	37	869.80	901.00	932.00	962.90	993.50	1024.30	1055.00	1085.10	1115.60	1145.80	30.67	1.29×10^{-7}	1.12×10^{-2}	0.60
3	50	247.90	285.50	323.00	360.50	398.00						37.53	1.19×10^{-7}	1.03×10^{-2}	0.55
4	37	457.50	483.30	508.80	534.50	560.20	585.70	611.40	637.10			25.66	1.08×10^{-7}	9.34×10^{-3}	0.50
5	25	675.60	692.55	709.65	726.90	744.30	761.60	779.11	796.60	814.20		17.33	1.05×10^{-7}	9.08×10^{-3}	0.49
												Average	1.25×10^{-7}	1.08×10^{-2}	0.59







Void filling
Lugeon: 0.491
Hydraulic Conductivity: 1.05E-7 m/s
Hydraulic Conductivity: 9.08E-3 m/d

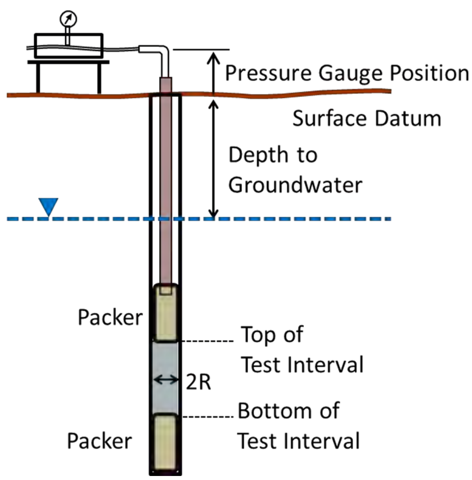
Performed using a single packer test assembly as the borehole was advanced, with the bottom of the test interval bounded by the bottom of the drilled section of the borehole.

~0.05 L/min system losses at 50 psi (during packer inflation); considered negligible in comparison to test flows. Pressure adjustments required during steps 1, 3, 4, and 5.

Although pressure-flow step profile suggests a Void Filling classification, the arithmetic mean (average) of the hydraulic conductivity (K) values determined for all steps used to calculate the representative K value for the test interval - K = 1.25E-7 m/s.

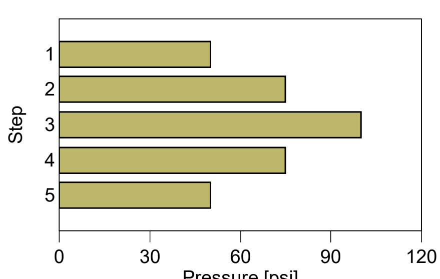
Lugeon Test Analysis Report	
Project:	Valentine Gold Feasibility Geotechnical Investigation
Number:	80047.03
Client:	Terrane Geoscience Inc.

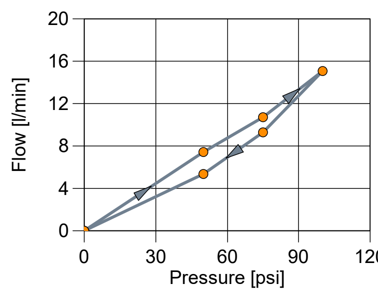
Location: Valentine Lake, NL	Lugeon Test: PT9	Tested bore: MA-GT-20-01
Test Conducted by: Terrane Geoscience Inc.		Test Date: 7/6/2020
Analysis Performed by: C. Anstey-Moore		Analysis Date: 10/27/2020
Lithology:		

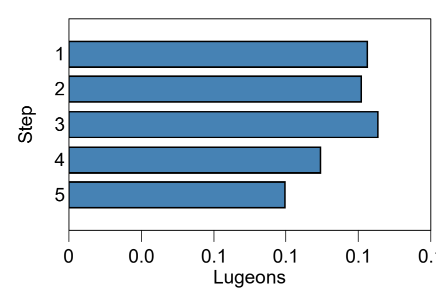


Top of Test Interval: 195.33 m
Bottom of Test Interval: 362.00 m
Length of Test Interval: 166.67 m
Gauge Position: 1.60 m
Depth to Groundwater: 0.00 m
Radius of Test Section: 0.05 m
Dip of bore: 40° from vertical
Vertical Top of Test Interval: 149.63 m
Vertical Bottom of Test Interval: 277.31 m

Step	Pressure [psi]	Flow Meter Readings [l]										Average Flow Rate [l/min]	Hydraulic Conductivity		
		1	2	3	4	5	6	7	8	9	10		[m/s]	[m/d]	Lugeon
1	50	960.95	968.90	976.70	984.35	991.90	999.30	1006.55	1013.75	1020.87	1027.85	7.43	2.62×10^{-8}	2.27×10^{-3}	0.12
2	75	91.00	103.50	114.95	125.50	136.00	146.60	157.00	167.35	177.60	187.75	10.75	2.57×10^{-8}	2.22×10^{-3}	0.12
3	100	282.60	298.35	313.25	328.15	343.00	357.90					15.06	2.72×10^{-8}	2.35×10^{-3}	0.13
4	75	373.00	382.10	391.35	400.70	410.00	429.25	428.60	437.85	447.10		9.26	2.21×10^{-8}	1.91×10^{-3}	0.10
5	50	441.50	447.08	452.37	457.63	462.91	468.25	473.59	479.00	484.40	489.89	5.38	1.90×10^{-8}	1.64×10^{-3}	0.09
												Average	2.40×10^{-8}	2.08×10^{-3}	0.11







Void filling
Lugeon: 0.09
Hydraulic Conductivity: 1.90E-8 m/s
Hydraulic Conductivity: 1.64E-3 m/d

Performed using a single packer test assembly as the borehole was advanced, with the bottom of the test interval bounded by the bottom of the drilled section of the borehole.

~0.28 L/min system losses at 100 psi (during packer inflation); considered negligible in comparison to test flows. Several pressure adjustments required during step 3.

Although pressure-flow step profile suggests a Void Filling classification, the arithmetic mean (average) of the hydraulic conductivity (K) values determined for steps 1,2, and 3 used to calculate the representative K value for the test interval - K = 2.64E-8 m/s.

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Lugeon Test Analysis Report

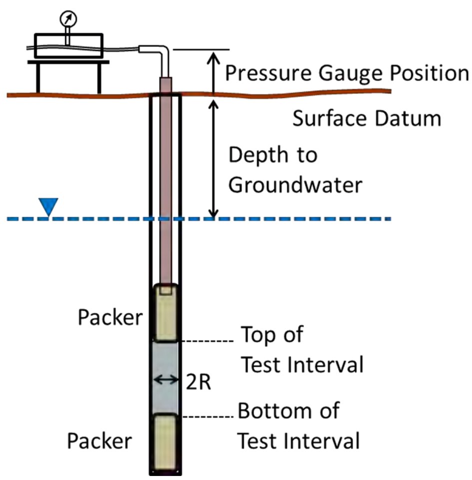
Project: Valentine Gold Feasibility Geotechnical Investigation

Number: 80047.03

Client: Terrane Geoscience Inc.

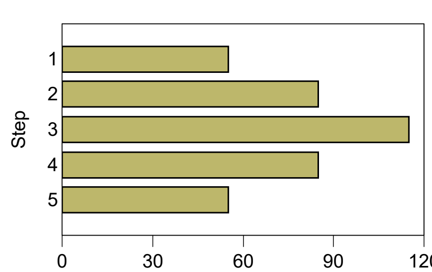
Location: Valentine Lake, NL	Lugeon Test: PT8	Tested bore: MA-GT-20-01
Test Conducted by: Terrane Geoscience Inc.		Test Date: 7/6/2020
Analysis Performed by: C. Anstey-Moore		Analysis Date: 10/27/2020

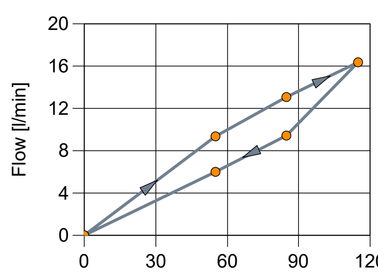
Lithology:

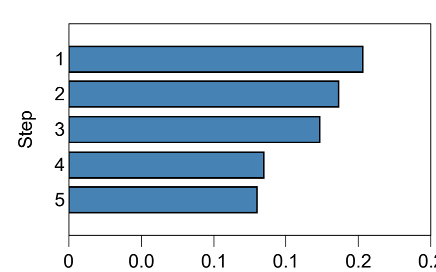


Top of Test Interval: 216.33 m
Bottom of Test Interval: 362.00 m
Length of Test Interval: 145.67 m
Gauge Position: 1.60 m
Depth to Groundwater: 0.00 m
Radius of Test Section: 0.05 m
Dip of bore: 40° from vertical
Vertical Top of Test Interval: 165.72 m
Vertical Bottom of Test Interval: 277.31 m

Step	Pressure [psi]	Flow Meter Readings [l]										Average Flow Rate [l/min]	Hydraulic Conductivity		
		1	2	3	4	5	6	7	8	9	10		[m/s]	[m/d]	Lugeon
1	55	415.70	425.60	435.10	444.50	453.75	462.85	471.75				9.34	3.39×10^{-8}	2.93×10^{-3}	0.16
2	85	524.70	538.90	552.30	565.55	578.65	591.60	604.40	617.10	629.65	642.20	13.06	3.11×10^{-8}	2.68×10^{-3}	0.15
3	115	703.00	719.80	736.40	752.95	769.35	785.70	801.90	818.00	833.95	850.00	16.33	2.89×10^{-8}	2.50×10^{-3}	0.14
4	85	857.00	866.30	875.75	885.15	894.65	904.15	913.55	923.10			9.44	2.25×10^{-8}	1.94×10^{-3}	0.11
5	55	941.50	947.80	953.77	959.65	965.50	971.35					5.97	2.16×10^{-8}	1.87×10^{-3}	0.10
												Average	2.76×10^{-8}	2.38×10^{-3}	0.13







Void filling
Lugeon: 0.10
Hydraulic Conductivity: 2.16E-8 m/s
Hydraulic Conductivity: 1.87E-3 m/d

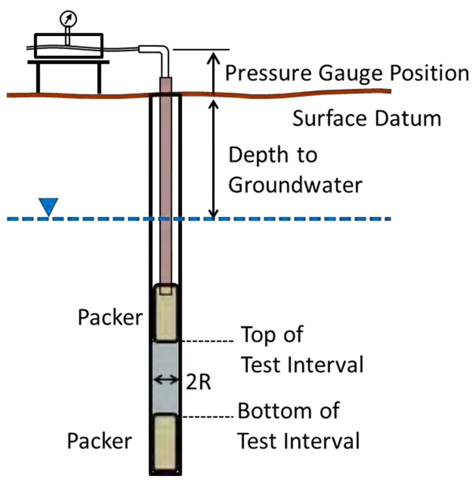
Performed using a single packer test assembly as the borehole was advanced, with the bottom of the test interval bounded by the bottom of the drilled section of the borehole.

No leaks were noticed during packer inflation or testing. A pressure adjustment required during steps 1, 3, and 5.

Although pressure-flow step profile suggests a Void Filling classification, the arithmetic mean (average) of the hydraulic conductivity (K) values determined for all steps used to calculate the representative K value for the test interval - K = 2.76E-8 m/s.

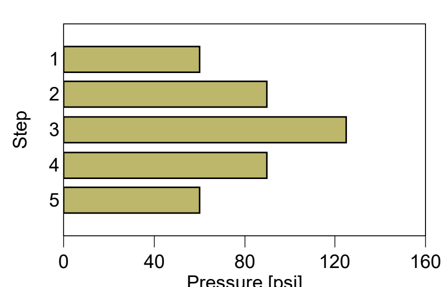
Lugeon Test Analysis Report	
Project:	Valentine Gold Feasibility Geotechnical Investigation
Number:	80047.03
Client:	Terrane Geoscience Inc.

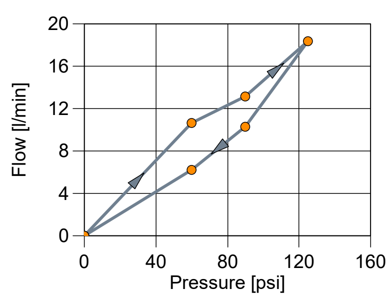
Location: Valentine Lake, NL	Lugeon Test: PT7	Tested bore: MA-GT-20-01
Test Conducted by: Terrane Geoscience Inc.		Test Date: 7/6/2020
Analysis Performed by: C. Anstey-Moore		Analysis Date: 10/27/2020
Lithology:		

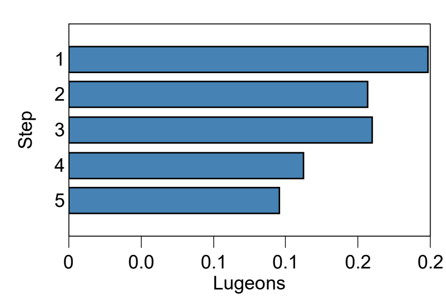


Top of Test Interval: 237.33 m
Bottom of Test Interval: 362.00 m
Length of Test Interval: 124.67 m
Gauge Position: 1.60 m
Depth to Groundwater: 0.00 m
Radius of Test Section: 0.05 m
Dip of bore: 40° from vertical
Vertical Top of Test Interval: 181.81 m
Vertical Bottom of Test Interval: 277.31 m

Step	Pressure [psi]	Flow Meter Readings [l]										Average Flow Rate [l/min]	Hydraulic Conductivity		
		1	2	3	4	5	6	7	8	9	10		[m/s]	[m/d]	Lugeon
1	60	797.00	808.75	820.00	830.90	841.70	852.20	862.60	872.80	882.90	892.80	10.64	4.07×10^{-8}	3.51×10^{-3}	0.20
2	90	1000.80	1014.10	1027.40	1040.60	1053.65	1066.60	1079.55				13.13	3.38×10^{-8}	2.92×10^{-3}	0.17
3	125	165.40	183.85	202.30	220.55	238.80						18.35	3.43×10^{-8}	2.96×10^{-3}	0.17
4	90	285.00	295.30	305.60	315.95	326.20	336.50					10.30	2.66×10^{-8}	2.29×10^{-3}	0.13
5	60	353.10	359.25	365.55	371.80	377.95	384.25	390.50				6.23	2.38×10^{-8}	2.06×10^{-3}	0.12
												Average	3.18×10^{-8}	2.75×10^{-3}	0.16







Void filling
Lugeon: 0.116
Hydraulic Conductivity: 2.38E-8 m/s
Hydraulic Conductivity: 2.06E-3 m/d

Performed using a single packer test assembly as the borehole was advanced, with the bottom of the test interval bounded by the bottom of the drilled section of the borehole.

No leaks were noticed during packer inflation or testing. A pressure adjustment required during steps 1, 2, 3 and 5.

Although pressure-flow step profile suggests a Void Filling classification, the arithmetic mean (average) of the hydraulic conductivity (K) values determined for all steps used to calculate the representative K value for the test interval - K = 3.18E-8 m/s.

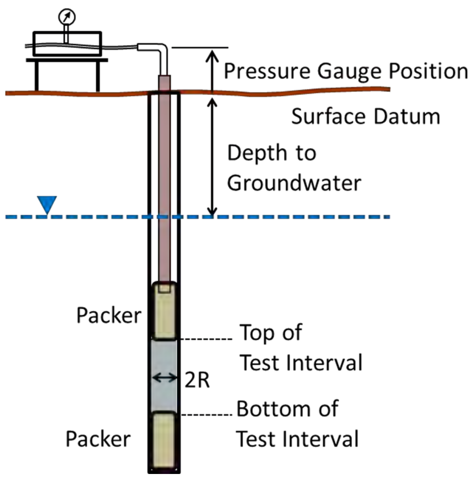
Lugeon Test Analysis Report

Project: Valentine Gold Feasibility Geotechnical Investigation

Number: 80047.03

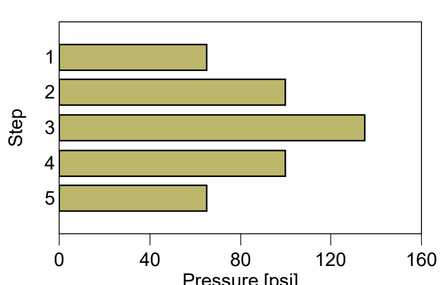
Client: Terrane Geoscience Inc.

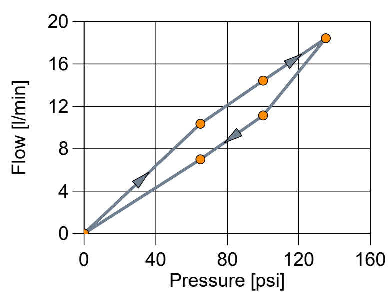
Location: Valentine Lake, NL	Lugeon Test: PT6	Tested bore: MA-GT-20-01
Test Conducted by: Terrane Geoscience Inc.		Test Date: 7/6/2020
Analysis Performed by: C. Anstey-Moore		Analysis Date: 10/27/2020
Lithology:		

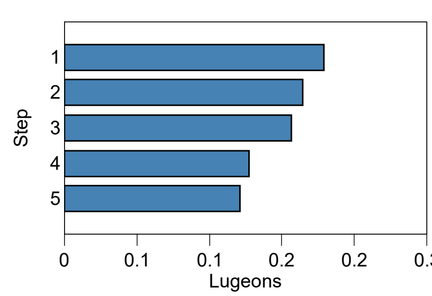


Top of Test Interval: 258.33 m
Bottom of Test Interval: 362.00 m
Length of Test Interval: 103.67 m
Gauge Position: 1.60 m
Depth to Groundwater: 0.00 m
Radius of Test Section: 0.05 m
Dip of bore: 40° from vertical
Vertical Top of Test Interval: 197.89 m
Vertical Bottom of Test Interval: 277.31 m

Step	Pressure [psi]	Flow Meter Readings [l]										Average Flow Rate [l/min]	Hydraulic Conductivity		
		1	2	3	4	5	6	7	8	9	10		[m/s]	[m/d]	Lugeon
1	65	36.05	46.90	57.70	68.35	78.75	89.10	99.30	109.30	119.25	129.00	10.33	4.29×10^{-8}	3.71×10^{-3}	0.21
2	100	237.10	251.80	266.50	281.00	295.50	309.80	323.90	338.00			14.41	3.94×10^{-8}	3.40×10^{-3}	0.20
3	135	554.00	573.20	591.75	610.00	628.15	646.30					18.46	3.76×10^{-8}	3.25×10^{-3}	0.19
4	100	650.00	661.20	672.30	683.40	694.60	705.80	717.00				11.17	3.05×10^{-8}	2.64×10^{-3}	0.15
5	65	727.60	734.35	741.30	748.20	755.15	762.20	769.30	776.40	783.55		6.99	2.90×10^{-8}	2.51×10^{-3}	0.15
												Average	3.59×10^{-8}	3.10×10^{-3}	0.18







Void filling
Lugeon: 0.145
Hydraulic Conductivity: 2.90E-8 m/s
Hydraulic Conductivity: 2.51E-3 m/d

Performed using a single packer test assembly as the borehole was advanced, with the bottom of the test interval bounded by the bottom of the drilled section of the borehole.

~0.06 L/min system losses at 135 psi (during packer inflation); considered negligible in comparison to test flows. Several pressure adjustments required during step 3.

Although pressure-flow step profile suggests a Void Filling classification, the arithmetic mean (average) of the hydraulic conductivity (K) values determined for all steps used to calculate the representative K value for the test interval - K = 3.59E-8 m/s.

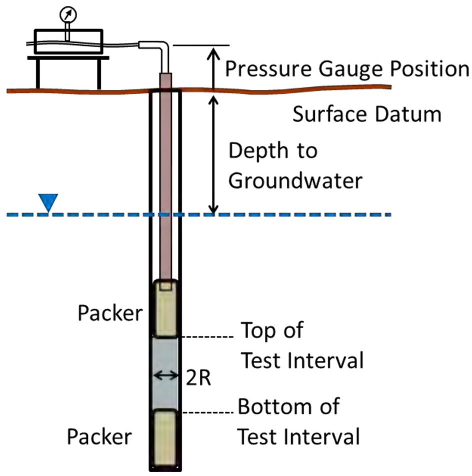
Lugeon Test Analysis Report

Project: Valentine Gold Feasibility Geotechnical Investigation

Number: 80047.03

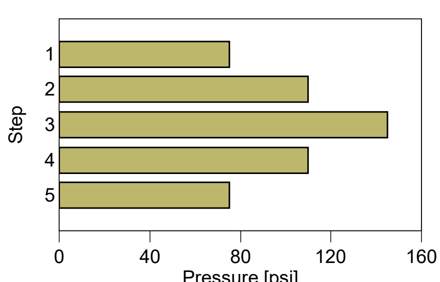
Client: Terrane Geoscience Inc.

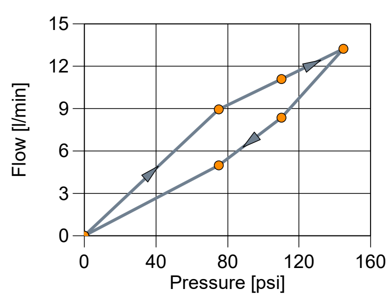
Location: Valentine Lake, NL	Lugeon Test: PT5	Tested bore: MA-GT-20-01
Test Conducted by: Terrane Geoscience Inc.		Test Date: 7/6/2020
Analysis Performed by: C. Anstey-Moore		Analysis Date: 10/27/2020
Lithology:		

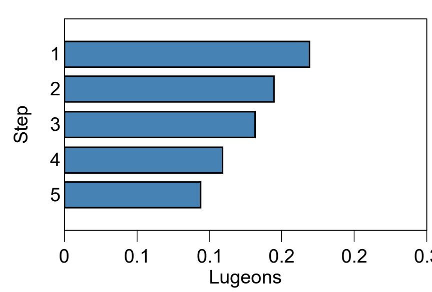


Top of Test Interval: 279.33 m
Bottom of Test Interval: 362.00 m
Length of Test Interval: 82.67 m
Gauge Position: 1.60 m
Depth to Groundwater: 0.00 m
Radius of Test Section: 0.05 m
Dip of bore: 40° from vertical
Vertical Top of Test Interval: 213.98 m
Vertical Bottom of Test Interval: 277.31 m

Step	Pressure [psi]	Flow Meter Readings [l]										Average Flow Rate [l/min]	Hydraulic Conductivity		
		1	2	3	4	5	6	7	8	9	10		[m/s]	[m/d]	Lugeon
1	75	565.50	575.20	584.55	593.77	602.80	611.60	620.35	629.00	637.60	646.05	8.95	3.94×10^{-8}	3.40×10^{-3}	0.20
2	110	677.00	688.55	699.95	711.20	722.25	733.30	744.25	755.20	766.10	776.95	11.11	3.36×10^{-8}	2.91×10^{-3}	0.17
3	145	797.00	811.05	824.45	837.80	850.90	864.05	877.05	890.15	903.15	916.15	13.24	3.06×10^{-8}	2.64×10^{-3}	0.16
4	110	928.00	936.35	944.80	953.15	961.45	969.80	978.15				8.36	2.53×10^{-8}	2.19×10^{-3}	0.13
5	75	991.90	996.82	1001.75	1006.73	1011.70	1016.68	1021.66				4.96	2.18×10^{-8}	1.89×10^{-3}	0.11
												Average	3.01×10^{-8}	2.60×10^{-3}	0.16







Void filling
Lugeon: 0.113
Hydraulic Conductivity: 2.18E-8 m/s
Hydraulic Conductivity: 1.89E-3 m/d

Performed using a single packer test assembly as the borehole was advanced, with the bottom of the test interval bounded by the bottom of the drilled section of the borehole.

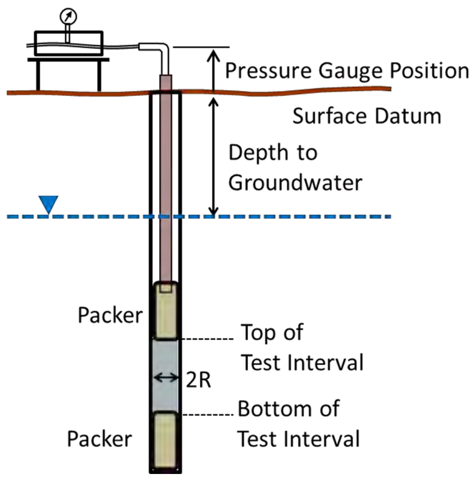
No leaks were noticed during packer inflation or testing.

Although pressure-flow step profile suggests a Void Filling classification, the arithmetic mean (average) of the hydraulic conductivity (K) values determined for all steps used to calculate the representative K value for the test interval - K = 3.01E-8 m/s.

Lugeon Test Analysis Report	
Project:	Valentine Gold Feasibility Geotechnical Investigation
Number:	80047.03
Client:	Terrane Geoscience Inc.

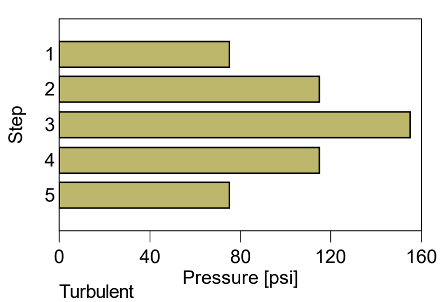
GEMTEC Consulting Engineers and Scientists

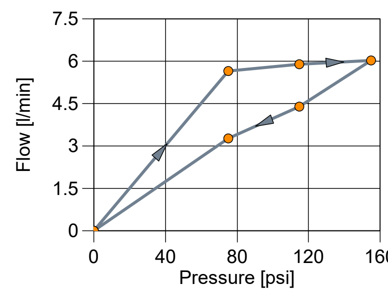
Location: Valentine Lake, NL	Lugeon Test: PT4	Tested bore: MA-GT-20-01
Test Conducted by: Terrane Geoscience Inc.		Test Date: 7/6/2020
Analysis Performed by: C. Anstey-Moore		Analysis Date: 10/27/2020
Lithology:		

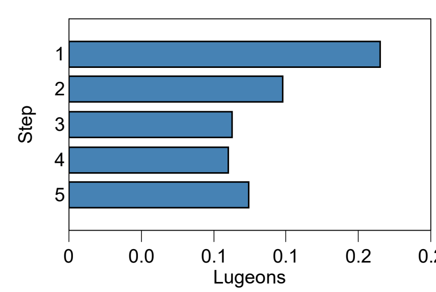


Top of Test Interval: 300.33 m
Bottom of Test Interval: 362.00 m
Length of Test Interval: 61.67 m
Gauge Position: 1.60 m
Depth to Groundwater: 0.00 m
Radius of Test Section: 0.05 m
Dip of bore: 40° from vertical
Vertical Top of Test Interval: 230.07 m
Vertical Bottom of Test Interval: 277.31 m

Step	Pressure [psi]	Flow Meter Readings [l]										Average Flow Rate [l/min]	Hydraulic Conductivity		
		1	2	3	4	5	6	7	8	9	10		[m/s]	[m/d]	Lugeon
1	75	300.00	305.84	311.70	317.43	223.12	328.78	334.35	340.00	345.41	350.92	5.66	3.19×10^{-8}	2.75×10^{-3}	0.17
2	115	380.00	386.15	392.10	398.10	403.98	409.75	415.71	421.51	427.31	432.95	5.88	2.18×10^{-8}	1.89×10^{-3}	0.12
3	155	460.00	466.31	472.63	478.71	484.71	490.55	496.47	502.48	508.39	514.19	6.02	1.67×10^{-8}	1.44×10^{-3}	0.09
4	115	535.00	539.48	543.89	548.29	552.70	557.07	561.44	565.81			4.40	1.63×10^{-8}	1.41×10^{-3}	0.09
5	75	575.00	578.29	581.57	584.85	588.10	591.35	594.60				3.27	1.84×10^{-8}	1.59×10^{-3}	0.10
												Average	2.10×10^{-8}	1.82×10^{-3}	0.11







Turbulent
Lugeon: 0.118
Hydraulic Conductivity: 2.18E-8 m/s
Hydraulic Conductivity: 1.89E-3 m/d

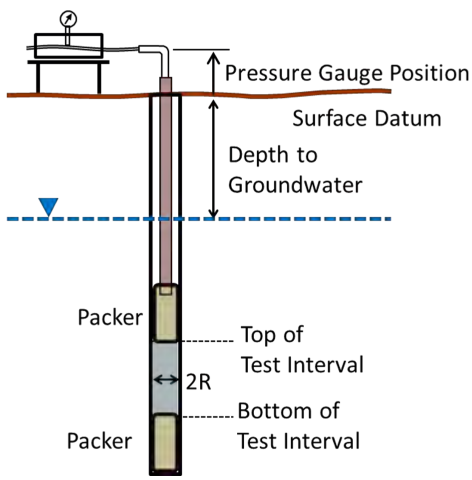
Performed using a single packer test assembly as the borehole was advanced, with the bottom of the test interval bounded by the bottom of the drilled section of the borehole.

No leaks were noticed during packer inflation or testing.

Hydraulic conductivity value for test interval derived based on flow classification: Turbulent (Step 2).

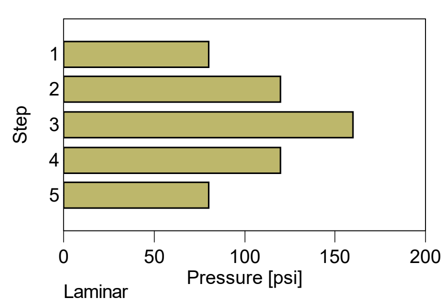
GEMTEC Consulting Engineers and Scientists	**Lugeon Test Analysis Report**
	Project: Valentine Gold Feasibility Geotechnical Investigation
	Number: 80047.03
	Client: Terrane Geoscience Inc.

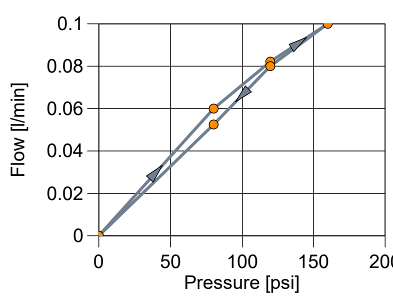
Location: Valentine Lake, NL	Lugeon Test: PT3	Tested bore: MA-GT-20-01
Test Conducted by: Terrane Geoscience Inc.		Test Date: 7/6/2020
Analysis Performed by: C. Anstey-Moore		Analysis Date: 10/27/2020
Lithology:		

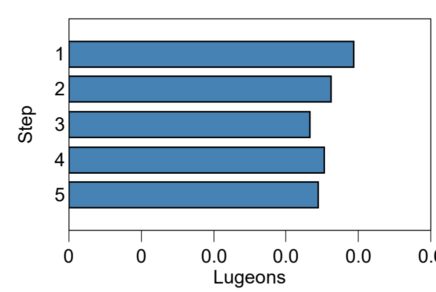


Top of Test Interval: 308.33 m
Bottom of Test Interval: 312.81 m
Length of Test Interval: 4.48 m
Gauge Position: 1.60 m
Depth to Groundwater: 0.00 m
Radius of Test Section: 0.05 m
Dip of bore: 40° from vertical
Vertical Top of Test Interval: 236.19 m
Vertical Bottom of Test Interval: 239.63 m

Step	Pressure [psi]	Flow Meter Readings [l]										Average Flow Rate [l/min]	Hydraulic Conductivity		
		1	2	3	4	5	6	7	8	9	10		[m/s]	[m/d]	Lugeon
1	80	270.45	270.51	270.57	270.63							0.06	2.79×10^{-9}	2.41×10^{-4}	0.02
2	120	271.10	271.18	271.26	271.33	271.42	271.51					0.08	2.56×10^{-9}	2.21×10^{-4}	0.02
3	160	272.10	272.20	272.30	272.40	272.50						0.10	2.35×10^{-9}	2.03×10^{-4}	0.02
4	120	272.50	272.58	272.66	272.74							0.08	2.50×10^{-9}	2.16×10^{-4}	0.02
5	80	272.65	272.71	272.76	272.81	272.86						0.05	2.44×10^{-9}	2.11×10^{-4}	0.02
												Average	2.53×10^{-9}	2.18×10^{-4}	0.02







Laminar
Lugeon: 0.02
Hydraulic Conductivity: 2.53E-9 m/s
Hydraulic Conductivity: 2.18E-4 m/d

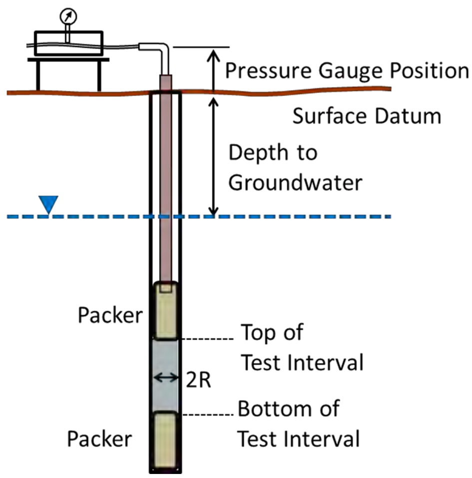
Performed using a straddle double packer test assembly to isolate test interval.

No leaks were noticed during packer inflation or testing.

Hydraulic conductivity value for test interval derived based on flow classification: Laminar (average for all steps).

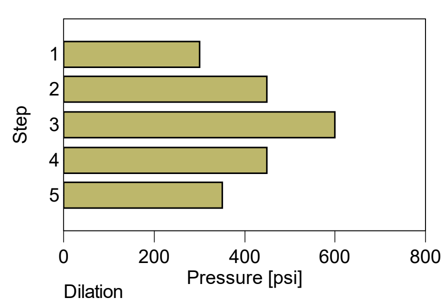
GEMTEC Consulting Engineers and Scientists	**Lugeon Test Analysis Report**
	Project: Valentine Gold Feasibility Geotechnical Investigation
	Number: 80047.03
	Client: Terrane Geoscience Inc.

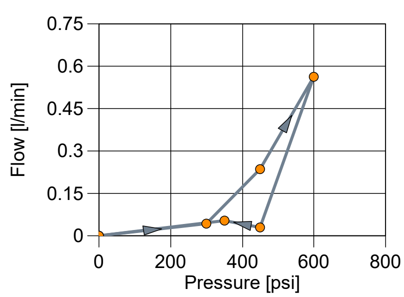
Location: Valentine Lake, NL	Lugeon Test: PT2	Tested bore: MA-GT-20-01
Test Conducted by: Terrane Geoscience Inc.		Test Date: 7/5/2020
Analysis Performed by: C. Anstey-Moore		Analysis Date: 10/27/2020
Lithology:		

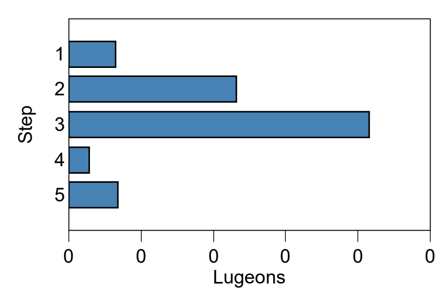


Top of Test Interval: 321.33 m
Bottom of Test Interval: 362.00 m
Length of Test Interval: 40.67 m
Gauge Position: 1.60 m
Depth to Groundwater: 0.00 m
Radius of Test Section: 0.05 m
Dip of bore: 40° from vertical
Vertical Top of Test Interval: 246.15 m
Vertical Bottom of Test Interval: 277.31 m

Step	Pressure [psi]	Flow Meter Readings [l]										Average Flow Rate [l/min]	Hydraulic Conductivity		
		1	2	3	4	5	6	7	8	9	10		[m/s]	[m/d]	Lugeon
1	300	260.82	260.87	260.90	260.95	260.99						0.04	9.00×10^{-11}	7.77×10^{-6}	0.001
2	450	262.90	263.16	263.40	263.62	263.84						0.23	3.23×10^{-10}	2.79×10^{-5}	0.002
3	600	268.30	268.89	269.44	269.95	270.53	271.11					0.56	5.80×10^{-10}	5.01×10^{-5}	0.003
4	450	269.21	269.23	269.27	269.28	269.30	269.34	269.38				0.03	3.89×10^{-11}	3.36×10^{-6}	0.000
5	350	266.90	266.98	267.03	267.06							0.05	9.41×10^{-11}	8.13×10^{-6}	0.001
												Average	2.25×10^{-10}	1.95×10^{-5}	0.001







Dilation
Lugeon: 0.001
Hydraulic Conductivity: 9.00E-11 m/s
Hydraulic Conductivity: 7.77E-6 m/d

Performed using a single packer test assembly as the borehole was advanced, with the bottom of the test interval bounded by the bottom of the drilled section of the borehole.

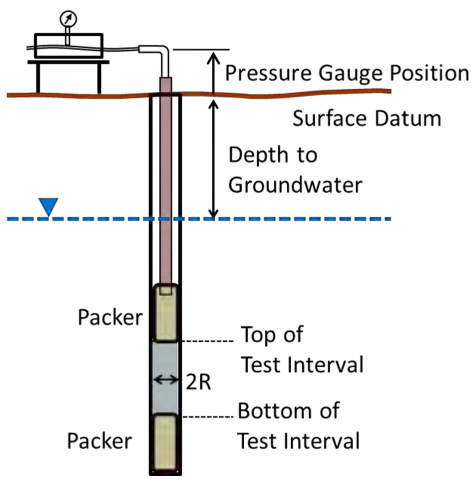
No flow at test pressures up to Pmax 175 psi. Increased test step pressures up to Pmax 600 psi. Surface gauge pressure readings checked with transducer data.

Note: ~0.05 L/min system losses at 300 psi (during packer inflation). Not accounted for in test flow data.

Hydraulic conductivity value for test interval derived based on flow classification: Dilation (Step 1).

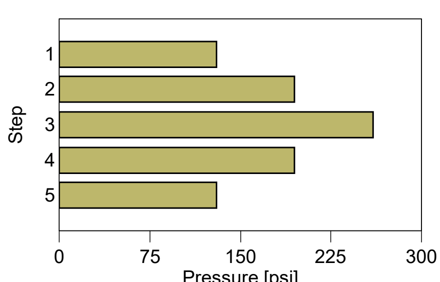
GEMTEC Consulting Engineers and Scientists	Lugeon Test Analysis Report
	Project: Valentine Gold Feasibility Geotechnical Investigation
	Number: 80047.03
	Client: Terrane Geoscience Inc.

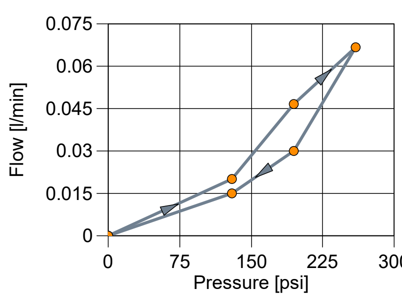
Location: Valentine Lake, NL	Lugeon Test: PT1	Tested bore: MA-GT-20-01
Test Conducted by: Terrane Geoscience Inc.		Test Date: 7/5/2020
Analysis Performed by: C. Anstey-Moore		Analysis Date: 10/27/2020
Lithology:		

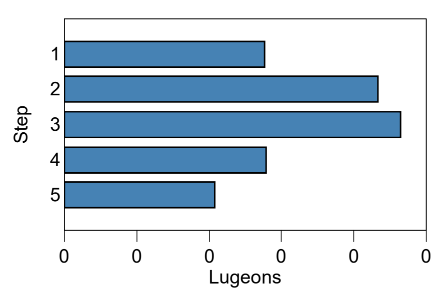


Top of Test Interval: 342.18 m
Bottom of Test Interval: 362.00 m
Length of Test Interval: 19.82 m
Gauge Position: 1.60 m
Depth to Groundwater: 0.00 m
Radius of Test Section: 0.05 m
Dip of bore: 40° from vertical
Vertical Top of Test Interval: 262.13 m
Vertical Bottom of Test Interval: 277.31 m

Step	Pressure [psi]	Flow Meter Readings [l]										Average Flow Rate [l/min]	Hydraulic Conductivity		
		1	2	3	4	5	6	7	8	9	10		[m/s]	[m/d]	Lugeon
1	130	148.51	148.53	148.55	148.57	148.59						0.02	1.73×10^{-10}	1.50×10^{-5}	0.001
2	195	149.07	149.11	149.17	149.22	149.26	149.31	149.35				0.05	2.71×10^{-10}	2.34×10^{-5}	0.002
3	260	149.94	150.01	150.09	150.16	150.23	150.31	150.37	150.45	150.51	150.54	0.07	2.91×10^{-10}	2.52×10^{-5}	0.002
4	195	150.26	150.29	150.31	150.34	150.39	150.42	150.44				0.03	1.74×10^{-10}	1.51×10^{-5}	0.001
5	130	150.33	150.35	150.36	150.38	150.39						0.01	1.30×10^{-10}	1.12×10^{-5}	0.001
												Average	2.08×10^{-10}	1.80×10^{-5}	0.001







Void filling
Lugeon: 0.001
Hydraulic Conductivity: 1.30E-10 m/s
Hydraulic Conductivity: 1.12E-5 m/d

Performed using a single packer test assembly as the borehole was advanced, with the bottom of the test interval bounded by the bottom of the drilled section of the borehole.

Note: ~0.03 L/min system losses at 180 psi (during packer inflation). Not accounted for in test flow data.

Hydraulic conductivity value for test interval derived based on flow classification: Void Filling (Step 5)

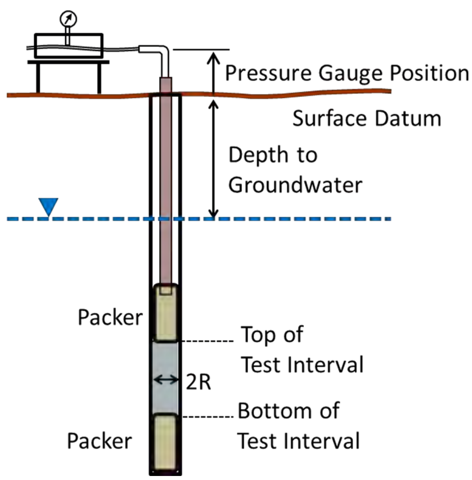
Lugeon Test Analysis Report

Project: Valentine Gold Feasibility Geotechnical Investigation

Number: 80047.03

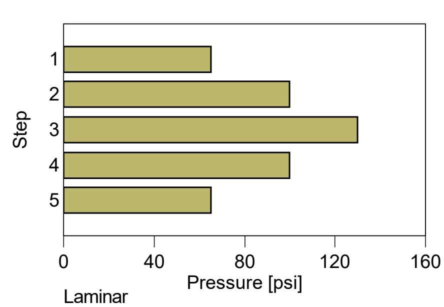
Client: Terrane Geoscience Inc.

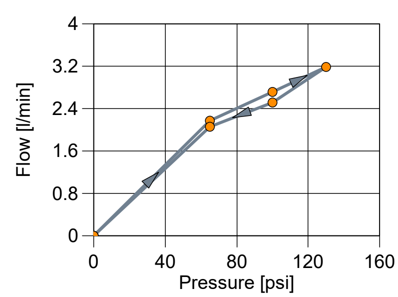
Location: Valentine Lake, NL	Lugeon Test: PT1	Tested bore: MA-GT-20-02
Test Conducted by: Terrane Geoscience Inc.		Test Date: 7/14/2020
Analysis Performed by: C. Anstey-Moore		Analysis Date: 10/27/2020
Lithology:		

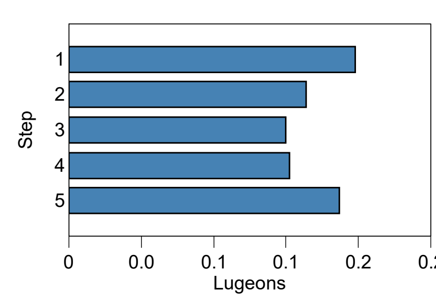


Top of Test Interval: 186.33 m
Bottom of Test Interval: 215.00 m
Length of Test Interval: 28.67 m
Gauge Position: 1.43 m
Depth to Groundwater: 1.80 m
Radius of Test Section: 0.05 m
Dip of bore: 35° from vertical
Vertical Top of Test Interval: 152.63 m
Vertical Bottom of Test Interval: 176.12 m

Step	Pressure [psi]	Flow Meter Readings [l]										Average Flow Rate [l/min]	Hydraulic Conductivity		
		1	2	3	4	5	6	7	8	9	10		[m/s]	[m/d]	Lugeon
1	65	112.00	114.43	116.75	119.01	121.21	123.37	125.48	127.53	129.57	131.59	2.18	2.61×10^{-8}	2.26×10^{-3}	0.16
2	100	140.00	143.87	145.67	148.39	151.12	153.81	156.45	159.14	161.79	164.42	2.71	2.17×10^{-8}	1.87×10^{-3}	0.13
3	130	184.89	188.09	191.30	194.49	197.67	200.86	204.01	207.18			3.18	1.98×10^{-8}	1.71×10^{-3}	0.12
4	100	215.00	217.65	220.18	222.73	225.24	227.74	230.21	232.68	235.15		2.52	2.01×10^{-8}	1.74×10^{-3}	0.12
5	65	238.00	239.65	241.29	244.58	246.23						2.06	2.47×10^{-8}	2.14×10^{-3}	0.15
												Average	2.25×10^{-8}	1.94×10^{-3}	0.14







Laminar
Lugeon: 0.14
Hydraulic Conductivity: 2.25E-8 m/s
Hydraulic Conductivity: 1.94E-3 m/d

Performed using a straddle double packer test assembly to isolate test interval.

No leaks were noticed during packer inflation or testing. Pressure adjustments required during steps 1, 3, and 4. Surface gauge pressure readings checked with transducer data.

Hydraulic conductivity value for test interval derived based on flow classification: Laminar (average for all steps).

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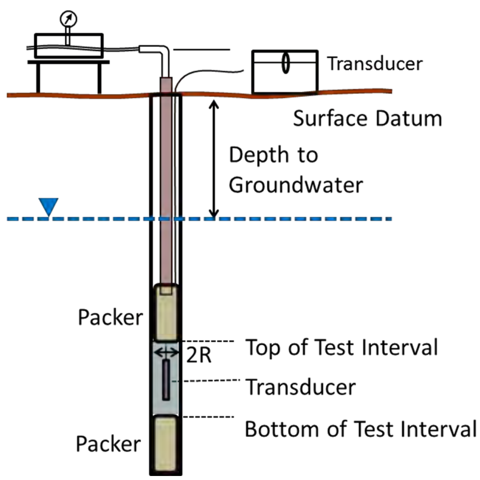
Lugeon Test Analysis Report

Project: Valentine Gold Feasibility Geotechnical Investigation

Number: 80047.03

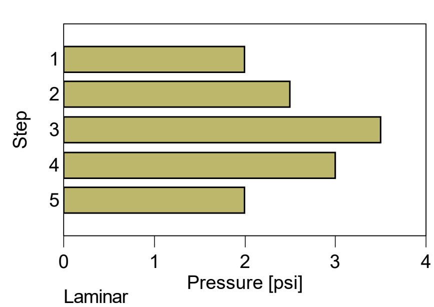
Client: Terrane Geoscience Inc.

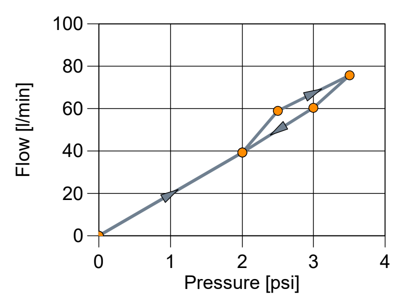
Location: Valentine Lake, NL	Lugeon Test: PT7	Tested bore: MA-GT-20-03
Test Conducted by: Terrane Geoscience Inc.		Test Date: 7/31/2020
Analysis Performed by: C. Anstey-Moore		Analysis Date: 10/27/2020
Lithology:		

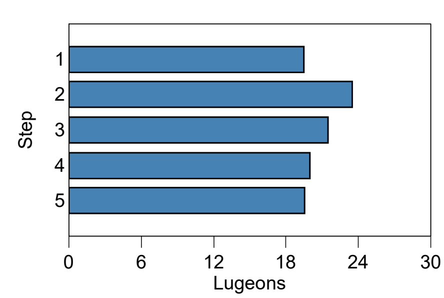


Top of Test Interval: 24.33 m
Bottom of Test Interval: 170.00 m
Length of Test Interval: 145.67 m
Depth to Groundwater: -1.00 m
Radius of Test Section: 0.05 m
Dip of bore: 32° from vertical
Vertical Top of Test Interval: 20.63 m
Vertical Bottom of Test Interval: 144.17 m

Step	Pressure [psi]	Flow Meter Readings [l]										Average Flow Rate [l/min]	Hydraulic Conductivity		
		1	2	3	4	5	6	7	8	9	10		[m/s]	[m/d]	Lugeon
1	2	474.00	512.50	552.00	591.00	631.00	670.00	709.00	748.00			39.14	4.04×10^{-6}	3.49×10^{-1}	19.486
2	3	780.00	839.00	898.00	957.00							59.00	4.88×10^{-6}	4.21×10^{-1}	23.497
3	4	30.00	105.00	181.00	257.00	332.00	408.00					75.60	4.46×10^{-6}	3.86×10^{-1}	21.506
4	3	461.00	522.00	582.00	642.00	702.00						60.25	4.15×10^{-6}	3.59×10^{-1}	19.996
5	2	721.00	760.00	800.00	839.00	878.00	918.00	957.00	996.00			39.29	4.06×10^{-6}	3.51×10^{-1}	19.557
												Average	4.32×10^{-6}	3.73×10^{-1}	20.809







Laminar
Lugeon: 20.809
Hydraulic Conductivity: 4.32E-6 m/s
Hydraulic Conductivity: 3.73E-1 m/d

Performed using a single packer test assembly as the borehole was advanced, with the bottom of the test interval bounded by the bottom of the drilled section of the borehole.

~0.01 L/min system losses at 98 psi (during packer inflation); considered negligible in comparison to test flows. Flowing artesian conditions; static water level not determined. Estimated -1 m below ground surface for purposes of analysis. Test pressures based on transducer data.

Hydraulic conductivity value for test interval derived based on flow classification: Laminar (average for all steps).

GEMTEC
CONSULTING ENGINEERS AND SCIENTISTS

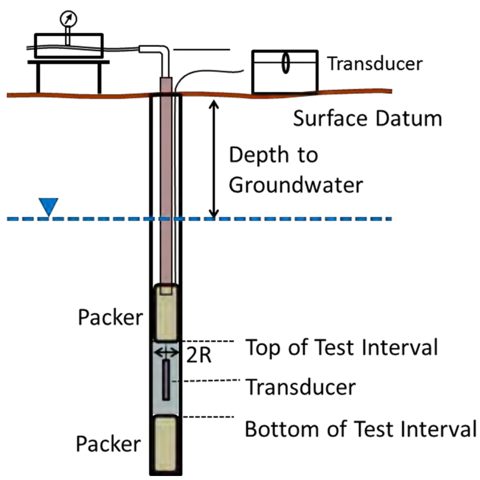
Lugeon Test Analysis Report

Project: Valentine Gold Feasibility Geotechnical Investigation

Number: 80047.03

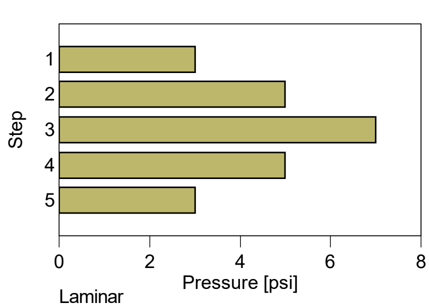
Client: Terrane Geoscience Inc.

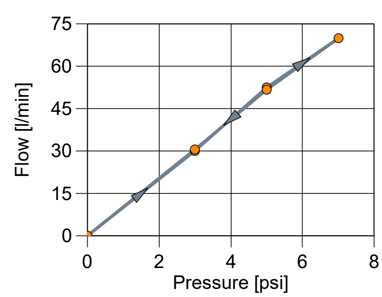
Location: Valentine Lake, NL	Lugeon Test: PT6	Tested bore: MA-GT-20-03
Test Conducted by: Terrane Geoscience Inc.		Test Date: 7/31/2020
Analysis Performed by: C. Anstey-Moore		Analysis Date: 10/27/2020
Lithology:		

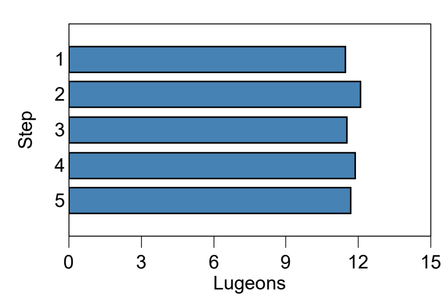


Top of Test Interval: 44.00 m
Bottom of Test Interval: 170.00 m
Length of Test Interval: 126.00 m
Depth to Groundwater: -1.00 m
Radius of Test Section: 0.05 m
Dip of bore: 32° from vertical
Vertical Top of Test Interval: 37.31 m
Vertical Bottom of Test Interval: 144.17 m

Step	Pressure [psi]	Flow Meter Readings [l]										Average Flow Rate [l/min]	Hydraulic Conductivity		
		1	2	3	4	5	6	7	8	9	10		[m/s]	[m/d]	Lugeon
1	3	310.00	339.60	368.50	398.20	428.00	458.00	488.00	518.70	548.80	579.00	29.89	2.34×10^{-6}	2.02×10^{-1}	11.468
2	5	610.00	662.00	715.00	767.00	819.00	872.00	925.00				52.50	2.46×10^{-6}	2.13×10^{-1}	12.086
3	7	5965.00	6034.00	6102.00	6173.00	6242.00	6313.00	6383.00	6453.00	6524.00	6595.00	70.00	2.35×10^{-6}	2.03×10^{-1}	11.511
4	5	712.00	763.00	814.00	866.00	918.00	970.00					51.60	2.42×10^{-6}	2.09×10^{-1}	11.879
5	3	6995.00	7025.50	7055.70	7086.00	7116.00	7147.00	7177.50	7208.00	7239.00	7269.00	30.44	2.38×10^{-6}	2.06×10^{-1}	11.681
												Average	2.39×10^{-6}	2.06×10^{-1}	11.725







Laminar
Lugeon: 11.725
Hydraulic Conductivity: 2.39E-6 m/s
Hydraulic Conductivity: 2.06E-1 m/d

Performed using a single packer test assembly as the borehole was advanced, with the bottom of the test interval bounded by the bottom of the drilled section of the borehole.

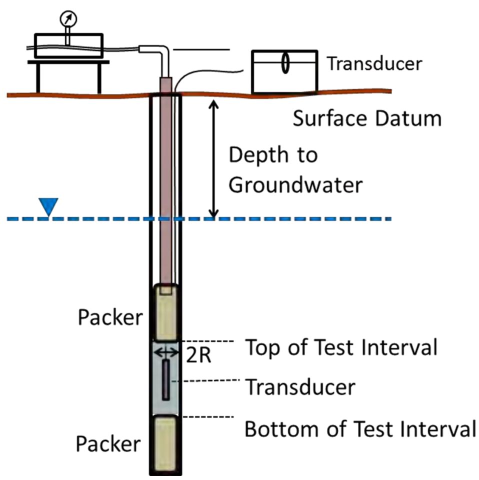
~0.05 L/min system losses at 108 psi (during packer inflation); considered negligible in comparison to test flows. Flowing artesian conditions; static water level not determined. Estimated -1 m below ground surface for purposes of analysis. Test pressures based on transducer data.

Hydraulic conductivity value for test interval derived based on flow classification: Laminar (average for all steps).

Lugeon Test Analysis Report	
Project:	Valentine Gold Feasibility Geotechnical Investigation
Number:	80047.03
Client:	Terrane Geoscience Inc.

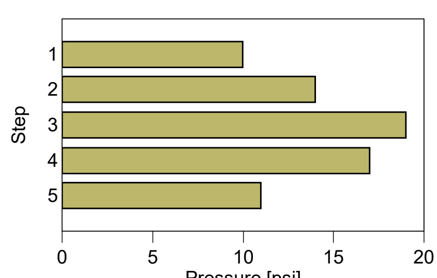
GEMTEC CONSULTING ENGINEERS AND SCIENTISTS

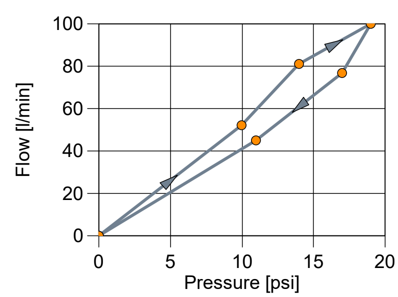
Location: Valentine Lake, NL	Lugeon Test: PT5	Tested bore: MA-GT-20-03
Test Conducted by: Terrane Geoscience Inc.		Test Date: 7/31/2020
Analysis Performed by: C. Anstey-Moore		Analysis Date: 10/27/2020
Lithology:		

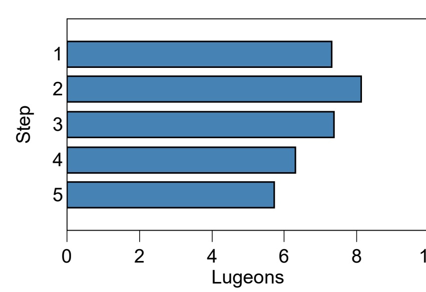


Top of Test Interval: 66.33 m
Bottom of Test Interval: 170.00 m
Length of Test Interval: 103.67 m
Depth to Groundwater: -1.00 m
Radius of Test Section: 0.05 m
Dip of bore: 32° from vertical
Vertical Top of Test Interval: 56.25 m
Vertical Bottom of Test Interval: 144.17 m

Step	Pressure [psi]	Flow Meter Readings [l]										Average Flow Rate [l/min]	Hydraulic Conductivity		
		1	2	3	4	5	6	7	8	9	10		[m/s]	[m/d]	Lugeon
1	10	320.00	372.50	424.50	476.50							52.17	1.45×10^{-6}	1.25×10^{-1}	7.298
2	14	550.00	632.00	713.00	794.00	875.00						81.25	1.61×10^{-6}	1.39×10^{-1}	8.119
3	19	3935.00	4035.00	4135.00	4235.00							100.00	1.46×10^{-6}	1.26×10^{-1}	7.363
4	17	325.00	402.00	479.00	555.00							76.67	1.25×10^{-6}	1.08×10^{-1}	6.309
5	11	620.00	664.00	708.50	754.00	799.50	845.00					45.00	1.14×10^{-6}	9.82×10^{-2}	5.723
												Average	1.38×10^{-6}	1.20×10^{-1}	6.963







Void filling
Lugeon: 5.723
Hydraulic Conductivity: 1.14E-6 m/s
Hydraulic Conductivity: 9.82E-2 m/d

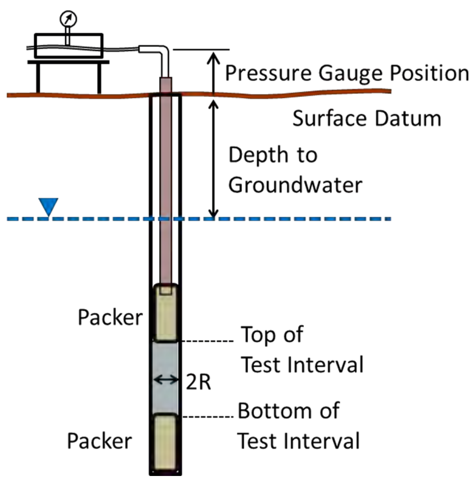
Performed using a single packer test assembly as the borehole was advanced, with the bottom of the test interval bounded by the bottom of the drilled section of the borehole.

~0.07 L/min system losses at 100 psi (during packer inflation); considered negligible in comparison to test flows. Flowing artesian conditions; static water level not determined. Estimated -1 m below ground surface for purposes of analysis. Test pressures based on transducer data.

Hydraulic conductivity value for test interval derived based on flow classification: Laminar (average for all steps).

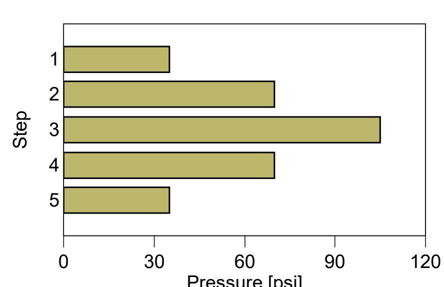
GEMTEC Consulting Engineers and Scientists	**Lugeon Test Analysis Report**
	Project: Valentine Gold Feasibility Geotechnical Investigation
	Number: 80047.03
	Client: Terrane Geoscience Inc.

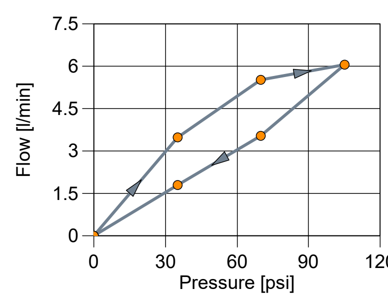
Location: Valentine Lake, NL	Lugeon Test: PT3	Tested bore: MA-GT-20-03
Test Conducted by: Terrane Geoscience Inc.		Test Date: 7/30/2020
Analysis Performed by: C. Anstey-Moore		Analysis Date: 10/27/2020
Lithology:		

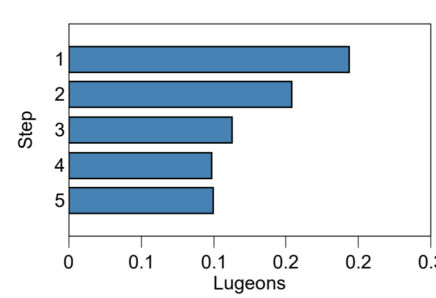


Top of Test Interval: 108.33 m
Bottom of Test Interval: 170.00 m
Length of Test Interval: 61.67 m
Gauge Position: 1.15 m
Depth to Groundwater: -1.00 m
Radius of Test Section: 0.05 m
Dip of bore: 32° from vertical
Vertical Top of Test Interval: 91.87 m
Vertical Bottom of Test Interval: 144.17 m

Step	Pressure [psi]	Flow Meter Readings [l]										Average Flow Rate [l/min]	Hydraulic Conductivity		
		1	2	3	4	5	6	7	8	9	10		[m/s]	[m/d]	Lugeon
1	35	590.80	594.74	598.38	601.88	605.27	608.64	611.90	615.17			3.48	4.31×10^{-8}	3.72×10^{-3}	0.233
2	70	34.30	40.27	46.07	51.70	57.25	62.70	68.13	73.45	78.71	83.91	5.51	3.42×10^{-8}	2.95×10^{-3}	0.185
3	105	705.35	712.30	718.80	724.80	730.91	736.95	742.87	748.49	754.15	759.77	6.05	2.50×10^{-8}	2.16×10^{-3}	0.135
4	70	64.20	67.71	71.25	74.79	78.30						3.52	2.19×10^{-8}	1.89×10^{-3}	0.118
5	35	79.30	80.80	82.42	84.12	85.87	87.69	89.52	91.43	93.35	95.39	1.79	2.21×10^{-8}	1.91×10^{-3}	0.119
												Average	2.92×10^{-8}	2.53×10^{-3}	0.158







Void filling
Lugeon: 0.115
Hydraulic Conductivity: 2.12E-8 m/s
Hydraulic Conductivity: 1.84E-3 m/d

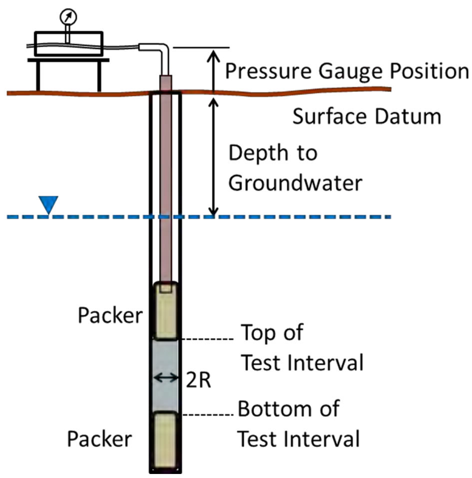
Performed using a single packer test assembly as the borehole was advanced, with the bottom of the test interval bounded by the bottom of the drilled section of the borehole.

~0.08 L/min system losses at 118 psi (during packer inflation); considered negligible in comparison to test flows. Surface gauge pressure readings checked with transducer data. Flowing artesian conditions; static water level not determined. Estimated -1 m below ground surface for purposes of analysis.

Although pressure-flow step profile suggests a Void Filling classification, the arithmetic mean (average) of the hydraulic conductivity (K) values determined for steps 1, 2, and 3 used to calculate the representative K value for the test interval - K = 3.32E-08 m/s.

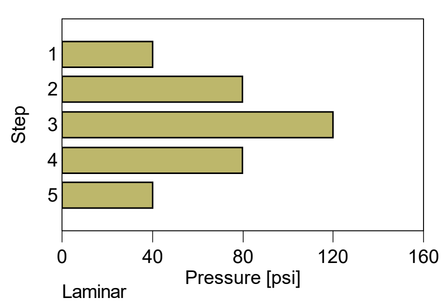
	Lugeon Test Analysis Report
GEMTEC Consulting Engineers and Scientists	Project: Valentine Gold Feasibility Geotechnical Investigation
	Number: 80047.03
	Client: Terrane Geoscience Inc.

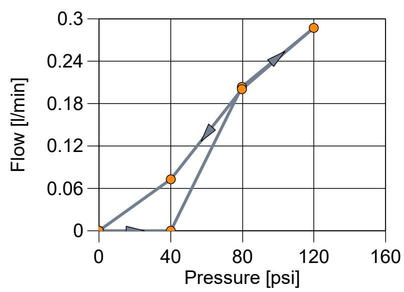
Location: Valentine Lake, NL	Lugeon Test: PT1	Tested bore: MA-GT-20-03
Test Conducted by: Terrane Geoscience Inc.		Test Date: 7/30/2020
Analysis Performed by: C. Anstey-Moore		Analysis Date: 10/27/2020
Lithology:		

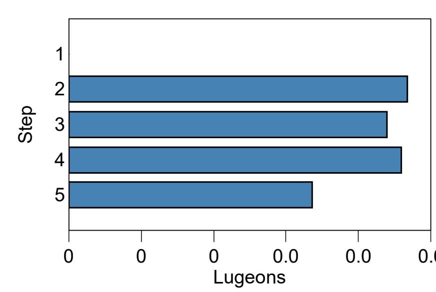


Top of Test Interval: 150.33 m
Bottom of Test Interval: 170.00 m
Length of Test Interval: 19.67 m
Gauge Position: 1.15 m
Depth to Groundwater: -1.00 m
Radius of Test Section: 0.05 m
Dip of bore: 32° from vertical
Vertical Top of Test Interval: 127.49 m
Vertical Bottom of Test Interval: 144.17 m

Step	Pressure [psi]	Flow Meter Readings [l]										Average Flow Rate [l/min]	Hydraulic Conductivity		
		1	2	3	4	5	6	7	8	9	10		[m/s]	[m/d]	Lugeon
1	40														
2	80	56.15	56.36	56.56	56.76							0.20	2.91×10^{-9}	2.51×10^{-4}	0.019
3	120	57.20	57.50	57.80	58.10	58.37	58.64	58.92				0.29	2.73×10^{-9}	2.36×10^{-4}	0.018
4	80	59.20	59.40	59.60	59.81	60.00						0.20	2.86×10^{-9}	2.47×10^{-4}	0.018
5	40	60.00	60.07	60.15	60.22							0.07	2.09×10^{-9}	1.81×10^{-4}	0.013
												Average	2.65×10^{-9}	2.29×10^{-4}	0.017







Laminar
Lugeon: 0.017
Hydraulic Conductivity: 2.60E-9 m/s
Hydraulic Conductivity: 2.24E-4 m/d

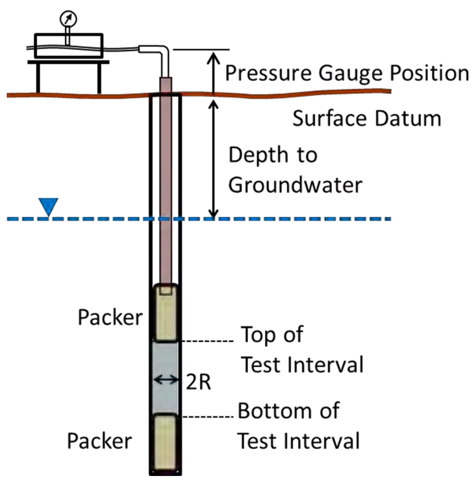
Performed using a single packer test assembly as the borehole was advanced, with the bottom of the test interval bounded by the bottom of the drilled section of the borehole.

~0.11 L/min system losses at 135 psi (during packer inflation). Not accounted for in test flow data. Flowing artesian conditions; static water level not determined. Estimated -1 m below ground surface for purposes of analysis.

No flow measured in step 1; the arithmetic mean (average) of the hydraulic conductivity (K) values determined for steps 2,3,4, and 5 used to calculate the representative K value for the test interval - K = 2.65E-09 m/s.

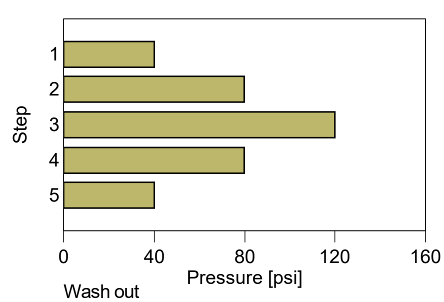
GEMTEC Consulting Engineers and Scientists	
	Lugeon Test Analysis Report
	Project: Valentine Gold Feasibility Geotechnical Investigation
	Number: 80047.03
	Client: Terrane Geoscience Inc.

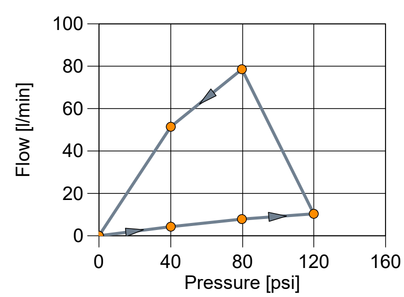
Location: Valentine Lake, NL	Lugeon Test: PT15	Tested bore: MA-GT-20-03
Test Conducted by: Terrane Geoscience Inc.		Test Date: 8/4/2020
Analysis Performed by: C. Anstey-Moore		Analysis Date: 10/27/2020
Lithology:		

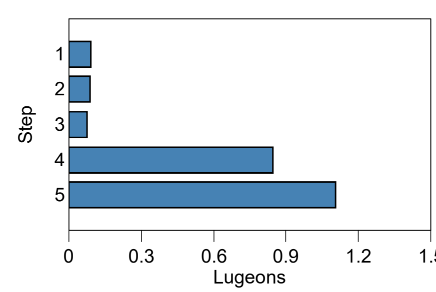


Top of Test Interval: 158.33 m
Bottom of Test Interval: 326.00 m
Length of Test Interval: 167.67 m
Gauge Position: 1.30 m
Depth to Groundwater: -1.00 m
Radius of Test Section: 0.05 m
Dip of bore: 32° from vertical
Vertical Top of Test Interval: 134.27 m
Vertical Bottom of Test Interval: 276.46 m

Step	Pressure [psi]	Flow Meter Readings [l]										Average Flow Rate [l/min]	Hydraulic Conductivity		
		1	2	3	4	5	6	7	8	9	10		[m/s]	[m/d]	Lugeon
1	40	23.00	28.05	32.80	37.21	41.34	45.30	49.23	53.21			4.32	1.95×10^{-8}	1.68×10^{-3}	0.092
2	80	587.00	598.80	605.35	613.65	621.60	629.20	636.80	644.30	651.76	659.15	8.02	1.82×10^{-8}	1.57×10^{-3}	0.086
3	120	694.00	705.60	716.50	726.95	737.20	747.15	757.10	767.00	776.80	786.30	10.26	1.56×10^{-8}	1.34×10^{-3}	0.074
4	80	4050.00	4129.00	4208.00	4286.00	4365.00						78.75	1.79×10^{-7}	1.55×10^{-2}	0.847
5	40	465.00	516.00	567.00	619.00	671.00	723.00					51.60	2.33×10^{-7}	2.01×10^{-2}	1.104
												Average	9.31×10^{-8}	8.04×10^{-3}	0.441







Wash out
Lugeon: 1.104
Hydraulic Conductivity: 2.33E-7 m/s
Hydraulic Conductivity: 2.01E-2 m/d

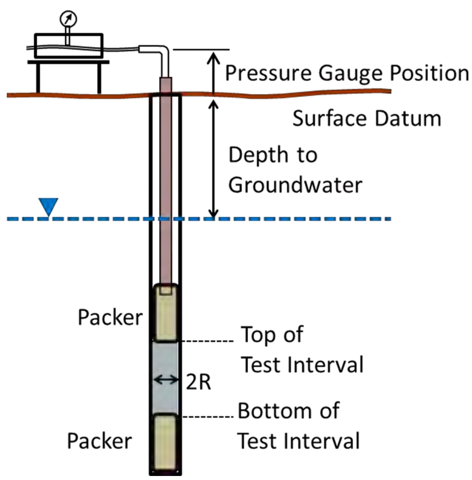
Performed using a single packer test assembly as the borehole was advanced, with the bottom of the test interval bounded by the bottom of the drilled section of the borehole.

No leaks were noticed during packer inflation or testing. Flowing artesian conditions; static water level not determined. Estimated -1 m below ground surface for purposes of analysis. Sudden pressure release when decreasing from P4 to P5. Significantly greater flow rates for step 5, suggesting backflow washed material from fracture zones, increasing permeability.

Although pressure-flow step profile suggests a Wash-out classification, the arithmetic mean (average) of the hydraulic conductivity (K) values determined for steps 1, 2, and 3 used to calculate the representative K value for the test interval - K = 1.78E-08 m/s.

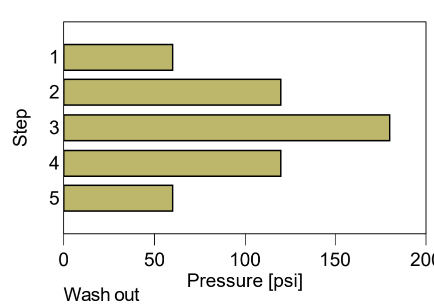
GEMTEC Consulting Engineers and Scientists	**Lugeon Test Analysis Report**
	Project: Valentine Gold Feasibility Geotechnical Investigation
	Number: 80047.03
	Client: Terrane Geoscience Inc.

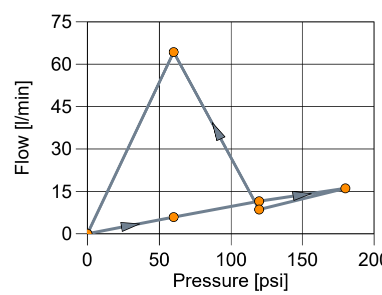
Location: Valentine Lake, NL	Lugeon Test: PT14	Tested bore: MA-GT-20-03
Test Conducted by: Terrane Geoscience Inc.		Test Date: 8/4/2020
Analysis Performed by: C. Anstey-Moore		Analysis Date: 10/27/2020
Lithology:		

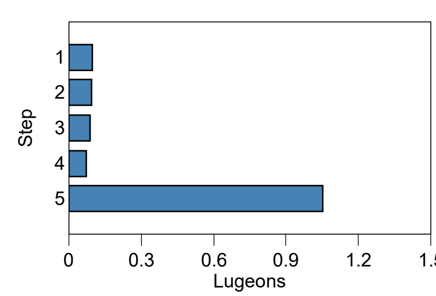


Top of Test Interval: 179.33 m
Bottom of Test Interval: 326.00 m
Length of Test Interval: 146.67 m
Gauge Position: 1.30 m
Depth to Groundwater: -1.00 m
Radius of Test Section: 0.05 m
Dip of bore: 32° from vertical
Vertical Top of Test Interval: 152.08 m
Vertical Bottom of Test Interval: 276.46 m

Step	Pressure [psi]	Flow Meter Readings [l]										Average Flow Rate [l/min]	Hydraulic Conductivity		
		1	2	3	4	5	6	7	8	9	10		[m/s]	[m/d]	Lugeon
1	60	41.90	48.35	54.63	60.70	66.67	72.50	78.21	83.87	89.45	95.00	5.90	2.01×10^{-8}	1.73×10^{-3}	0.097
2	120	141.00	154.00	166.40	178.00	189.40	200.70	211.80	222.70	233.60		11.57	1.97×10^{-8}	1.71×10^{-3}	0.095
3	180	354.00	371.00	388.00	403.80	419.60	435.30	450.80	466.20			16.03	1.82×10^{-8}	1.58×10^{-3}	0.088
4	120	25.50	33.90	42.50	51.30	60.10	68.90					8.68	1.48×10^{-8}	1.28×10^{-3}	0.071
5	60	840.00	905.00	969.00	1033.50	1098.00	1162.00	1226.50	1291.00	1355.00	1419.50	64.39	2.19×10^{-7}	1.89×10^{-2}	1.054
												Average	5.83×10^{-8}	5.04×10^{-3}	0.281







Wash out
Lugeon: 1.054
Hydraulic Conductivity: 2.19E-7 m/s
Hydraulic Conductivity: 1.89E-2 m/d

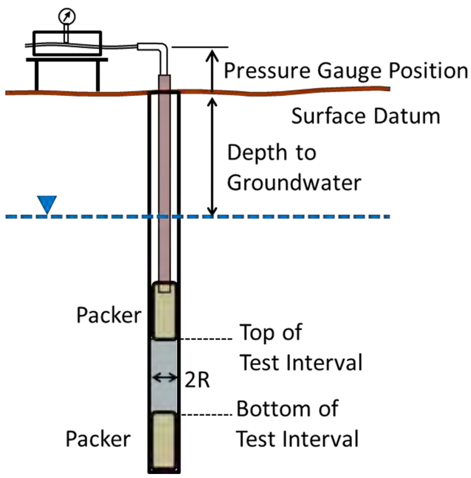
Performed using a single packer test assembly as the borehole was advanced, with the bottom of the test interval bounded by the bottom of the drilled section of the borehole.

~0.19 L/min system losses at 210 psi (during packer inflation); considered negligible in comparison to test flows. Flowing artesian conditions; static water level not determined. Estimated -1 m below ground surface for purposes of analysis. Pressure adjustments required during testing. Pressure release and backflow when decreasing from P4 to P5. Significantly greater flow rates for step 5, suggesting backflow washed material from fracture zones, increasing permeability. Surface gauge pressure readings checked with transducer data.

Although pressure-flow step profile suggests a Wash-out classification, the arithmetic mean (average) of the hydraulic conductivity (K) values determined for steps 1, 2, 3, and 4 used to calculate the representative K value for the test interval - K = 1.82E-08 m/s.

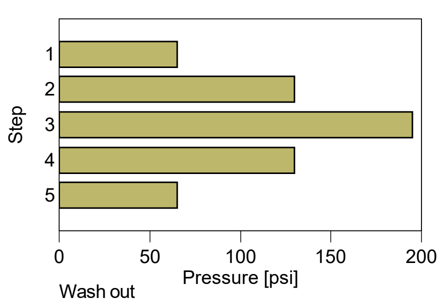
GEMTEC Consulting Engineers and Scientists	**Lugeon Test Analysis Report**
	Project: Valentine Gold Feasibility Geotechnical Investigation
	Number: 80047.03
	Client: Terrane Geoscience Inc.

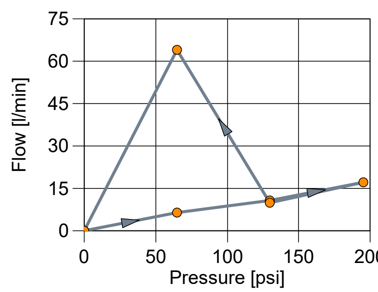
Location: Valentine Lake, NL	Lugeon Test: PT13	Tested bore: MA-GT-20-03
Test Conducted by: Terrane Geoscience Inc.		Test Date: 8/4/2020
Analysis Performed by: C. Anstey-Moore		Analysis Date: 10/27/2020
Lithology:		

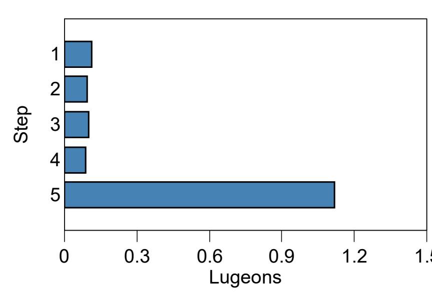


Top of Test Interval: 199.33 m
Bottom of Test Interval: 326.00 m
Length of Test Interval: 126.67 m
Gauge Position: 1.35 m
Depth to Groundwater: -1.00 m
Radius of Test Section: 0.05 m
Dip of bore: 32° from vertical
Vertical Top of Test Interval: 169.04 m
Vertical Bottom of Test Interval: 276.46 m

Step	Pressure [psi]	Flow Meter Readings [l]										Average Flow Rate [l/min]	Hydraulic Conductivity		
		1	2	3	4	5	6	7	8	9	10		[m/s]	[m/d]	Lugeon
1	65	658.71	665.61	672.41	679.06	685.50	691.65	697.71	703.69			6.43	2.29×10^{-8}	1.98×10^{-3}	0.112
2	130	802.02	812.91	823.83	834.65	845.31	855.89	866.25				10.71	1.91×10^{-8}	1.65×10^{-3}	0.094
3	195	948.60	966.80	984.60	1002.00	1019.30	1036.30	1053.20	1070.10	1086.70	1103.30	17.19	2.05×10^{-8}	1.77×10^{-3}	0.101
4	130	129.00	138.50	148.40	158.30	168.25	178.30	188.55	198.52	208.45		9.93	1.78×10^{-8}	1.53×10^{-3}	0.087
5	65	800.00	864.00	928.00	992.00							64.00	2.28×10^{-7}	1.97×10^{-2}	1.119
												Average	6.17×10^{-8}	5.33×10^{-3}	0.303







Wash out
Lugeon: 1.119
Hydraulic Conductivity: 2.28E-7 m/s
Hydraulic Conductivity: 1.97E-2 m/d

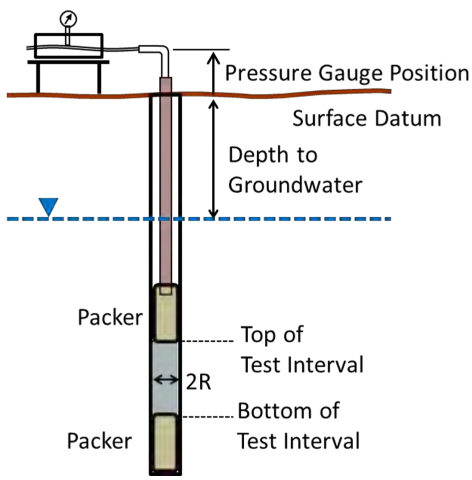
Performed using a single packer test assembly as the borehole was advanced, with the bottom of the test interval bounded by the bottom of the drilled section of the borehole.

~0.07 L/min system losses at 220 psi (during packer inflation); considered negligible in comparison to test flows. Flowing artesian conditions; static water level not determined. Estimated -1 m below ground surface for purposes of analysis. Pressure adjustments required during testing. Pressure release and backflow when decreasing from P4 to P5. Significantly greater flow rates for step 5, suggesting backflow washed material from fracture zones, increasing permeability. Surface gauge pressure readings checked with transducer data.

Although pressure-flow step profile suggests a Wash-out classification, the arithmetic mean (average) of the hydraulic conductivity (K) values determined for steps 1, 2, 3, and 4 used to calculate the representative K value for the test interval - K = 2.01E-08 m/s.

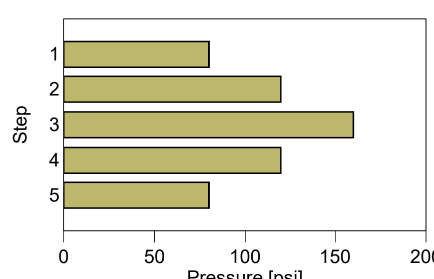
Lugeon Test Analysis Report	
Project: Valentine Gold Feasibility Geotechnical Investigation	
Number: 80047.03	
Client: Terrane Geoscience Inc.	

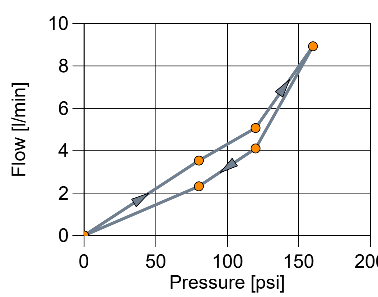
Location: Valentine Lake, NL	Lugeon Test: PT12	Tested bore: MA-GT-20-03
Test Conducted by: Terrane Geoscience Inc.		Test Date: 8/4/2020
Analysis Performed by: C. Anstey-Moore		Analysis Date: 10/27/2020
Lithology:		

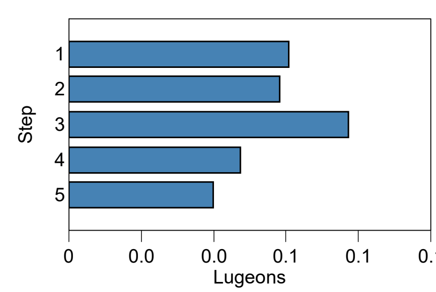


Top of Test Interval: 221.33 m
Bottom of Test Interval: 326.00 m
Length of Test Interval: 104.67 m
Gauge Position: 1.20 m
Depth to Groundwater: -1.00 m
Radius of Test Section: 0.05 m
Dip of bore: 32° from vertical
Vertical Top of Test Interval: 187.70 m
Vertical Bottom of Test Interval: 276.46 m

Step	Pressure [psi]	Flow Meter Readings [l]										Average Flow Rate [l/min]	Hydraulic Conductivity		
		1	2	3	4	5	6	7	8	9	10		[m/s]	[m/d]	Lugeon
1	80	389.37	393.68	397.70	401.50	405.08	408.48	411.77	414.95	418.05	421.05	3.52	1.21×10^{-8}	1.04×10^{-3}	0.061
2	120	55.15	60.77	65.65	70.75	75.75	80.75	85.65	90.55			5.06	1.16×10^{-8}	1.00×10^{-3}	0.058
3	160	520.90	530.30	539.50	548.50	557.60	566.60	575.50	584.20	592.75	601.40	8.94	1.54×10^{-8}	1.33×10^{-3}	0.077
4	120	3.00	5.82	9.25	13.35	17.75	22.20	26.75	31.30	35.85		4.11	9.41×10^{-9}	8.13×10^{-4}	0.047
5	80	34.26	35.90	37.88	40.07	42.40	44.85	47.35	49.88	52.45	55.05	2.31	7.93×10^{-9}	6.85×10^{-4}	0.040
												Average	1.13×10^{-8}	9.74×10^{-4}	0.057







Void filling
Lugeon: 0.040
Hydraulic Conductivity: 7.93E-9 m/s
Hydraulic Conductivity: 6.85E-4 m/d

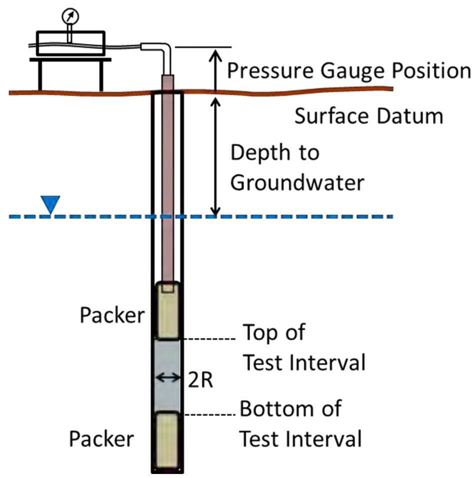
Performed using a single packer test assembly as the borehole was advanced, with the bottom of the test interval bounded by the bottom of the drilled section of the borehole.

No leaks were noticed during packer inflation or testing. Flowing artesian conditions; static water level not determined. Estimated -1 m below ground surface for purposes of analysis. Pressure adjustments required during steps 2 and 3. Surface gauge pressure readings checked with transducer data.

Although pressure-flow step profile suggests a Void Filling classification, the arithmetic mean (average) of the hydraulic conductivity (K) values determined for all steps used to calculate the representative K value for the test interval - K = 1.13E-8 m/s.

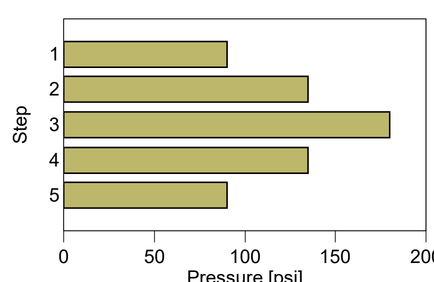
GEMTEC Consulting Engineers and Scientists	**Lugeon Test Analysis Report**
	Project: Valentine Gold Feasibility Geotechnical Investigation
	Number: 80047.03
	Client: Terrane Geoscience Inc.

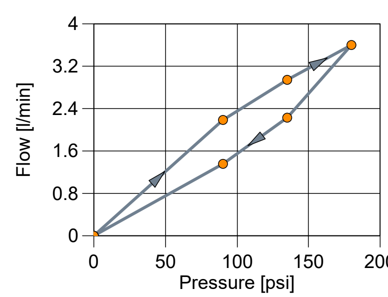
Location: Valentine Lake, NL	Lugeon Test: PT11	Tested bore: MA-GT-20-03
Test Conducted by: Terrane Geoscience Inc.		Test Date: 8/4/2020
Analysis Performed by: C. Anstey-Moore		Analysis Date: 10/27/2020
Lithology:		

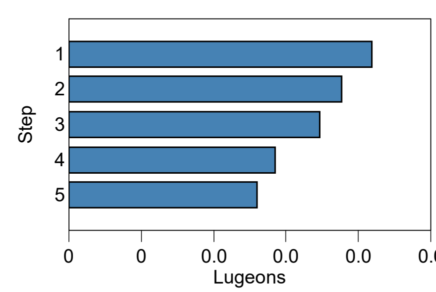


Top of Test Interval: 242.33 m
Bottom of Test Interval: 326.00 m
Length of Test Interval: 83.67 m
Gauge Position: 1.20 m
Depth to Groundwater: -1.00 m
Radius of Test Section: 0.05 m
Dip of bore: 32° from vertical
Vertical Top of Test Interval: 205.51 m
Vertical Bottom of Test Interval: 276.46 m

Step	Pressure [psi]	Flow Meter Readings [l]										Average Flow Rate [l/min]	Hydraulic Conductivity		
		1	2	3	4	5	6	7	8	9	10		[m/s]	[m/d]	Lugeon
1	90	40.08	42.51	44.85	47.10	49.29	51.44	53.55	55.61	57.66	59.69	2.18	8.08×10^{-9}	6.98×10^{-4}	0.042
2	135	66.36	69.51	72.57	75.58	78.52	81.42	84.31	87.16	90.00	92.80	2.94	7.27×10^{-9}	6.28×10^{-4}	0.038
3	180	301.03	304.85	308.64	312.31	315.98	319.55	323.08	326.55	330.03	333.46	3.60	6.69×10^{-9}	5.78×10^{-4}	0.035
4	135	35.60	37.78	39.99	42.24	44.47	46.70	48.93				2.22	5.50×10^{-9}	4.75×10^{-4}	0.028
5	90	49.00	50.16	51.61	52.99	54.38	55.76					1.35	5.01×10^{-9}	4.33×10^{-4}	0.026
												Average	6.51×10^{-9}	5.62×10^{-4}	0.034







Void filling
Lugeon: 0.026
Hydraulic Conductivity: 4.93E-9 m/s
Hydraulic Conductivity: 4.26E-4 m/d

Performed using a single packer test assembly as the borehole was advanced, with the bottom of the test interval bounded by the bottom of the drilled section of the borehole.

No leaks were noticed during packer inflation or testing. Flowing artesian conditions; static water level not determined. Estimated -1 m below ground surface for purposes of analysis. Pressure adjustments required during step 3. Surface gauge pressure readings checked with transducer data.

Although pressure-flow step profile suggests a Void Filling classification, the arithmetic mean (average) of the hydraulic conductivity (K) values determined for all steps used to calculate the representative K value for the test interval - K = 6.51E-09 m/s.

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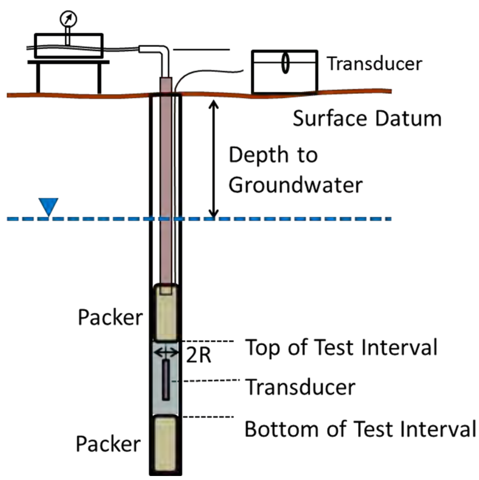
Lugeon Test Analysis Report

Project: Valentine Gold Feasibility Geotechnical Investigation

Number: 80047.03

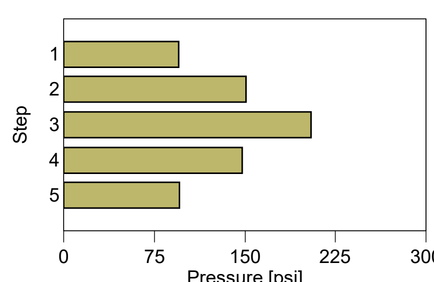
Client: Terrane Geoscience Inc.

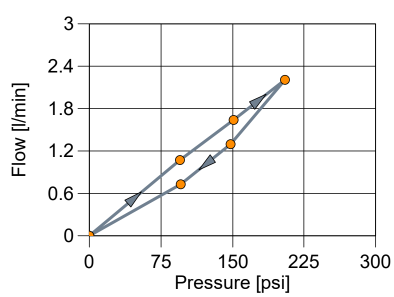
Location: Valentine Lake, NL	Lugeon Test: PT10	Tested bore: MA-GT-20-03
Test Conducted by: Terrane Geoscience Inc.		Test Date: 8/4/2020
Analysis Performed by: C. Anstey-Moore		Analysis Date: 10/27/2020
Lithology:		

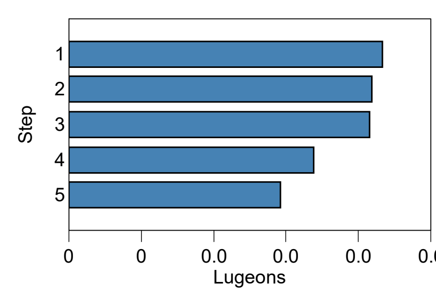


Top of Test Interval: 263.33 m
Bottom of Test Interval: 326.00 m
Length of Test Interval: 62.67 m
Depth to Groundwater: -1.00 m
Radius of Test Section: 0.05 m
Dip of bore: 32° from vertical
Vertical Top of Test Interval: 223.32 m
Vertical Bottom of Test Interval: 276.46 m

Step	Pressure [psi]	Flow Meter Readings [l]										Average Flow Rate [l/min]	Hydraulic Conductivity		
		1	2	3	4	5	6	7	8	9	10		[m/s]	[m/d]	Lugeon
1	95	1.00	2.28	3.44	4.51	5.57	6.59	7.57	8.55	9.53		1.07	4.82×10^{-9}	4.16×10^{-4}	0.026
2	151	73.90	75.66	77.36	79.05	80.67	82.27	83.85	85.49	87.08	88.65	1.64	4.66×10^{-9}	4.03×10^{-4}	0.025
3	205	191.50	194.00	196.36	198.58	200.75	202.91	205.04	207.15	209.26	211.37	2.21	4.63×10^{-9}	4.00×10^{-4}	0.025
4	148	13.16	14.40	15.73	17.07	18.31	19.60	20.91	22.19	23.48	24.83	1.30	3.76×10^{-9}	3.25×10^{-4}	0.020
5	96	25.49	26.16	26.86	27.57	28.30	29.04	29.79	30.55	31.28	32.04	0.73	3.26×10^{-9}	2.81×10^{-4}	0.018
												Average	4.23×10^{-9}	3.65×10^{-4}	0.023







Void filling
Lugeon: 0.018
Hydraulic Conductivity: 3.26E-9 m/s
Hydraulic Conductivity: 2.81E-4 m/d

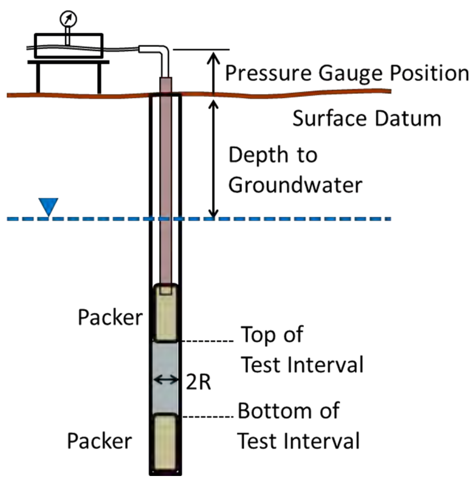
Performed using a single packer test assembly as the borehole was advanced, with the bottom of the test interval bounded by the bottom of the drilled section of the borehole.

No leaks were noticed during packer inflation or testing. Flowing artesian conditions; static water level not determined. Estimated -1 m below ground surface for purposes of analysis. Pressure adjustments required during step 3. Test pressures based on transducer data.

Although pressure-flow step profile suggests a Void Filling classification, the hydraulic conductivity (K) value determined for step 1 used to calculate the representative K value for the test interval - K = 4.82E-09 m/s.

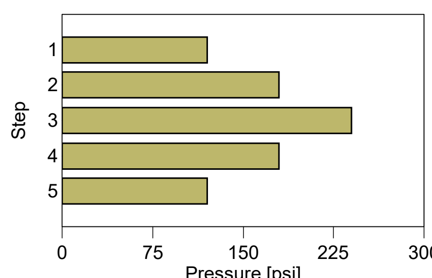
GEMTEC Consulting Engineers and Scientists	**Lugeon Test Analysis Report**
	Project: Valentine Gold Feasibility Geotechnical Investigation
	Number: 80047.03
	Client: Terrane Geoscience Inc.

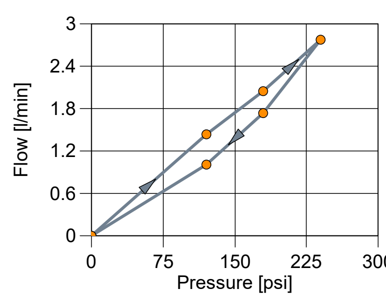
Location: Valentine Lake, NL	Lugeon Test: PT9	Tested bore: MA-GT-20-03
Test Conducted by: Terrane Geoscience Inc.		Test Date: 8/4/2020
Analysis Performed by: C. Anstey-Moore		Analysis Date: 10/27/2020
Lithology:		

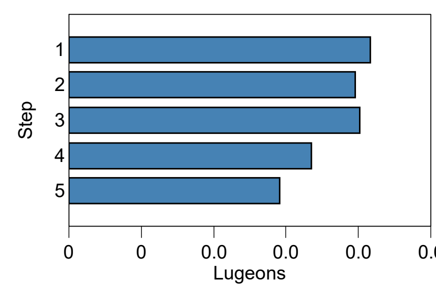


Top of Test Interval: 284.33 m
Bottom of Test Interval: 326.00 m
Length of Test Interval: 41.67 m
Gauge Position: 1.20 m
Depth to Groundwater: -1.00 m
Radius of Test Section: 0.05 m
Dip of bore: 32° from vertical
Vertical Top of Test Interval: 241.13 m
Vertical Bottom of Test Interval: 276.46 m

Step	Pressure [psi]	Flow Meter Readings [l]										Average Flow Rate [l/min]	Hydraulic Conductivity		
		1	2	3	4	5	6	7	8	9	10		[m/s]	[m/d]	Lugeon
1	120	39.06	40.74	42.28	43.77	45.22	46.62	47.98	49.33	50.66	52.00	1.44	7.28×10^{-9}	6.29×10^{-4}	0.042
2	180	57.35	59.55	61.67	63.71	65.77	67.82	69.83	71.83	73.80	75.77	2.05	6.91×10^{-9}	5.97×10^{-4}	0.040
3	240	88.49	91.30	94.07	96.83	99.60						2.78	7.04×10^{-9}	6.08×10^{-4}	0.040
4	180	2.00	3.62	5.34	7.10	8.87	10.62	12.38	14.15			1.74	5.86×10^{-9}	5.07×10^{-4}	0.034
5	120	15.59	16.51	17.48	18.47	19.48	20.50	21.53	22.57	23.60	24.64	1.01	5.09×10^{-9}	4.40×10^{-4}	0.029
												Average	6.44×10^{-9}	5.56×10^{-4}	0.037







Void filling
Lugeon: 0.029
Hydraulic Conductivity: 5.09E-9 m/s
Hydraulic Conductivity: 4.40E-4 m/d

Performed using a single packer test assembly as the borehole was advanced, with the bottom of the test interval bounded by the bottom of the drilled section of the borehole.

~0.08 L/min system losses at 240 psi (during packer inflation); considered negligible in comparison to test flows. Flowing artesian conditions; static water level not determined. Estimated -1 m below ground surface for purposes of analysis. Pressure adjustments required during step 3. Surface gauge pressure readings checked with transducer data.

Although pressure-flow step profile suggests a Void Filling classification, the arithmetic mean (average) of the hydraulic conductivity (K) values determined for steps 1, 2, and 3 used to calculate the representative K value for the test interval - K = 7.08E-09 m/s.

GEMTEC
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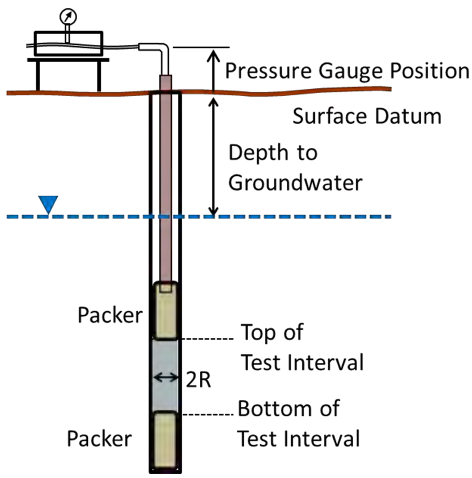
Lugeon Test Analysis Report

Project: Valentine Gold Feasibility Geotechnical Investigation

Number: 80047.03

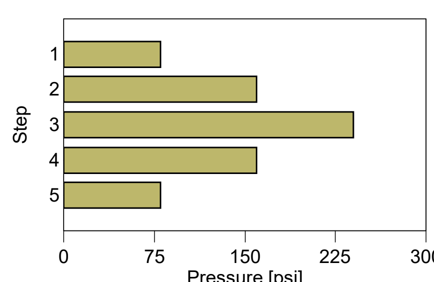
Client: Terrane Geoscience Inc.

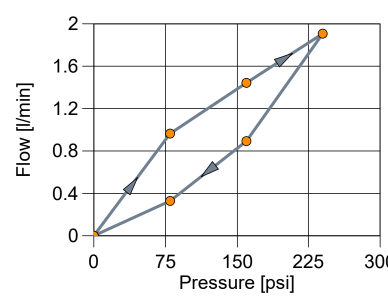
Location: Valentine Lake, NL	Lugeon Test: PT8	Tested bore: MA-GT-20-03
Test Conducted by: Terrane Geoscience Inc.		Test Date: 8/3/2020
Analysis Performed by: C. Anstey-Moore		Analysis Date: 10/27/2020
Lithology:		

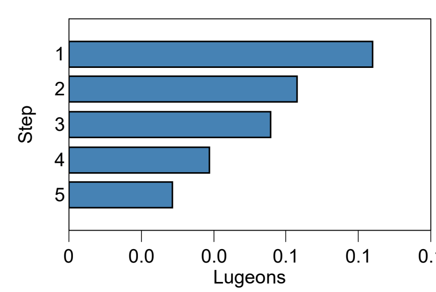


Top of Test Interval: 305.33 m
Bottom of Test Interval: 326.00 m
Length of Test Interval: 20.67 m
Gauge Position: 1.30 m
Depth to Groundwater: -1.00 m
Radius of Test Section: 0.05 m
Dip of bore: 32° from vertical
Vertical Top of Test Interval: 258.93 m
Vertical Bottom of Test Interval: 276.46 m

Step	Pressure [psi]	Flow Meter Readings [l]										Average Flow Rate [l/min]	Hydraulic Conductivity		
		1	2	3	4	5	6	7	8	9	10		[m/s]	[m/d]	Lugeon
1	80	87.00	88.18	89.19	90.14	91.05	91.93	92.77				0.96	1.31×10^{-8}	1.14×10^{-3}	0.084
2	160	395.90	397.56	399.08	400.54	401.97	403.33	404.66	405.98			1.44	9.87×10^{-9}	8.53×10^{-4}	0.063
3	240	408.50	410.70	412.70	414.60	416.42	418.18	419.94				1.91	8.72×10^{-9}	7.53×10^{-4}	0.056
4	160	22.90	23.78	24.67	25.57							0.89	6.10×10^{-9}	5.27×10^{-4}	0.039
5	80	25.70	25.99	26.32	26.65	27.00	27.34					0.33	4.48×10^{-9}	3.87×10^{-4}	0.029
												Average	8.47×10^{-9}	7.31×10^{-4}	0.054







Void filling
Lugeon: 0.029
Hydraulic Conductivity: 4.48E-9 m/s
Hydraulic Conductivity: 3.87E-4 m/d

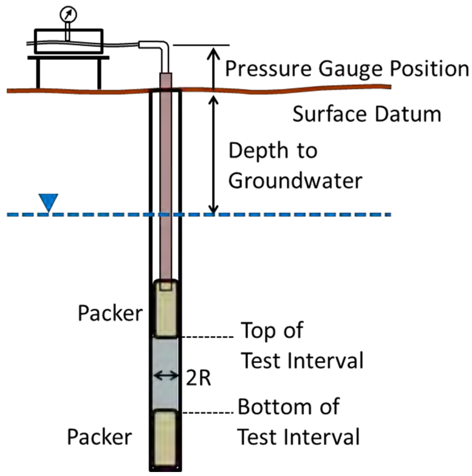
Performed using a single packer test assembly as the borehole was advanced, with the bottom of the test interval bounded by the bottom of the drilled section of the borehole.

~0.08 L/min system losses at 267 psi (during packer inflation); considered negligible in comparison to test flows. Flowing artesian conditions; static water level not determined. Estimated -1 m below ground surface for purposes of analysis. Slight pressure adjustments required during step 3. Surface gauge pressure readings checked with transducer data.

Although pressure-flow step profile suggests a Void Filling classification, the arithmetic mean (average) of the hydraulic conductivity (K) values determined for all steps used to calculate the representative K value for the test interval - K = 8.47E-9 m/s.

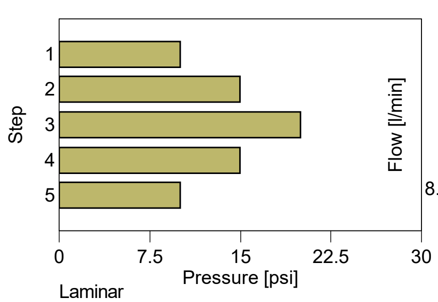
GEMTEC Consulting Engineers and Scientists	**Lugeon Test Analysis Report**
	Project: Valentine Gold Feasibility Geotechnical Investigation
	Number: 80047.03
	Client: Terrane Geoscience Inc.

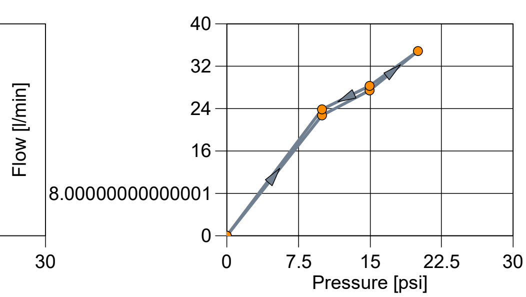
Location: Valentine Lake, NL	Lugeon Test: PT1	Tested bore: MA-GT-20-04
Test Conducted by: Terrane Geoscience Inc.		Test Date: 7/8/2020
Analysis Performed by: C. Anstey-Moore		Analysis Date: 10/27/2020
Lithology:		

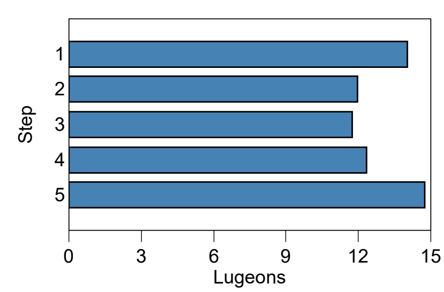


Top of Test Interval: 15.33 m
Bottom of Test Interval: 35.00 m
Length of Test Interval: 19.67 m
Gauge Position: 1.35 m
Depth to Groundwater: 0.00 m
Radius of Test Section: 0.05 m
Dip of bore: 28° from vertical
Vertical Top of Test Interval: 13.54 m
Vertical Bottom of Test Interval: 30.90 m

Step	Pressure [psi]	Flow Meter Readings [l]										Average Flow Rate [l/min]	Hydraulic Conductivity		
		1	2	3	4	5	6	7	8	9	10		[m/s]	[m/d]	Lugeon
1	10	92.20	115.80	138.10	161.00	183.70	206.30	229.10	251.40	274.00	296.50	22.70	2.18×10^{-6}	1.89×10^{-1}	14
2	15	370.00	397.30	424.70	425.00	479.50	507.00	534.50				27.42	1.86×10^{-6}	1.60×10^{-1}	12
3	20	608.30	643.20	678.30	713.20	748.30	783.20	818.00	853.00	887.80	922.60	34.92	1.83×10^{-6}	1.58×10^{-1}	12
4	15	986.60	1014.40	1042.50	1070.90	1099.00	1127.30	1155.70	1184.20	1212.70	1241.10	28.28	1.92×10^{-6}	1.65×10^{-1}	12
5	10	273.00	295.80	319.30	343.10	367.20	391.40	415.60	439.80			23.83	2.29×10^{-6}	1.98×10^{-1}	15
												Average	2.01×10^{-6}	1.74×10^{-1}	13







Laminar
Lugeon: 13
Hydraulic Conductivity: 2.01E-6 m/s
Hydraulic Conductivity: 1.74E-1 m/d

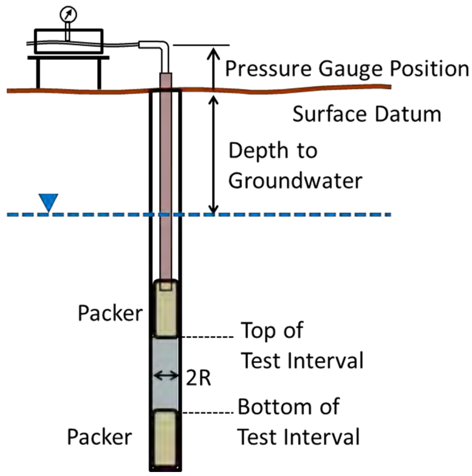
Performed using a single packer test assembly as the borehole was advanced, with the bottom of the test interval bounded by the bottom of the drilled section of the borehole.

No leaks were noticed during packer inflation or testing.

Hydraulic conductivity value for test interval derived based on flow classification: Laminar (average for all steps).

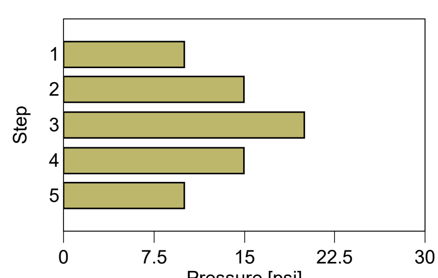
GEMTEC Consulting Engineers and Scientists	**Lugeon Test Analysis Report**
	Project: Valentine Gold Feasibility Geotechnical Investigation
	Number: 80047.03
	Client: Terrane Geoscience Inc.

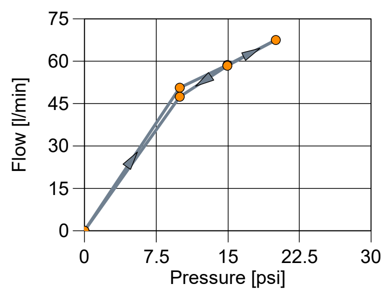
Location: Valentine Lake, NL	Lugeon Test: PT2	Tested bore: MA-GT-20-04
Test Conducted by: Terrane Geoscience Inc.		Test Date: 7/8/2020
Analysis Performed by: C. Anstey-Moore		Analysis Date: 10/27/2020
Lithology:		

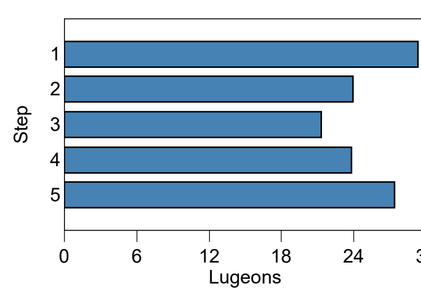


Top of Test Interval: 35.00 m
Bottom of Test Interval: 56.00 m
Length of Test Interval: 21.00 m
Gauge Position: 1.35 m
Depth to Groundwater: 0.00 m
Radius of Test Section: 0.05 m
Dip of bore: 28° from vertical
Vertical Top of Test Interval: 30.90 m
Vertical Bottom of Test Interval: 49.45 m

Step	Pressure [psi]	Flow Meter Readings [l]										Average Flow Rate [l/min]	Hydraulic Conductivity		
		1	2	3	4	5	6	7	8	9	10		[m/s]	[m/d]	Lugeon
1	10	687.00	737.50	788.50	839.00	889.00	940.00	990.50	1041.00			50.57	4.60×10^{-6}	3.98×10^{-1}	29
2	15	97.00	155.50	213.00	271.50	330.50	388.50	447.50	506.50	565.50		58.56	3.76×10^{-6}	3.25×10^{-1}	24
3	20	614.00	681.50	749.00	816.50	884.00						67.50	3.34×10^{-6}	2.89×10^{-1}	21
4	15	1029.50	1087.50	1145.00	1203.00	1261.00	1320.00	1378.50	1436.50	1495.50	1554.00	58.28	3.74×10^{-6}	3.23×10^{-1}	24
5	10	842.00	893.50	940.50	987.00	1034.50	1080.50	1127.00	1173.50	1220.50	1267.50	47.28	4.30×10^{-6}	3.72×10^{-1}	27
												Average	3.95×10^{-6}	3.41×10^{-1}	25







Turbulent
Lugeon: 23.904
Hydraulic Conductivity: 3.76E-6 m/s
Hydraulic Conductivity: 3.25E-1 m/d

Performed using a single packer test assembly as the borehole was advanced, with the bottom of the test interval bounded by the bottom of the drilled section of the borehole.

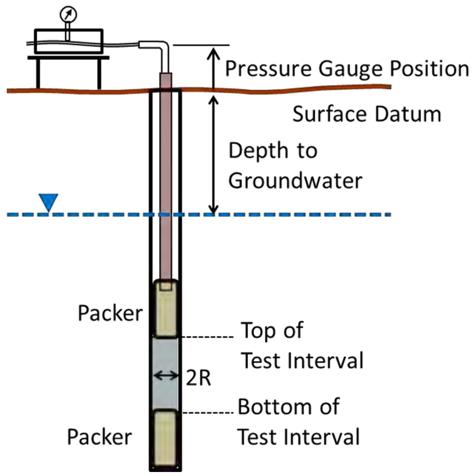
~0.23 L/min system losses at 30 psi (during packer inflation); considered negligible in comparison to test flows.

Hydraulic conductivity value for test interval derived based on flow classification: Turbulent (Step 2).

Lugeon Test Analysis Report	
Project:	Valentine Gold Feasibility Geotechnical Investigation
Number:	80047.03
Client:	Terrane Geoscience Inc.

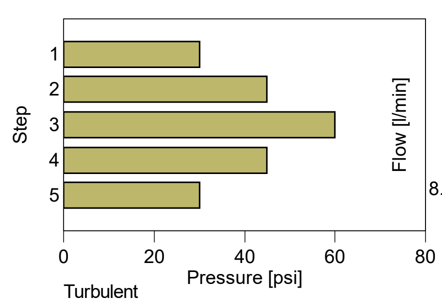
GEMTEC
Consulting Engineers and Scientists

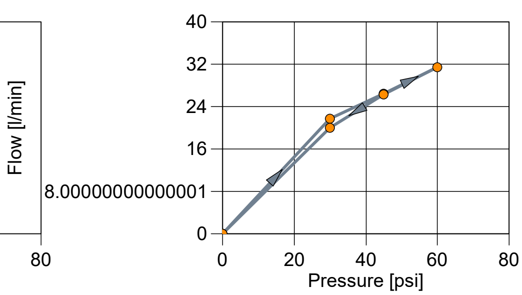
Location: Valentine Lake, NL	Lugeon Test: PT3	Tested bore: MA-GT-20-04
Test Conducted by: Terrane Geoscience Inc.		Test Date: 7/9/2020
Analysis Performed by: C. Anstey-Moore		Analysis Date: 10/27/2020
Lithology:		

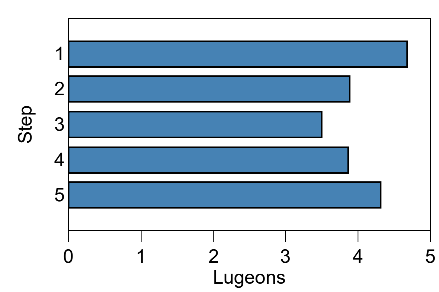


Top of Test Interval: 56.00 m
Bottom of Test Interval: 77.00 m
Length of Test Interval: 21.00 m
Gauge Position: 1.43 m
Depth to Groundwater: 0.00 m
Radius of Test Section: 0.05 m
Dip of bore: 28° from vertical
Vertical Top of Test Interval: 49.45 m
Vertical Bottom of Test Interval: 67.99 m

Step	Pressure [psi]	Flow Meter Readings [l]										Average Flow Rate [l/min]	Hydraulic Conductivity		
		1	2	3	4	5	6	7	8	9	10		[m/s]	[m/d]	Lugeon
1	30	380.00	402.10	424.00	445.80	467.40	488.90	510.40	531.90			21.70	7.35×10^{-7}	6.35×10^{-2}	4.7
2	45	570.00	596.70	622.90	649.40	675.70	702.10	728.50	754.90			26.41	6.09×10^{-7}	5.27×10^{-2}	3.9
3	60	810.00	841.60	872.90	904.40	935.70	967.00	998.30				31.38	5.49×10^{-7}	4.74×10^{-2}	3.5
4	45	70.00	96.50	122.90	149.30	175.60	201.90	228.10	254.40	280.60	306.90	26.32	6.07×10^{-7}	5.25×10^{-2}	3.9
5	30	345.00	365.10	385.20	405.20	425.30	445.20	465.20	485.10	505.00	524.90	19.99	6.77×10^{-7}	5.85×10^{-2}	4.3
												Average	6.36×10^{-7}	5.49×10^{-2}	4.0







Turbulent
Lugeon: 3.879
Hydraulic Conductivity: 6.09E-7 m/s
Hydraulic Conductivity: 5.27E-2 m/d

Performed using a single packer test assembly as the borehole was advanced, with the bottom of the test interval bounded by the bottom of the drilled section of the borehole.

~0.02 L/min system losses at 60 psi (during packer inflation); considered negligible in comparison to test flows.

Hydraulic conductivity value for test interval derived based on flow classification: Turbulent (Step 2).

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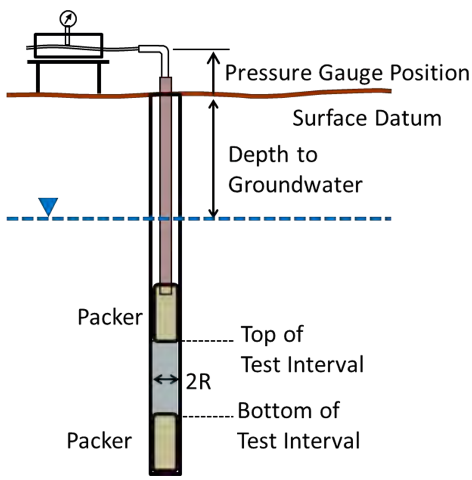
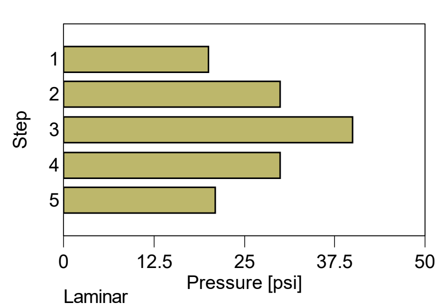
Lugeon Test Analysis Report
Project: Valentine Gold Feasibility Geotechnical Investigation
Number: 80047.03
Client: Terrane Geoscience Inc.

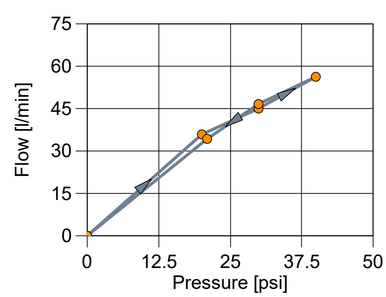
Location: Valentine Lake, NL	Lugeon Test: PT4	Tested bore: MA-GT-20-04
Test Conducted by: Terrane Geoscience Inc.		Test Date: 7/9/2020
Analysis Performed by: C. Anstey-Moore		Analysis Date: 10/27/2020
Lithology:		

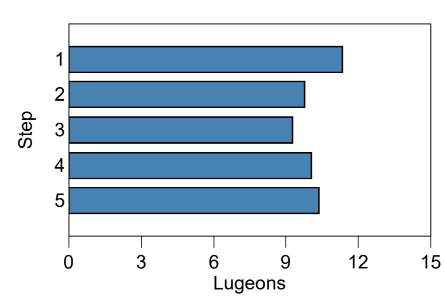


Top of Test Interval: 77.00 m
Bottom of Test Interval: 98.00 m
Length of Test Interval: 21.00 m
Gauge Position: 1.35 m
Depth to Groundwater: 0.00 m
Radius of Test Section: 0.05 m
Dip of bore: 28° from vertical
Vertical Top of Test Interval: 67.99 m
Vertical Bottom of Test Interval: 86.53 m

Step	Pressure [psi]	Flow Meter Readings [l]										Average Flow Rate [l/min]	Hydraulic Conductivity		
		1	2	3	4	5	6	7	8	9	10		[m/s]	[m/d]	Lugeon
1	20	670.00	707.50	743.50	779.50	815.50	851.00	886.50	922.00			36.00	1.78×10^{-6}	1.54×10^{-1}	11.3
2	30	970.00	1015.50	1060.50	1105.50	1150.50	1195.50					45.10	1.53×10^{-6}	1.32×10^{-1}	9.8
3	40	240.00	297.00	353.50	410.00	466.00	522.00	578.00				56.33	1.46×10^{-6}	1.26×10^{-1}	9.3
4	30	774.00	820.50	867.00	913.50							46.50	1.58×10^{-6}	1.37×10^{-1}	10.1
5	21	950.00	984.50	1019.00	1053.50	1087.50	1122.00	1156.50	1190.50	1225.00	1259.50	34.39	1.63×10^{-6}	1.41×10^{-1}	10.4
												Average	1.60×10^{-6}	1.38×10^{-1}	10.2







Laminar
Lugeon: 10.2
Hydraulic Conductivity: 1.60E-6 m/s
Hydraulic Conductivity: 1.38E-1 m/d

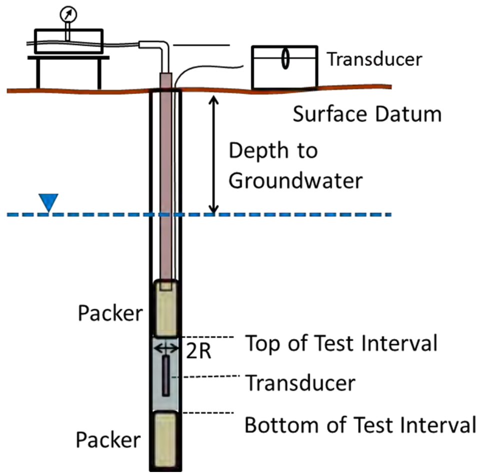
Performed using a single packer test assembly as the borehole was advanced, with the bottom of the test interval bounded by the bottom of the drilled section of the borehole.

No leaks were noticed during packer inflation or testing. At pump maximum output only 40 psi attainable pressure. Pressure adjustments required during steps 1 and 3. Surface gauge pressure readings checked with transducer data.

Hydraulic conductivity value for test interval derived based on flow classification: Laminar (average for all steps).

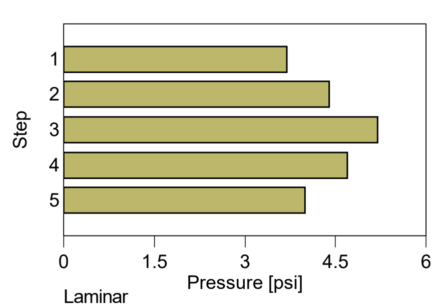
GEMTEC Consulting Engineers and Scientists	**Lugeon Test Analysis Report**
	Project: Valentine Gold Feasibility Geotechnical Investigation
	Number: 80047.03
	Client: Terrane Geoscience Inc.

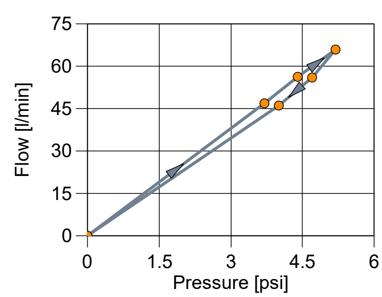
Location: Valentine Lake, NL	Lugeon Test: PT5	Tested bore: MA-GT-20-04
Test Conducted by: Terrane Geoscience Inc.		Test Date: 7/9/2020
Analysis Performed by: C. Anstey-Moore		Analysis Date: 10/27/2020
Lithology:		

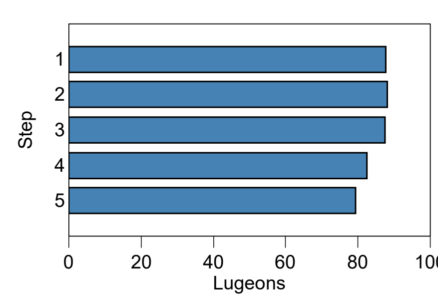


Top of Test Interval: 98.00 m
Bottom of Test Interval: 119.00 m
Length of Test Interval: 21.00 m
Depth to Groundwater: 0.00 m
Radius of Test Section: 0.05 m
Dip of bore: 28° from vertical
Vertical Top of Test Interval: 86.53 m
Vertical Bottom of Test Interval: 105.07 m

Step	Pressure [psi]	Flow Meter Readings [l]										Average Flow Rate [l/min]	Hydraulic Conductivity		
		1	2	3	4	5	6	7	8	9	10		[m/s]	[m/d]	Lugeon
1	3.7	620.00	667.00	714.00	761.00	808.00						47.00	1.38×10^{-5}	1.19×10^{0}	88
2	4.4	900.00	956.50	1012.50	1068.50	1124.50						56.13	1.38×10^{-5}	1.20×10^{0}	88
3	5.2	260.00	326.00	392.00	457.50	523.00	589.00	655.00				65.83	1.37×10^{-5}	1.19×10^{0}	87
4	4.7	780.00	836.00	892.50	948.50	1004.50	1060.50					56.10	1.30×10^{-5}	1.12×10^{0}	82
5	4.0	120.00	166.00	212.00	258.00	304.00						46.00	1.25×10^{-5}	1.08×10^{0}	79
												Average	1.34×10^{-5}	1.15×10^{0}	85







Laminar
Lugeon: 85
Hydraulic Conductivity: 1.34E-5 m/s
Hydraulic Conductivity: 1.15E0 m/d

Performed using a single packer test assembly as the borehole was advanced, with the bottom of the test interval bounded by the bottom of the drilled section of the borehole.

~0.2 L/min system losses at 150 psi (during packer inflation). At pump maximum output only 20 psi attainable pressure. High flows up to 66 L/min recorded. Test pressures based on transducer data; which indicated lower test pressures than that recorded on surface gauge (suggests artesian pressures within test interval). Some water loss (not measured) noted during step 3; low confidence in flow measurements for this step.

Hydraulic conductivity (K) values determined for steps 1, 2, 4, and 5 used to calculate the representative K value for the test interval - K = 1.33E-05 m/s.

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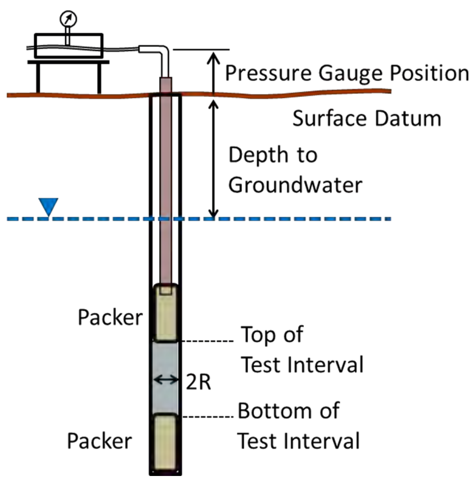
Lugeon Test Analysis Report

Project: Valentine Gold Feasibility Geotechnical Investigation

Number: 80047.03

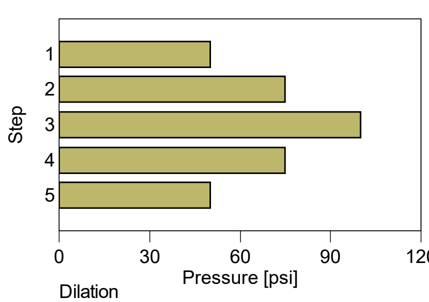
Client: Terrane Geoscience Inc.

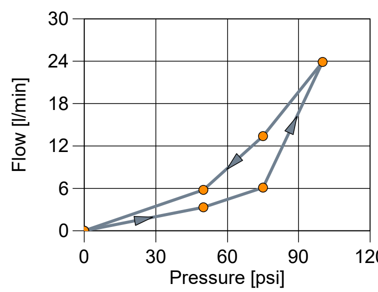
Location: Valentine Lake, NL	Lugeon Test: PT6	Tested bore: MA-GT-20-04
Test Conducted by: Terrane Geoscience Inc.		Test Date: 7/10/2020
Analysis Performed by: C. Anstey-Moore		Analysis Date: 10/27/2020
Lithology:		

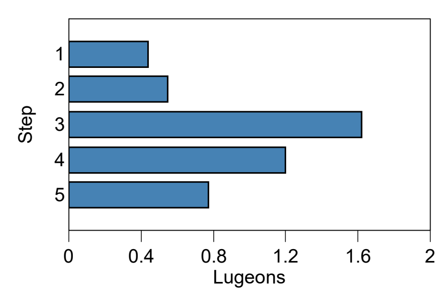


Top of Test Interval: 119.00 m
Bottom of Test Interval: 140.00 m
Length of Test Interval: 21.00 m
Gauge Position: 1.44 m
Depth to Groundwater: 0.00 m
Radius of Test Section: 0.05 m
Dip of bore: 28° from vertical
Vertical Top of Test Interval: 105.07 m
Vertical Bottom of Test Interval: 123.61 m

Step	Pressure [psi]	Flow Meter Readings [l]										Average Flow Rate [l/min]	Hydraulic Conductivity		
		1	2	3	4	5	6	7	8	9	10		[m/s]	[m/d]	Lugeon
1	50	352.00	355.47	358.88	362.23	365.55	368.83	372.10	375.33	378.56	381.79	3.31	6.90×10^{-8}	5.96×10^{-3}	0.439
2	75	395.00	401.10	407.15	413.25	419.35	425.45					6.09	8.58×10^{-8}	7.41×10^{-3}	0.546
3	100	500.00	523.85	547.70	571.60	595.60	619.60	643.60				23.93	2.55×10^{-7}	2.20×10^{-2}	1.620
4	75	741.30	754.90	768.40	781.70	795.20	808.50	821.90	835.20	848.50	861.80	13.39	1.89×10^{-7}	1.63×10^{-2}	1.200
5	50	886.30	892.41	898.45	904.45	910.35	916.20	921.98	927.64	933.21	938.74	5.83	1.21×10^{-7}	1.05×10^{-2}	0.773
												Average	1.44×10^{-7}	1.24×10^{-2}	0.916







Dilation
Lugeon: 0.439
Hydraulic Conductivity: 6.90E-8 m/s
Hydraulic Conductivity: 5.96E-3 m/d

Performed using a single packer test assembly as the borehole was advanced, with the bottom of the test interval bounded by the bottom of the drilled section of the borehole.

No leaks were noticed during packer inflation or testing.

Although pressure-flow step profile suggests a Dilation classification, the arithmetic mean (average) of the hydraulic conductivity (K) values determined for all steps used to calculate the representative K value for the test interval - K = 1.44E-7 m/s.

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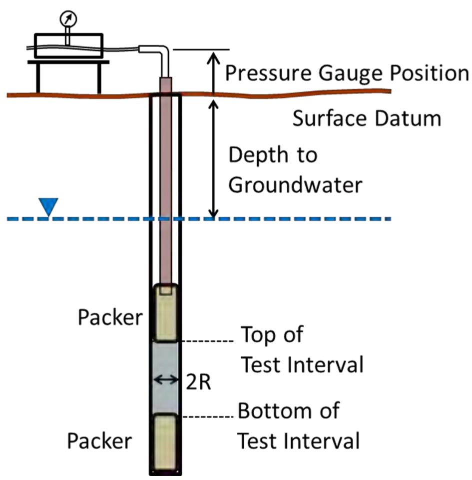
Lugeon Test Analysis Report

Project: Valentine Gold Feasibility Geotechnical Investigation

Number: 80047.03

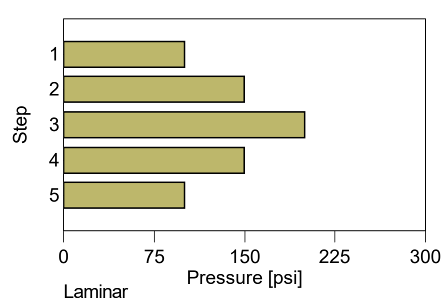
Client: Terrane Geoscience Inc.

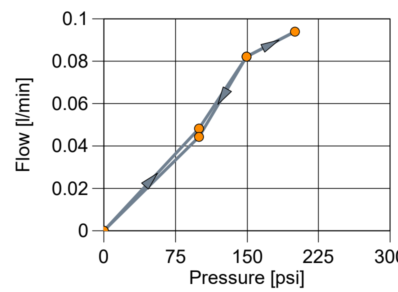
Location: Valentine Lake, NL	Lugeon Test: PT7	Tested bore: MA-GT-20-04
Test Conducted by: Terrane Geoscience Inc.		Test Date: 7/10/2020
Analysis Performed by: C. Anstey-Moore		Analysis Date: 10/27/2020
Lithology:		

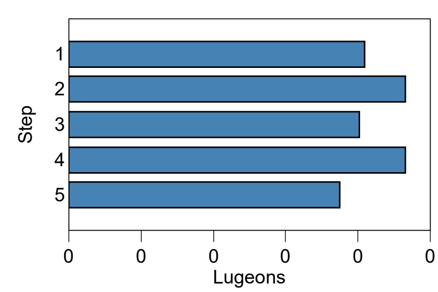


Top of Test Interval: 140.00 m
Bottom of Test Interval: 161.00 m
Length of Test Interval: 21.00 m
Gauge Position: 1.42 m
Depth to Groundwater: 0.00 m
Radius of Test Section: 0.05 m
Dip of bore: 28° from vertical
Vertical Top of Test Interval: 123.61 m
Vertical Bottom of Test Interval: 142.15 m

Step	Pressure [psi]	Flow Meter Readings [l]										Average Flow Rate [l/min]	Hydraulic Conductivity		
		1	2	3	4	5	6	7	8	9	10		[m/s]	[m/d]	Lugeon
1	100	54.34	54.39	54.44	54.49	54.53	54.58	54.63				0.05	5.14×10^{-10}	4.44×10^{-5}	0.003
2	150	54.89	54.98	55.06	55.14	55.22	55.30					0.08	5.85×10^{-10}	5.06×10^{-5}	0.004
3	200	55.53	55.64	55.73	55.82	55.91	56.00					0.09	5.05×10^{-10}	4.36×10^{-5}	0.003
4	150	55.90	55.99	56.07	56.15	56.23	56.31					0.08	5.85×10^{-10}	5.06×10^{-5}	0.004
5	100	56.20	56.20	56.26	56.32	56.36	56.41	56.46	56.51			0.04	4.71×10^{-10}	4.07×10^{-5}	0.003
												Average	5.32×10^{-10}	4.60×10^{-5}	0.003







Laminar
Lugeon: 0.003
Hydraulic Conductivity: 5.32E-10 m/s
Hydraulic Conductivity: 4.60E-5 m/d

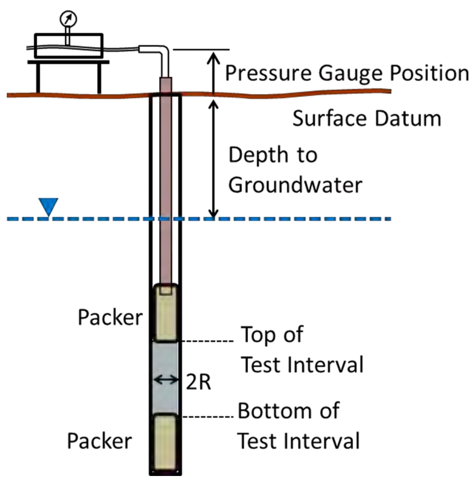
Performed using a single packer test assembly as the borehole was advanced, with the bottom of the test interval bounded by the bottom of the drilled section of the borehole.

~0.07 L/min system losses at 110 psi (during packer inflation). Not accounted for in test flow data. Test pressures higher than determined Pmax required to induce flow for steps 2, 3, and 4. Test pressure-flow profile does not suggest dilation, and test results at these steps are considered reliable.

Hydraulic conductivity value for test interval derived based on flow classification: Laminar (average for all steps).

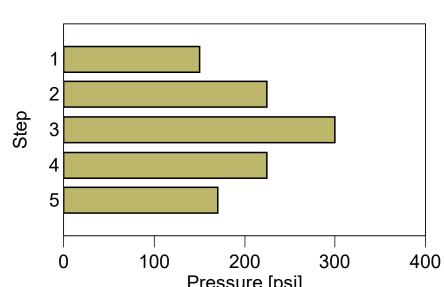
Lugeon Test Analysis Report	
Project:	Valentine Gold Feasibility Geotechnical Investigation
Number:	80047.03
Client:	Terrane Geoscience Inc.

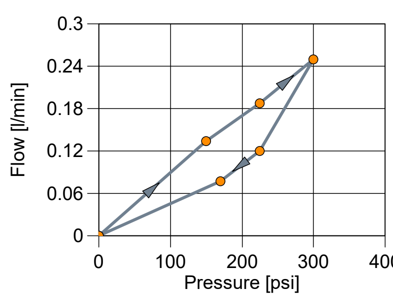
Location: Valentine Lake, NL	Lugeon Test: PT8	Tested bore: MA-GT-20-04
Test Conducted by: Terrane Geoscience Inc.		Test Date: 7/10/2020
Analysis Performed by: C. Anstey-Moore		Analysis Date: 10/27/2020
Lithology:		

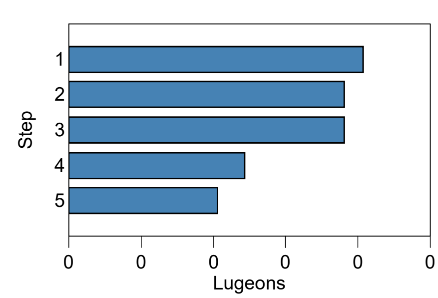


Top of Test Interval: 161.00 m
Bottom of Test Interval: 182.00 m
Length of Test Interval: 21.00 m
Gauge Position: 1.42 m
Depth to Groundwater: 0.00 m
Radius of Test Section: 0.05 m
Dip of bore: 28° from vertical
Vertical Top of Test Interval: 142.15 m
Vertical Bottom of Test Interval: 160.70 m

Step	Pressure [psi]	Flow Meter Readings [l]										Average Flow Rate [l/min]	Hydraulic Conductivity		
		1	2	3	4	5	6	7	8	9	10		[m/s]	[m/d]	Lugeon
1	150	65.80	65.99	66.15	66.31	66.44	66.56	66.69	66.81	66.91	67.01	0.13	9.60×10^{-10}	8.29×10^{-5}	0.006
2	225	67.80	68.00	68.20	68.38	68.56	68.74					0.19	8.99×10^{-10}	7.76×10^{-5}	0.006
3	300	70.00	70.25	70.50	70.75							0.25	8.98×10^{-10}	7.76×10^{-5}	0.006
4	225	70.90	71.02	71.14	71.26	71.38						0.12	5.74×10^{-10}	4.96×10^{-5}	0.004
5	170	71.20	71.27	71.35	71.42	71.50	71.58	71.66				0.08	4.84×10^{-10}	4.18×10^{-5}	0.003
												Average	7.63×10^{-10}	6.59×10^{-5}	0.005







Void filling
Lugeon: 0.003
Hydraulic Conductivity: 4.84E-10 m/s
Hydraulic Conductivity: 4.18E-5 m/d

Performed using a single packer test assembly as the borehole was advanced, with the bottom of the test interval bounded by the bottom of the drilled section of the borehole.

~0.08 L/min system losses at 130 psi (during packer inflation). Not accounted for in test flow data. Test pressures higher than determined Pmax required to induce flow for all steps. Test pressure-flow profile does not suggest dilation and test results are considered reliable.

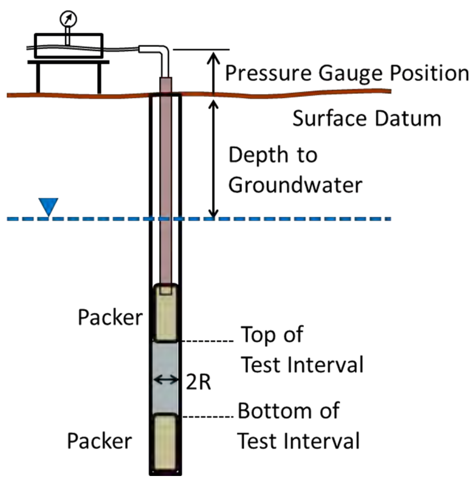
Although pressure-flow step profile suggests a Void Filling classification, the arithmetic mean (average) of the hydraulic conductivity (K) values determined for all steps used to calculate the representative K value for the test interval - K = 7.63E-10 m/s.

GEMTEC Consulting Engineers and Scientists

Lugeon Test Analysis Report

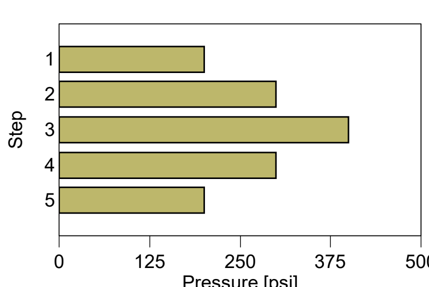
Project:	Valentine Gold Feasibility Geotechnical Investigation
Number:	80047.03
Client:	Terrane Geoscience Inc.

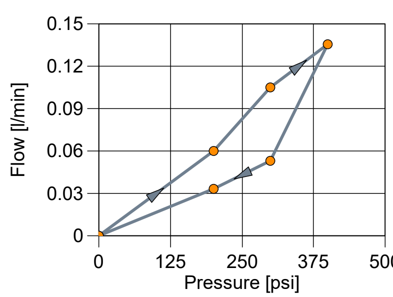
Location: Valentine Lake, NL	Lugeon Test: PT9	Tested bore: MA-GT-20-04
Test Conducted by: Terrane Geoscience Inc.		Test Date: 7/11/2020
Analysis Performed by: C. Anstey-Moore		Analysis Date: 10/27/2020
Lithology:		

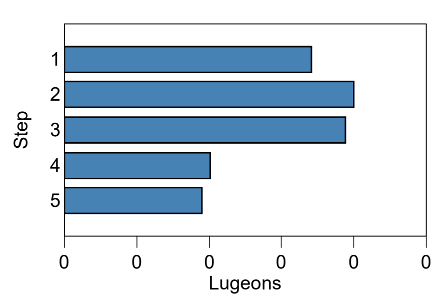


Top of Test Interval: 182.00 m
Bottom of Test Interval: 203.00 m
Length of Test Interval: 21.00 m
Gauge Position: 1.44 m
Depth to Groundwater: 0.00 m
Radius of Test Section: 0.05 m
Dip of bore: 28° from vertical
Vertical Top of Test Interval: 160.70 m
Vertical Bottom of Test Interval: 179.24 m

Step	Pressure [psi]	Flow Meter Readings [l]										Average Flow Rate [l/min]	Hydraulic Conductivity		
		1	2	3	4	5	6	7	8	9	10		[m/s]	[m/d]	Lugeon
1	200	93.89	93.95	94.02	94.07	94.13						0.06	3.22×10^{-10}	2.78×10^{-5}	0.002
2	300	95.34	95.45	95.56	95.66	95.75	95.87	95.97				0.10	3.77×10^{-10}	3.26×10^{-5}	0.002
3	400	96.40	96.62	96.75	96.88	97.00	97.13	97.24	97.35			0.14	3.66×10^{-10}	3.17×10^{-5}	0.002
4	300	97.22	97.27	97.33	97.39	97.44	97.49	97.54	97.59			0.05	1.90×10^{-10}	1.64×10^{-5}	0.001
5	200	97.31	97.35	97.37	97.42	97.44	97.48	97.50	97.55	97.57	97.61	0.03	1.79×10^{-10}	1.55×10^{-5}	0.001
												Average	2.87×10^{-10}	2.48×10^{-5}	0.002







Void filling
Lugeon: 0.001
Hydraulic Conductivity: 1.79E-10 m/s
Hydraulic Conductivity: 1.55E-5 m/d

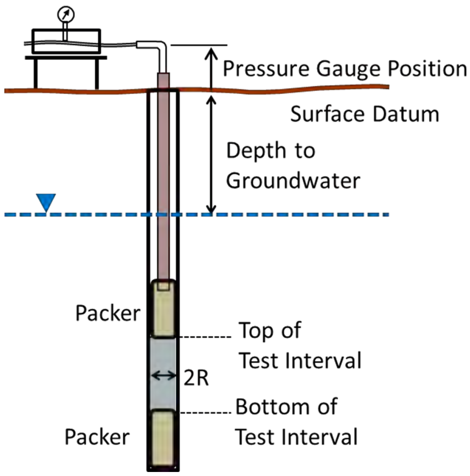
Performed using a single packer test assembly as the borehole was advanced, with the bottom of the test interval bounded by the bottom of the drilled section of the borehole.

No leaks were noticed during packer inflation or testing. Test pressures higher than determined Pmax required to induce flow for all steps. Test pressure-flow profile does not suggest dilation and test results are considered reliable. Several pressure adjustments required during steps 2 and 3.

Although pressure-flow step profile suggests a Void Filling classification, the arithmetic mean (average) of the hydraulic conductivity (K) values determined for all steps used to calculate the representative K value for the test interval - K = 2.87E-10 m/s.

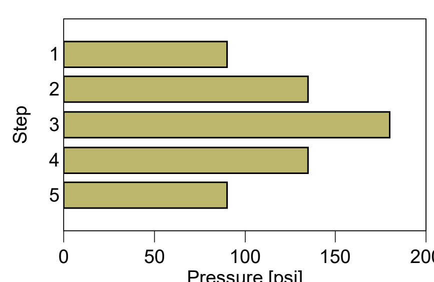
GEMTEC Consulting Engineers and Scientists	**Lugeon Test Analysis Report**
	Project: Valentine Gold Feasibility Geotechnical Investigation
	Number: 80047.03
	Client: Terrane Geoscience Inc.

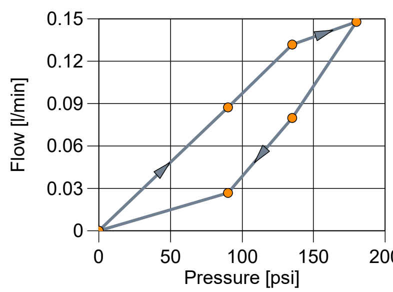
Location: Valentine Lake, NL	Lugeon Test: PT10	Tested bore: MA-GT-20-04
Test Conducted by: Terrane Geoscience Inc.		Test Date: 7/11/2020
Analysis Performed by: C. Anstey-Moore		Analysis Date: 10/27/2020
Lithology:		

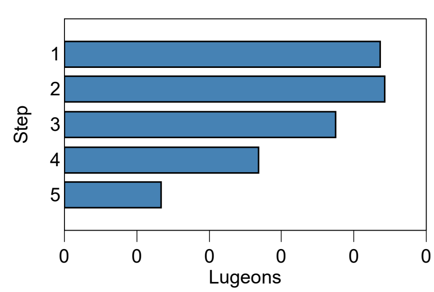


Top of Test Interval: 203.00 m
Bottom of Test Interval: 224.00 m
Length of Test Interval: 21.00 m
Gauge Position: 1.44 m
Depth to Groundwater: 0.00 m
Radius of Test Section: 0.05 m
Dip of bore: 28° from vertical
Vertical Top of Test Interval: 179.24 m
Vertical Bottom of Test Interval: 197.78 m

Step	Pressure [psi]	Flow Meter Readings [l]										Average Flow Rate [l/min]	Hydraulic Conductivity		
		1	2	3	4	5	6	7	8	9	10		[m/s]	[m/d]	Lugeon
1	90	100.44	100.53	100.64	100.72	100.81	100.89	100.97	101.05			0.09	1.03×10^{-9}	8.94×10^{-5}	0.007
2	135	101.48	101.63	101.76	101.90	102.02	102.15	102.27				0.13	1.05×10^{-9}	9.07×10^{-5}	0.007
3	180	102.80	102.97	103.12	103.26	103.40	103.54					0.15	8.88×10^{-10}	7.67×10^{-5}	0.006
4	135	103.43	103.52	103.60	103.69	103.76	103.84	103.92	103.99	104.07		0.08	6.38×10^{-10}	5.51×10^{-5}	0.004
5	90	103.83	103.83	103.83	103.87	103.91	103.95	103.99				0.03	3.17×10^{-10}	2.73×10^{-5}	0.002
												Average	7.85×10^{-10}	6.79×10^{-5}	0.005







Void filling
Lugeon: 0.002
Hydraulic Conductivity: 3.17E-10 m/s
Hydraulic Conductivity: 2.73E-5 m/d

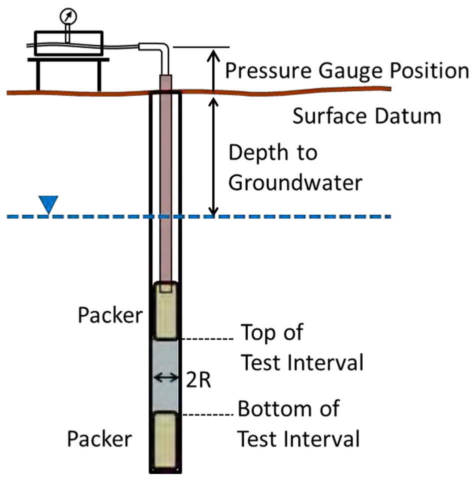
Performed using a single packer test assembly as the borehole was advanced, with the bottom of the test interval bounded by the bottom of the drilled section of the borehole.

~0.08 L/min system losses at 130 psi (during packer inflation). Surface gauge pressure readings checked with transducer data.

Although pressure-flow step profile suggests a Void Filling classification, the arithmetic mean (average) of the hydraulic conductivity (K) values determined for all steps used to calculate the representative K value for the test interval - K = 7.85E-10 m/s.

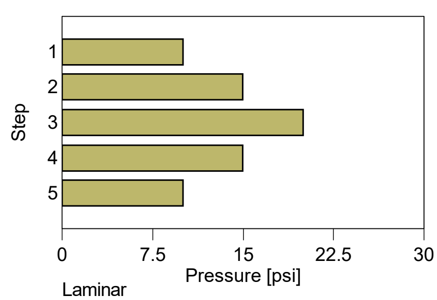
Lugeon Test Analysis Report	
Project:	Valentine Gold Feasibility Geotechnical Investigation
Number:	80047.03
Client:	Terrane Geoscience Inc.

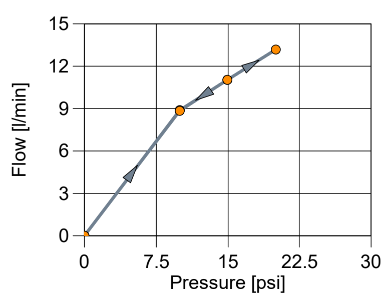
Location: Valentine Lake, NL	Lugeon Test: PT2	Tested bore: MA-GT-20-06
Test Conducted by: Terrane Geoscience Inc.		Test Date: 7/28/2020
Analysis Performed by: C. Anstey-Moore		Analysis Date: 10/27/2020
Lithology:		

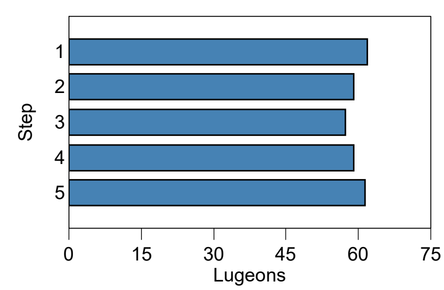


Top of Test Interval: 23.85 m
Bottom of Test Interval: 25.10 m
Length of Test Interval: 1.25 m
Gauge Position: 1.40 m
Depth to Groundwater: 3.30 m
Radius of Test Section: 0.05 m
Dip of bore: 32° from vertical
Vertical Top of Test Interval: 20.23 m
Vertical Bottom of Test Interval: 21.29 m

Step	Pressure [psi]	Flow Meter Readings [l]										Average Flow Rate [l/min]	Hydraulic Conductivity		
		1	2	3	4	5	6	7	8	9	10		[m/s]	[m/d]	Lugeon
1	10	111.00	119.90	128.70	137.70	146.50	155.40	164.30	173.30			8.90	5.18×10^{-6}	4.48×10^{-1}	62
2	15	183.00	193.80	204.70	216.00	226.90	237.90	249.00	260.10	271.20		11.02	4.94×10^{-6}	4.27×10^{-1}	59
3	20	279.00	292.70	305.80	319.40	332.70	345.90	359.20	372.10	384.90	397.70	13.19	4.80×10^{-6}	4.15×10^{-1}	57
4	15	419.00	430.20	441.50	452.60	463.70	474.50	485.40	496.30			11.04	4.95×10^{-6}	4.27×10^{-1}	59
5	10	502.00	510.90	519.70	528.50	537.30						8.82	5.14×10^{-6}	4.44×10^{-1}	61
												Average	5.00×10^{-6}	4.32×10^{-1}	60







Laminar
Lugeon: 59.737
Hydraulic Conductivity: 5.00E-6 m/s
Hydraulic Conductivity: 4.32E-1 m/d

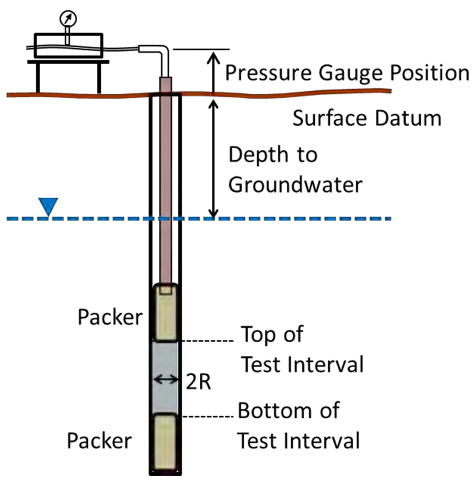
Performed using a straddle double packer test assembly to isolate test interval.

~0.05 L/min system losses at 50 psi (during packer inflation); considered negligible in comparison to test flows.). Surface gauge pressure readings checked with transducer data.

Hydraulic conductivity value for test interval derived based on flow classification: Laminar (average for all steps).

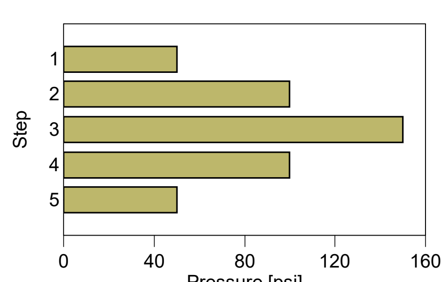
GEMTEC Consulting Engineers and Scientists	**Lugeon Test Analysis Report**
	Project: Valentine Gold Feasibility Geotechnical Investigation
	Number: 80047.03
	Client: Terrane Geoscience Inc.

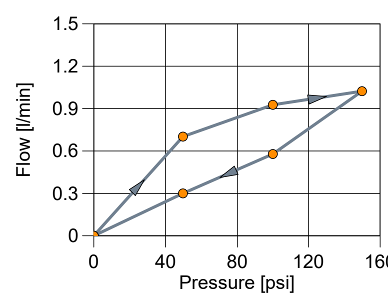
Location: Valentine Lake, NL	Lugeon Test: PT1	Tested bore: MA-GT-20-06
Test Conducted by: Terrane Geoscience Inc.		Test Date: 7/25/2020
Analysis Performed by: C. Anstey-Moore		Analysis Date: 10/27/2020
Lithology:		

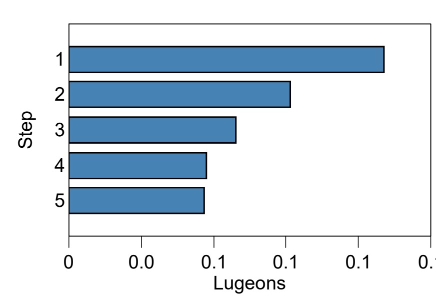


Top of Test Interval: 183.30 m
Bottom of Test Interval: 197.00 m
Length of Test Interval: 13.70 m
Gauge Position: 1.42 m
Depth to Groundwater: 3.30 m
Radius of Test Section: 0.05 m
Dip of bore: 32° from vertical
Vertical Top of Test Interval: 155.45 m
Vertical Bottom of Test Interval: 167.07 m

Step	Pressure [psi]	Flow Meter Readings [l]										Average Flow Rate [l/min]	Hydraulic Conductivity		
		1	2	3	4	5	6	7	8	9	10		[m/s]	[m/d]	Lugeon
1	50	9046.20	9046.96	9047.87	9048.70	9049.37	9050.04	9050.67	9051.30	9051.92	9052.50	0.70	1.91×10^{-8}	1.65×10^{-3}	0.131
2	100	9054.30	9055.47	9056.50	9057.45	9058.39	9059.27	9060.15	9061.00	9061.81	9062.62	0.92	1.34×10^{-8}	1.16×10^{-3}	0.092
3	150	29066.50	29067.73	29068.84	29069.90	29070.91	29071.91	29072.90	29073.86	29074.81	29075.71	1.02	1.01×10^{-8}	8.72×10^{-4}	0.069
4	100	77.00	77.56	78.13	78.72	79.30	79.88					0.58	8.34×10^{-9}	7.21×10^{-4}	0.057
5	50	79.90	80.18	80.46	80.88	81.10						0.30	8.18×10^{-9}	7.07×10^{-4}	0.056
												Average	1.18×10^{-8}	1.02×10^{-3}	0.081







Void filling
Lugeon: 0.056
Hydraulic Conductivity: 8.18E-9 m/s
Hydraulic Conductivity: 7.07E-4 m/d

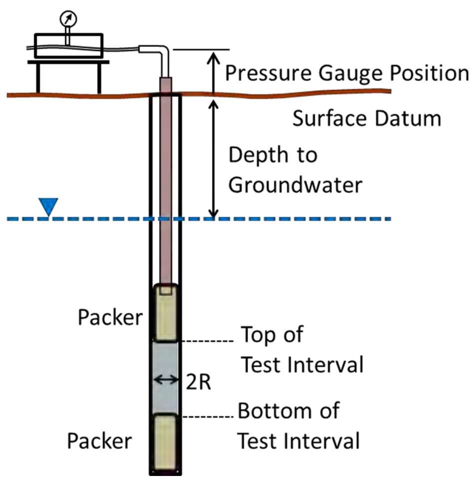
Performed using a straddle double packer test assembly to isolate test interval.

No leaks were noticed during packer inflation or testing.

Although pressure-flow step profile suggests a Void Filling classification, the arithmetic mean (average) of the hydraulic conductivity (K) values determined for all steps used to calculate the representative K value for the test interval - K = 1.18E-8 m/s.

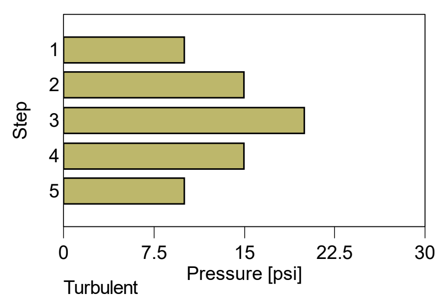
	Lugeon Test Analysis Report
GEMTEC Consulting Engineers and Scientists	Project: Valentine Gold Feasibility Geotechnical Investigation
	Number: 80047.03
	Client: Terrane Geoscience Inc.

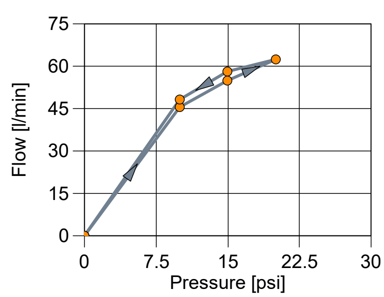
Location: Valentine Lake, NL	Lugeon Test: PT6	Tested bore: VL-GT-20-01
Test Conducted by: Terrane Geoscience Inc.		Test Date: 8/20/2020
Analysis Performed by: C. Anstey-Moore		Analysis Date: 10/26/2020
Lithology:		

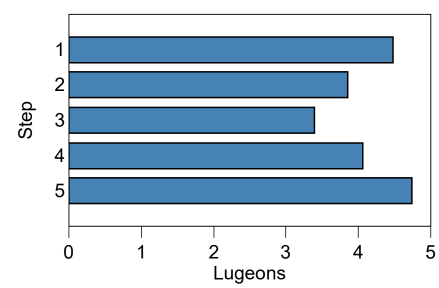


Top of Test Interval: 5.33 m
Bottom of Test Interval: 125.00 m
Length of Test Interval: 119.67 m
Gauge Position: 1.62 m
Depth to Groundwater: 0.00 m
Radius of Test Section: 0.05 m
Dip of bore: 35° from vertical
Vertical Top of Test Interval: 4.37 m
Vertical Bottom of Test Interval: 102.39 m

Step	Pressure [psi]	Flow Meter Readings [l]										Average Flow Rate [l/min]	Hydraulic Conductivity		
		1	2	3	4	5	6	7	8	9	10		[m/s]	[m/d]	Lugeon
1	10	715.00	759.50	804.50	849.50	895.50	941.50	987.50				45.42	9.05×10^{-7}	7.82×10^{-2}	4.5
2	15	35.00	90.00	145.00	200.00							55.00	7.80×10^{-7}	6.74×10^{-2}	3.9
3	20	230.00	293.00	356.00	418.00	480.00	542.00					62.40	6.86×10^{-7}	5.93×10^{-2}	3.4
4	15	730.00	788.00	846.00	904.00							58.00	8.22×10^{-7}	7.10×10^{-2}	4.1
5	10	50.00	98.50	146.50	194.50	242.50						48.13	9.59×10^{-7}	8.29×10^{-2}	4.7
												Average	8.31×10^{-7}	7.18×10^{-2}	4.1







Turbulent
Lugeon: 3.852
Hydraulic Conductivity: 7.80E-7 m/s
Hydraulic Conductivity: 6.74E-2 m/d

Performed using a single packer test assembly as the borehole was advanced, with the bottom of the test interval bounded by the bottom of the drilled section of the borehole.

No leaks were noticed during packer inflation or testing. Test pressures higher than determined Pmax required to induce flow. Test pressure-flow profile does not suggest dilation and test results at these steps are considered reliable.

Although pressure-flow step profile suggests a Turbulent classification, the arithmetic mean (average) of the hydraulic conductivity (K) values determined for all steps used to calculate the representative K value for the test interval - K = 8.31E-7 m/s.

GEMTEC
CONSULTING ENGINEERS AND SCIENTISTS

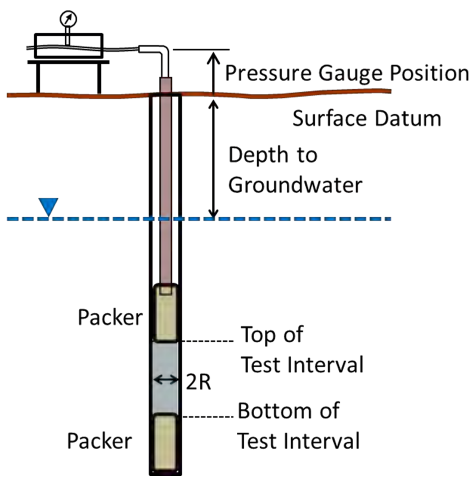
Lugeon Test Analysis Report

Project: Valentine Gold Feasibility Geotechnical Investigation

Number: 80047.03

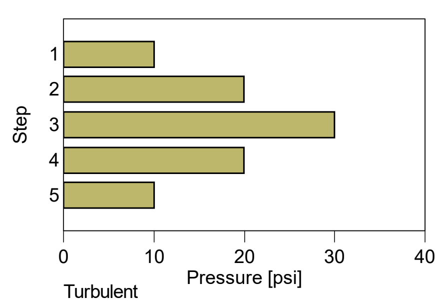
Client: Terrane Geoscience Inc.

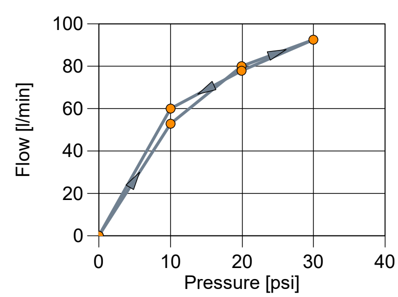
Location: Valentine Lake, NL	Lugeon Test: PT5	Tested bore: VL-GT-20-01
Test Conducted by: Terrane Geoscience Inc.		Test Date: 8/20/2020
Analysis Performed by: C. Anstey-Moore		Analysis Date: 10/26/2020
Lithology:		

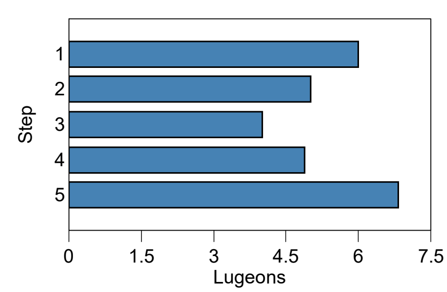


Top of Test Interval: 21.33 m
Bottom of Test Interval: 125.00 m
Length of Test Interval: 103.67 m
Gauge Position: 1.62 m
Depth to Groundwater: 0.00 m
Radius of Test Section: 0.05 m
Dip of bore: 35° from vertical
Vertical Top of Test Interval: 17.47 m
Vertical Bottom of Test Interval: 102.39 m

Step	Pressure [psi]	Flow Meter Readings [l]										Average Flow Rate [l/min]	Hydraulic Conductivity		
		1	2	3	4	5	6	7	8	9	10		[m/s]	[m/d]	Lugeon
1	10	781.00	834.00	887.00	939.00	992.00	1045.00					52.80	1.19×10^{-6}	1.03×10^{-1}	6.0
2	20	89.00	169.00	249.00	329.00							80.00	9.97×10^{-7}	8.61×10^{-2}	5.0
3	30	353.00	446.00	538.00	631.00	723.00	815.00					92.40	7.95×10^{-7}	6.87×10^{-2}	4.0
4	20	883.00	961.00	1039.00	1117.00							78.00	9.72×10^{-7}	8.40×10^{-2}	4.9
5	10	170.00	230.00	290.00	349.00	407.00	466.00	527.00	587.00	648.00	710.00	60.00	1.36×10^{-6}	1.17×10^{-1}	6.8
												Average	1.06×10^{-6}	9.18×10^{-2}	5.3







Turbulent
Lugeon: 5.0
Hydraulic Conductivity: 9.97E-7 m/s
Hydraulic Conductivity: 8.61E-2 m/d

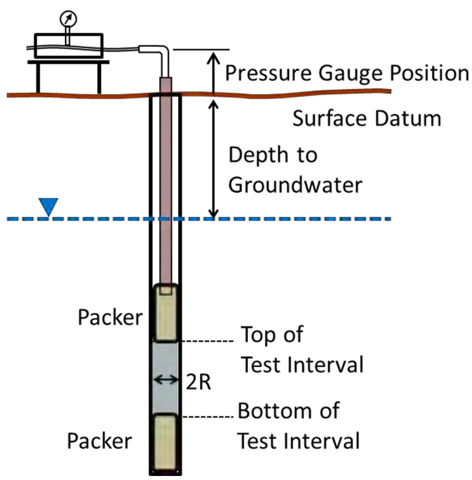
Performed using a single packer test assembly as the borehole was advanced, with the bottom of the test interval bounded by the bottom of the drilled section of the borehole.

~0.18 L/min system losses at 58 psi (during packer inflation); considered negligible in comparison to test flows. Test pressures higher than determined Pmax required to induce flow. Test pressure-flow profile does not suggest dilation and test results at these steps are considered reliable.

Although pressure-flow step profile suggests a Turbulent classification, the arithmetic mean (average) of the hydraulic conductivity (K) values determined for steps 2, 3 and 4 used to calculate the representative K value for the test interval - K = 9.21E-07 m/s.

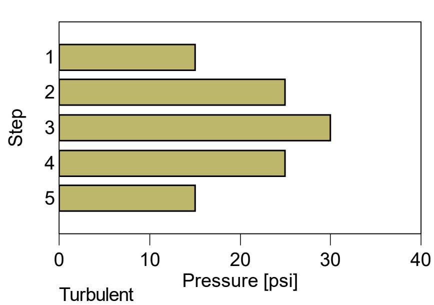
GEMTEC Consulting Engineers and Scientists	**Lugeon Test Analysis Report**
	Project: Valentine Gold Feasibility Geotechnical Investigation
	Number: 80047.03
	Client: Terrane Geoscience Inc.

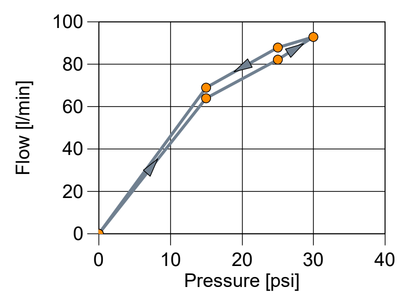
Location: Valentine Lake, NL	Lugeon Test: PT4	Tested bore: VL-GT-20-01
Test Conducted by: Terrane Geoscience Inc.		Test Date: 8/20/2020
Analysis Performed by: C. Anstey-Moore		Analysis Date: 10/26/2020
Lithology:		

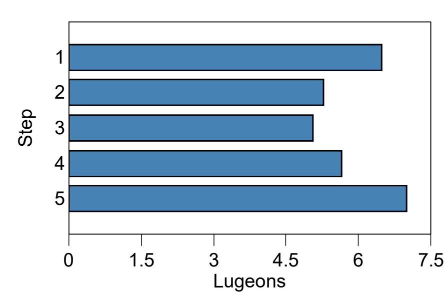


Top of Test Interval: 42.33 m
Bottom of Test Interval: 125.00 m
Length of Test Interval: 82.67 m
Gauge Position: 1.62 m
Depth to Groundwater: 0.00 m
Radius of Test Section: 0.05 m
Dip of bore: 35° from vertical
Vertical Top of Test Interval: 34.67 m
Vertical Bottom of Test Interval: 102.39 m

Step	Pressure [psi]	Flow Meter Readings [l]										Average Flow Rate [l/min]	Hydraulic Conductivity		
		1	2	3	4	5	6	7	8	9	10		[m/s]	[m/d]	Lugeon
1	15	705.00	769.00	833.00	897.00							64.00	1.25×10^{-6}	1.08×10^{-1}	6.5
2	25	947.00	1029.00	1111.00	1193.00							82.00	1.02×10^{-6}	8.78×10^{-2}	5.3
3	30	594.00	687.00	780.00	873.00							93.00	9.74×10^{-7}	8.41×10^{-2}	5.1
4	25	0.00	88.00	176.00	264.00							88.00	1.09×10^{-6}	9.42×10^{-2}	5.7
5	15	296.00	365.00	434.00	503.00							69.00	1.35×10^{-6}	1.17×10^{-1}	7.0
												Average	1.14×10^{-6}	9.81×10^{-2}	5.9







Turbulent
Lugeon: 5.3
Hydraulic Conductivity: 1.02E-6 m/s
Hydraulic Conductivity: 8.78E-2 m/d

Performed using a single packer test assembly as the borehole was advanced, with the bottom of the test interval bounded by the bottom of the drilled section of the borehole.

No leaks were noticed during packer inflation or testing.

Hydraulic conductivity value for test interval derived based on flow classification: Turbulent (Step 2).

GEMTEC
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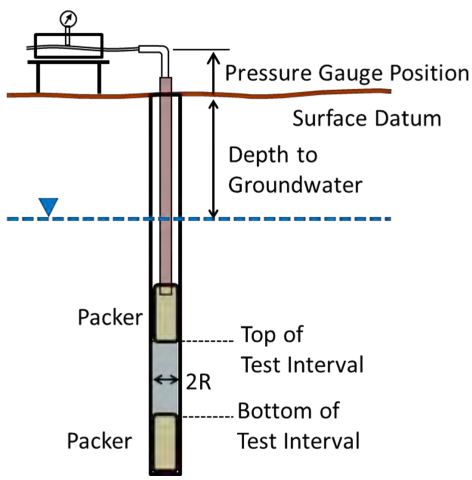
Lugeon Test Analysis Report

Project: Valentine Gold Feasibility Geotechnical Investigation

Number: 80047.03

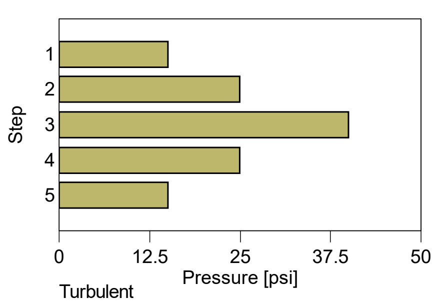
Client: Terrane Geoscience Inc.

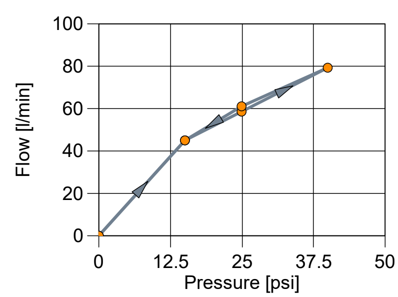
Location: Valentine Lake, NL	Lugeon Test: PT3	Tested bore: VL-GT-20-01
Test Conducted by: Terrane Geoscience Inc.		Test Date: 8/20/2020
Analysis Performed by: C. Anstey-Moore		Analysis Date: 10/26/2020
Lithology:		

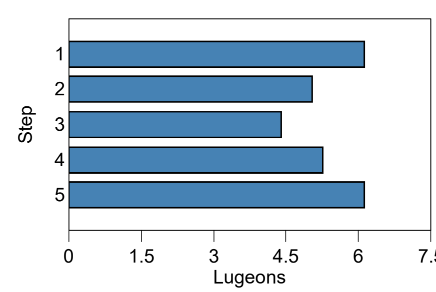


Top of Test Interval: 63.33 m
Bottom of Test Interval: 125.00 m
Length of Test Interval: 61.67 m
Gauge Position: 1.62 m
Depth to Groundwater: 0.00 m
Radius of Test Section: 0.05 m
Dip of bore: 35° from vertical
Vertical Top of Test Interval: 51.88 m
Vertical Bottom of Test Interval: 102.39 m

Step	Pressure [psi]	Flow Meter Readings [l]										Average Flow Rate [l/min]	Hydraulic Conductivity		
		1	2	3	4	5	6	7	8	9	10		[m/s]	[m/d]	Lugeon
1	15	706.00	751.00	796.00	841.00							45.00	1.13×10^{-6}	9.78×10^{-2}	6.1
2	25	886.00	944.00	1003.00	1061.00	1120.00	1178.00	1237.00				58.50	9.33×10^{-7}	8.06×10^{-2}	5.0
3	40	323.00	402.00	482.00	561.00	640.00	719.00					79.20	8.15×10^{-7}	7.04×10^{-2}	4.4
4	25	806.00	865.00	924.00	984.00	1047.00	1109.00	1171.00	1233.00			61.00	9.73×10^{-7}	8.41×10^{-2}	5.3
5	15	275.00	320.00	365.00	410.00							45.00	1.13×10^{-6}	9.78×10^{-2}	6.1
												Average	9.97×10^{-7}	8.62×10^{-2}	5.4







Turbulent
Lugeon: 5.0
Hydraulic Conductivity: 9.33E-7 m/s
Hydraulic Conductivity: 8.06E-2 m/d

Performed using a single packer test assembly as the borehole was advanced, with the bottom of the test interval bounded by the bottom of the drilled section of the borehole.

No leaks were noticed during packer inflation or testing.

Although pressure-flow step profile suggests a Turbulent classification, the hydraulic conductivity (K) value determined for step 1 used to calculate the representative K value for the test interval - K = 1.13E-06 m/s.

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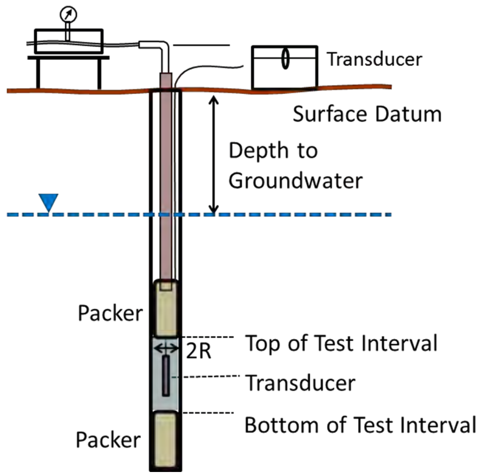
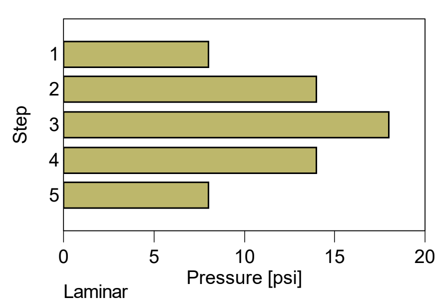
Lugeon Test Analysis Report	
Project:	Valentine Gold Feasibility Geotechnical Investigation
Number:	80047.03
Client:	Terrane Geoscience Inc.

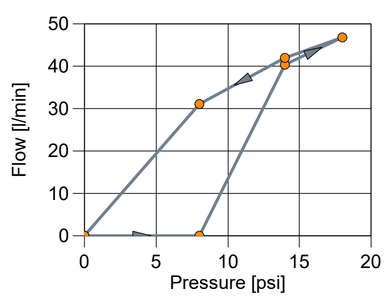
Location: Valentine Lake, NL	Lugeon Test: PT2	Tested bore: VL-GT-20-01
Test Conducted by: Terrane Geoscience Inc.		Test Date: 8/20/2020
Analysis Performed by: C. Anstey-Moore		Analysis Date: 10/26/2020
Lithology:		

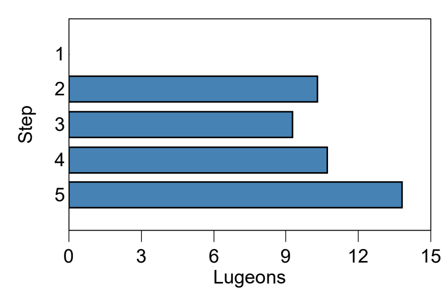


Top of Test Interval: 84.33 m
Bottom of Test Interval: 125.00 m
Length of Test Interval: 40.67 m
Depth to Groundwater: 0.00 m
Radius of Test Section: 0.05 m
Dip of bore: 35° from vertical
Vertical Top of Test Interval: 69.08 m
Vertical Bottom of Test Interval: 102.39 m

Step	Pressure [psi]	Flow Meter Readings [l]										Average Flow Rate [l/min]	Hydraulic Conductivity		
		1	2	3	4	5	6	7	8	9	10		[m/s]	[m/d]	Lugeon
1	8														
2	14	1167.00	1207.00	1247.00	1288.00	1329.00	1369.00					40.40	1.79×10^{-6}	1.55×10^{-1}	10
3	18	468.00	515.00	561.00	608.00	655.00	702.00					46.80	1.62×10^{-6}	1.40×10^{-1}	9
4	14	726.00	768.00	810.00	852.00							42.00	1.87×10^{-6}	1.61×10^{-1}	11
5	8	875.00	906.00	937.00	968.00							31.00	2.41×10^{-6}	2.08×10^{-1}	14
												Average	1.92×10^{-6}	1.66×10^{-1}	11







Laminar
Lugeon: 11.020
Hydraulic Conductivity: 1.92E-6 m/s
Hydraulic Conductivity: 1.66E-1 m/d

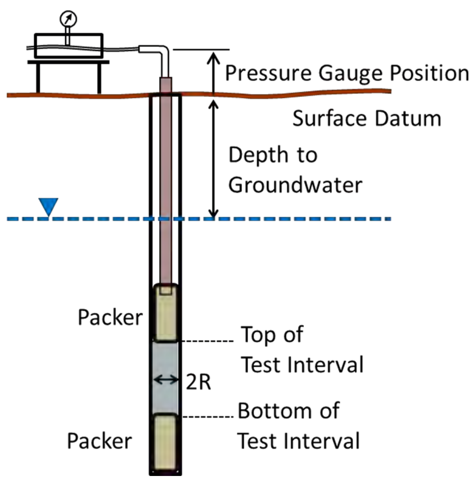
Performed using a single packer test assembly as the borehole was advanced, with the bottom of the test interval bounded by the bottom of the drilled section of the borehole.

Negative flow readings during leak test suggesting artesian pressures within test interval. Pressure adjustments required during step 2. Test pressures based on transducer data. Test pressures and flow data measured for step 1 not considered reliable.

The hydraulic conductivity (K) value determined for step 3 used to calculate the representative K value for the test interval - K = 1.62E-06 m/s.

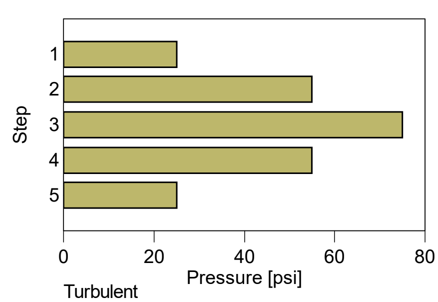
GEMTEC Consulting Engineers and Scientists	**Lugeon Test Analysis Report**
	Project: Valentine Gold Feasibility Geotechnical Investigation
	Number: 80047.03
	Client: Terrane Geoscience Inc.

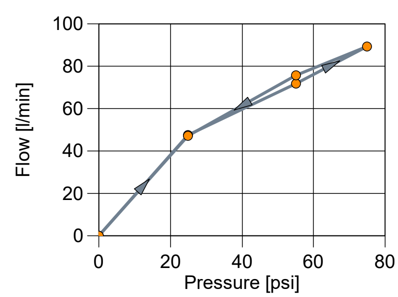
Location: Valentine Lake, NL	Lugeon Test: PT1	Tested bore: VL-GT-20-01
Test Conducted by: Terrane Geoscience Inc.		Test Date: 8/20/2020
Analysis Performed by: C. Anstey-Moore		Analysis Date: 10/26/2020
Lithology:		

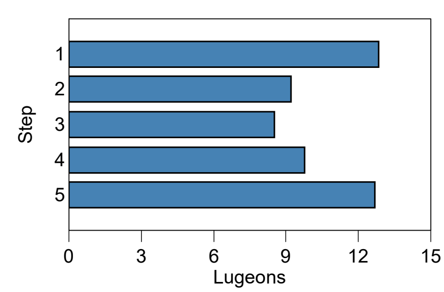


Top of Test Interval: 105.33 m
Bottom of Test Interval: 125.00 m
Length of Test Interval: 19.67 m
Gauge Position: 1.62 m
Depth to Groundwater: 0.00 m
Radius of Test Section: 0.05 m
Dip of bore: 35° from vertical
Vertical Top of Test Interval: 86.28 m
Vertical Bottom of Test Interval: 102.39 m

Step	Pressure [psi]	Flow Meter Readings [l]										Average Flow Rate [l/min]	Hydraulic Conductivity		
		1	2	3	4	5	6	7	8	9	10		[m/s]	[m/d]	Lugeon
1	25	413.00	460.00	508.00	555.00	603.00	650.00	698.00				47.50	1.99×10^{-6}	1.72×10^{-1}	12.8
2	55	8845.00	8916.00	8988.00	9059.00	9131.00	9203.00	9275.00				71.67	1.43×10^{-6}	1.24×10^{-1}	9.2
3	75	315.00	405.00	494.00	583.00	672.00						89.25	1.32×10^{-6}	1.14×10^{-1}	8.5
4	55	9930.00	10006.00	10081.00	10156.00	10233.00	10309.00	10385.00	10461.00			75.86	1.52×10^{-6}	1.31×10^{-1}	9.8
5	25	491.00	538.00	585.00	632.00							47.00	1.97×10^{-6}	1.70×10^{-1}	12.7
												Average	1.65×10^{-6}	1.42×10^{-1}	10.6







Turbulent
Lugeon: 9.2
Hydraulic Conductivity: 1.43E-6 m/s
Hydraulic Conductivity: 1.24E-1 m/d

Performed using a single packer test assembly as the borehole was advanced, with the bottom of the test interval bounded by the bottom of the drilled section of the borehole.

~0.01 L/min system losses at 90 psi (during packer inflation); considered negligible in comparison to test flows. Pressure adjustment required during step 3.

Hydraulic conductivity value for test interval derived based on flow classification: Turbulent (Step 2).

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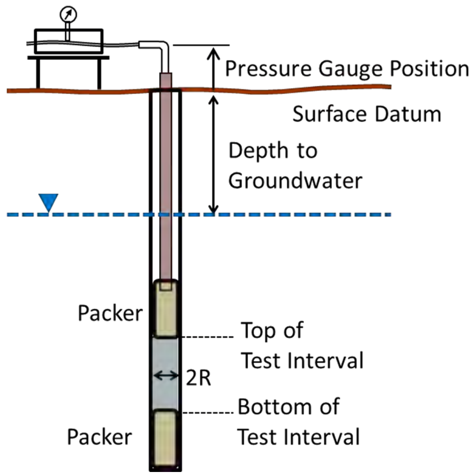
Lugeon Test Analysis Report

Project: Valentine Gold Feasibility Geotechnical Investigation

Number: 80047.03

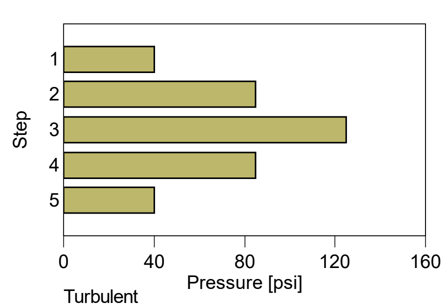
Client: Terrane Geoscience Inc.

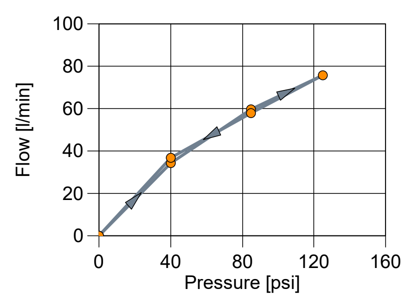
Location: Valentine Lake, NL	Lugeon Test: PT11	Tested bore: VL-GT-20-01
Test Conducted by: Terrane Geoscience Inc.		Test Date: 8/22/2020
Analysis Performed by: C. Anstey-Moore		Analysis Date: 10/26/2020
Lithology:		

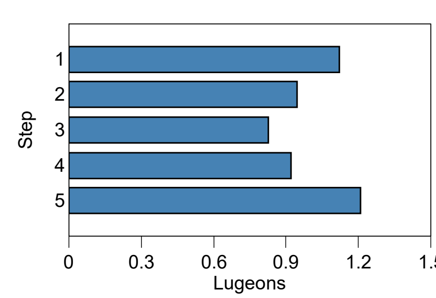


Top of Test Interval: 125.33 m
Bottom of Test Interval: 230.00 m
Length of Test Interval: 104.67 m
Gauge Position: 1.62 m
Depth to Groundwater: 0.00 m
Radius of Test Section: 0.05 m
Dip of bore: 35° from vertical
Vertical Top of Test Interval: 102.66 m
Vertical Bottom of Test Interval: 188.40 m

Step	Pressure [psi]	Flow Meter Readings [l]										Average Flow Rate [l/min]	Hydraulic Conductivity		
		1	2	3	4	5	6	7	8	9	10		[m/s]	[m/d]	Lugeon
1	40	69.00	105.00	140.00	174.00	209.00	243.00	276.00	310.00	343.00	377.00	34.22	2.23×10^{-7}	1.93×10^{-2}	1.12
2	85	479.00	540.00	600.00	660.00	719.00	779.00	838.00	897.00	956.00		59.63	1.88×10^{-7}	1.63×10^{-2}	0.95
3	125	190.00	266.00	342.00	417.00	493.00	569.00	645.00				75.83	1.64×10^{-7}	1.42×10^{-2}	0.83
4	85	726.00	783.00	839.00	897.00	955.00	1014.00	1073.00	1132.00			58.00	1.83×10^{-7}	1.58×10^{-2}	0.92
5	40	178.00	212.00	248.00	285.00	322.00	360.00	398.00	436.00			36.86	2.40×10^{-7}	2.07×10^{-2}	1.21
												Average	2.00×10^{-7}	1.73×10^{-2}	1.00







Turbulent
Lugeon: 0.946
Hydraulic Conductivity: 1.88E-7 m/s
Hydraulic Conductivity: 1.63E-2 m/d

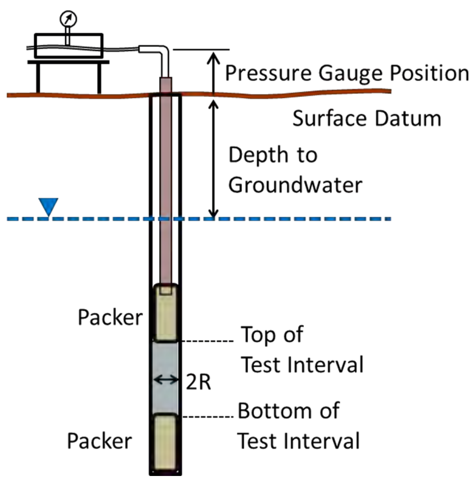
Performed using a single packer test assembly as the borehole was advanced, with the bottom of the test interval bounded by the bottom of the drilled section of the borehole.

No leaks were noticed during packer inflation or testing. Pressure adjustments required during steps 3, 4 and 5.

Although pressure-flow step profile suggests a Turbulent classification, the arithmetic mean (average) of the hydraulic conductivity (K) values determined for all steps used to calculate the representative K value for the test interval - K = 2.00E-7 m/s.

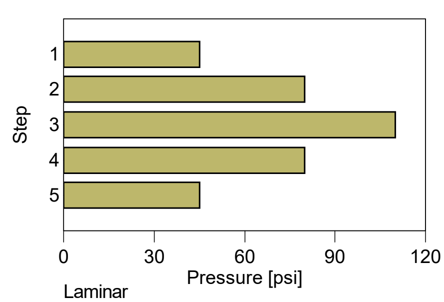
CONSULTING ENGINEERS AND SCIENTISTS	**Lugeon Test Analysis Report**
	Project: Valentine Gold Feasibility Geotechnical Investigation
	Number: 80047.03
	Client: Terrane Geoscience Inc.

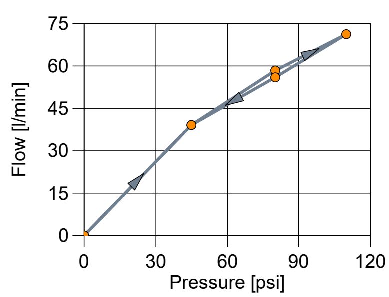
Location: Valentine Lake, NL	Lugeon Test: PT10	Tested bore: VL-GT-20-01
Test Conducted by: Terrane Geoscience Inc.		Test Date: 8/22/2020
Analysis Performed by: C. Anstey-Moore		Analysis Date: 10/26/2020
Lithology:		

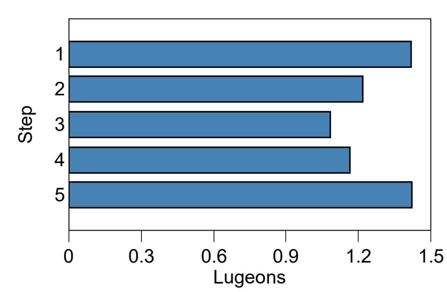


Top of Test Interval: 145.33 m
Bottom of Test Interval: 230.00 m
Length of Test Interval: 84.67 m
Gauge Position: 1.62 m
Depth to Groundwater: 0.00 m
Radius of Test Section: 0.05 m
Dip of bore: 35° from vertical
Vertical Top of Test Interval: 119.05 m
Vertical Bottom of Test Interval: 188.40 m

Step	Pressure [psi]	Flow Meter Readings [l]										Average Flow Rate [l/min]	Hydraulic Conductivity		
		1	2	3	4	5	6	7	8	9	10		[m/s]	[m/d]	Lugeon
1	45	47.00	89.00	129.00	168.00	206.00	244.00	282.00				39.17	2.74×10^{-7}	2.37×10^{-2}	1.4
2	80	336.00	396.00	454.00	512.00	570.00						58.50	2.35×10^{-7}	2.03×10^{-2}	1.2
3	110	620.00	693.00	766.00	837.00	908.00	979.00	1049.00	1119.00	1189.00		71.13	2.10×10^{-7}	1.81×10^{-2}	1.1
4	80	246.00	302.00	358.00	414.00							56.00	2.25×10^{-7}	1.95×10^{-2}	1.2
5	45	476.00	513.00	551.00	591.00	630.00	670.00	710.00	749.00	789.00	829.00	39.22	2.75×10^{-7}	2.37×10^{-2}	1.4
												Average	2.44×10^{-7}	2.11×10^{-2}	1.3







Laminar
Lugeon: 1.26
Hydraulic Conductivity: 2.44E-7 m/s
Hydraulic Conductivity: 2.11E-2 m/d

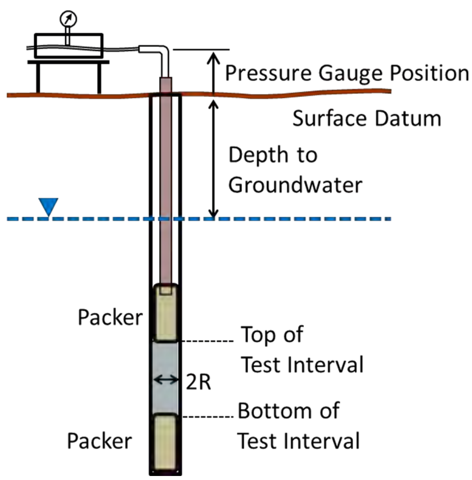
Performed using a single packer test assembly as the borehole was advanced, with the bottom of the test interval bounded by the bottom of the drilled section of the borehole.

~0.03 L/min system losses at 150 psi (during packer inflation); considered negligible in comparison to test flows.

Hydraulic conductivity value for test interval derived based on flow classification: Laminar (average for all steps).

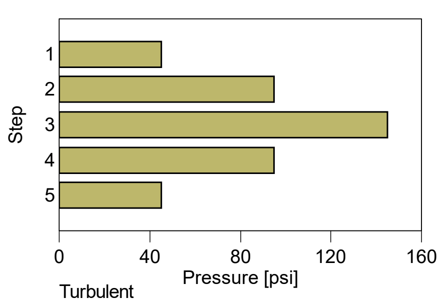
GEMTEC Consulting Engineers and Scientists	**Lugeon Test Analysis Report**
	Project: Valentine Gold Feasibility Geotechnical Investigation
	Number: 80047.03
	Client: Terrane Geoscience Inc.

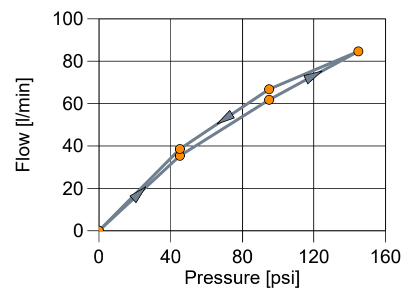
Location: Valentine Lake, NL	Lugeon Test: PT9	Tested bore: VL-GT-20-01
Test Conducted by: Terrane Geoscience Inc.		Test Date: 8/22/2020
Analysis Performed by: C. Anstey-Moore		Analysis Date: 10/26/2020
Lithology:		

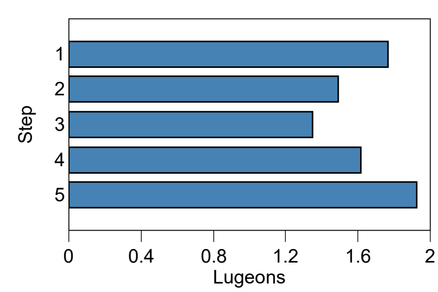


Top of Test Interval: 168.33 m
Bottom of Test Interval: 230.00 m
Length of Test Interval: 61.67 m
Gauge Position: 1.62 m
Depth to Groundwater: 0.00 m
Radius of Test Section: 0.05 m
Dip of bore: 35° from vertical
Vertical Top of Test Interval: 137.89 m
Vertical Bottom of Test Interval: 188.40 m

Step	Pressure [psi]	Flow Meter Readings [l]										Average Flow Rate [l/min]	Hydraulic Conductivity		
		1	2	3	4	5	6	7	8	9	10		[m/s]	[m/d]	Lugeon
1	45	535.00	572.00	607.00	643.00	678.00	713.00	748.00				35.50	3.27×10^{-7}	2.82×10^{-2}	1.8
2	95	885.00	946.00	1008.00	1070.00	1132.00						61.75	2.76×10^{-7}	2.39×10^{-2}	1.5
3	145	195.00	280.00	365.00	449.00	533.00						84.50	2.50×10^{-7}	2.16×10^{-2}	1.3
4	95	311.00	383.00	451.00	517.00	582.00	647.00	712.00				66.83	2.99×10^{-7}	2.58×10^{-2}	1.6
5	45	760.00	798.00	837.00	876.00	915.00						38.75	3.57×10^{-7}	3.08×10^{-2}	1.9
												Average	3.02×10^{-7}	2.61×10^{-2}	1.6







Turbulent
Lugeon: 1.5
Hydraulic Conductivity: 2.76E-7 m/s
Hydraulic Conductivity: 2.39E-2 m/d

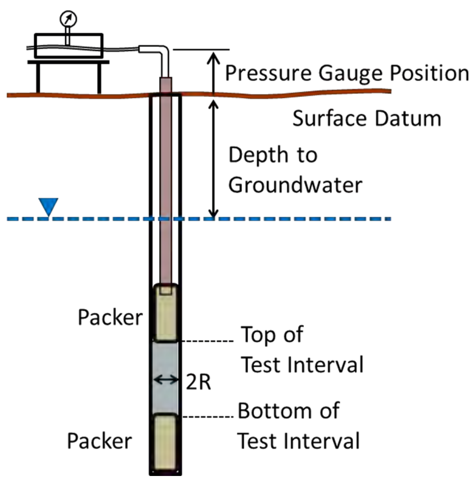
Performed using a single packer test assembly as the borehole was advanced, with the bottom of the test interval bounded by the bottom of the drilled section of the borehole.

No leaks were noticed during packer inflation or testing. Pressure adjustments required during steps 1 and 3.

Hydraulic conductivity value for test interval derived based on flow classification: Turbulent (Step 2).

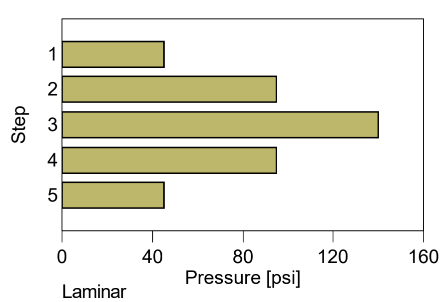
GEMTEC Consulting Engineers and Scientists	**Lugeon Test Analysis Report**
	Project: Valentine Gold Feasibility Geotechnical Investigation
	Number: 80047.03
	Client: Terrane Geoscience Inc.

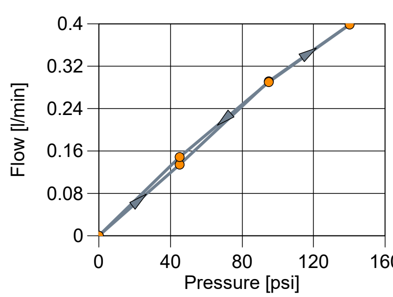
Location: Valentine Lake, NL	Lugeon Test: PT8	Tested bore: VL-GT-20-01
Test Conducted by: Terrane Geoscience Inc.		Test Date: 8/22/2020
Analysis Performed by: C. Anstey-Moore		Analysis Date: 10/26/2020
Lithology:		

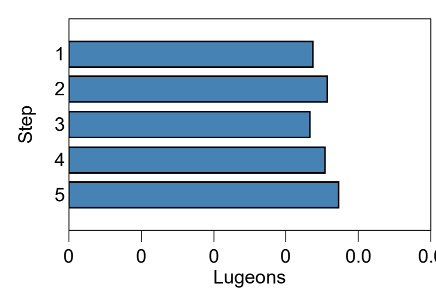


Top of Test Interval: 189.33 m
Bottom of Test Interval: 230.00 m
Length of Test Interval: 40.67 m
Gauge Position: 1.62 m
Depth to Groundwater: 0.00 m
Radius of Test Section: 0.05 m
Dip of bore: 35° from vertical
Vertical Top of Test Interval: 155.09 m
Vertical Bottom of Test Interval: 188.40 m

Step	Pressure [psi]	Flow Meter Readings [l]										Average Flow Rate [l/min]	Hydraulic Conductivity		
		1	2	3	4	5	6	7	8	9	10		[m/s]	[m/d]	Lugeon
1	45	367.05	367.18	367.32	367.46	367.59	367.72					0.13	1.76×10^{-9}	1.52×10^{-4}	0.010
2	95	368.16	368.45	368.75	369.04	369.33	369.62					0.29	1.87×10^{-9}	1.61×10^{-4}	0.011
3	140	370.41	370.84	371.20	371.62	372.01	372.41	372.81	373.20	373.60	374.00	0.40	1.74×10^{-9}	1.51×10^{-4}	0.010
4	95	374.15	374.44	374.73	375.02							0.29	1.85×10^{-9}	1.60×10^{-4}	0.011
5	45	375.03	375.15	375.30	375.46	375.61	375.77	375.92				0.15	1.95×10^{-9}	1.68×10^{-4}	0.011
												Average	1.83×10^{-9}	1.58×10^{-4}	0.011







Laminar
Lugeon: 0.011
Hydraulic Conductivity: 1.83E-9 m/s
Hydraulic Conductivity: 1.58E-4 m/d

Performed using a single packer test assembly as the borehole was advanced, with the bottom of the test interval bounded by the bottom of the drilled section of the borehole.

Leak test indicated 0.26L/min at 165 psi. Test flows within the same range as leak flows during steps 2, 3, and 4. Potential for enhanced hydraulic conductivity value determined for this test interval.

Hydraulic conductivity value for test interval derived based on flow classification: Laminar (average for all steps).

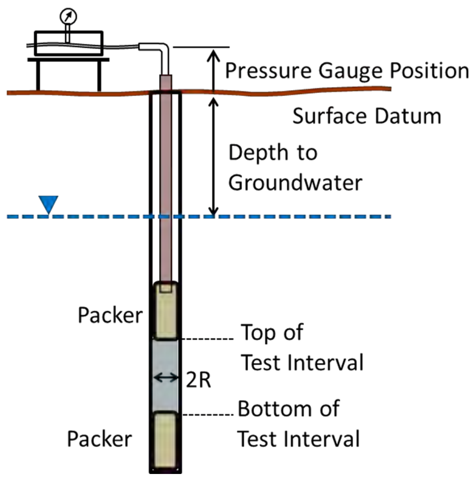
Lugeon Test Analysis Report

Project: Valentine Gold Feasibility Geotechnical Investigation

Number: 80047.03

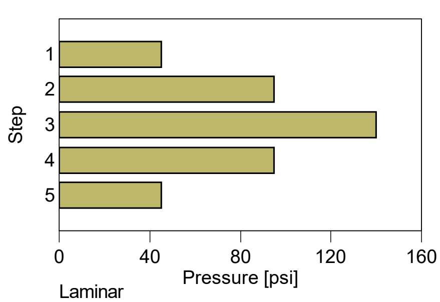
Client: Terrane Geoscience Inc.

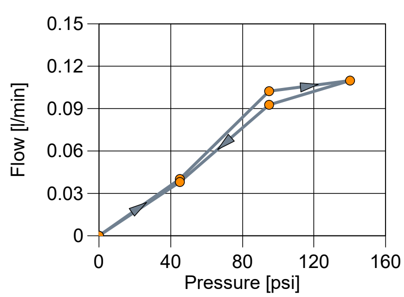
Location: Valentine Lake, NL	Lugeon Test: PT7	Tested bore: VL-GT-20-01
Test Conducted by: Terrane Geoscience Inc.		Test Date: 8/22/2020
Analysis Performed by: C. Anstey-Moore		Analysis Date: 10/26/2020
Lithology:		

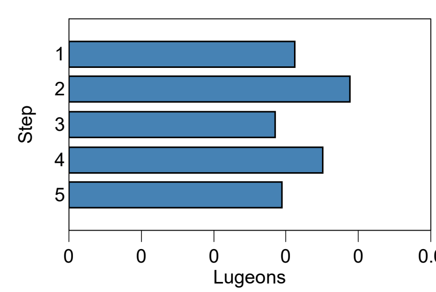


Top of Test Interval: 210.33 m
Bottom of Test Interval: 230.00 m
Length of Test Interval: 19.67 m
Gauge Position: 1.62 m
Depth to Groundwater: 0.00 m
Radius of Test Section: 0.05 m
Dip of bore: 35° from vertical
Vertical Top of Test Interval: 172.29 m
Vertical Bottom of Test Interval: 188.40 m

Step	Pressure [psi]	Flow Meter Readings [l]										Average Flow Rate [l/min]	Hydraulic Conductivity		
		1	2	3	4	5	6	7	8	9	10		[m/s]	[m/d]	Lugeon
1	45	55.76	55.77	55.82	55.88							0.04	9.69×10^{-10}	8.37×10^{-5}	0.006
2	95	56.29	56.40	56.50	56.60	56.70						0.10	1.21×10^{-9}	1.04×10^{-4}	0.008
3	140	57.00	57.11	57.22	57.33							0.11	8.86×10^{-10}	7.65×10^{-5}	0.006
4	95	57.19	57.29	57.38	57.47	57.56						0.09	1.09×10^{-9}	9.41×10^{-5}	0.007
5	45	57.39	57.40	57.43	57.45	57.49	57.54	57.58	57.63	57.68	57.73	0.04	9.15×10^{-10}	7.91×10^{-5}	0.006
												Average	1.01×10^{-9}	8.76×10^{-5}	0.007







Laminar
Lugeon: 0.007
Hydraulic Conductivity: 1.01E-9 m/s
Hydraulic Conductivity: 8.76E-5 m/d

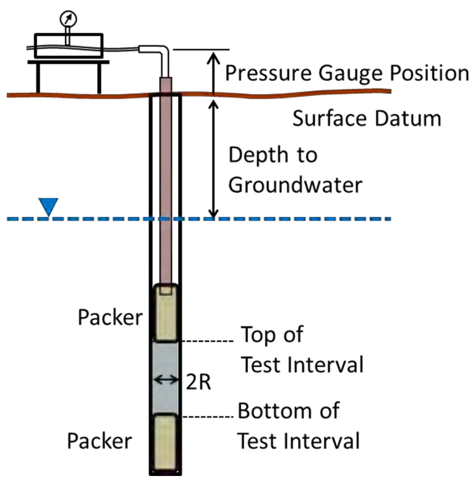
Performed using a single packer test assembly as the borehole was advanced, with the bottom of the test interval bounded by the bottom of the drilled section of the borehole.

Leak test indicated 0.3 L/min at 160 psi. Test flows less than leak flow, and not considered to impact results.

Hydraulic conductivity value for test interval derived based on flow classification: Laminar (average for all steps).

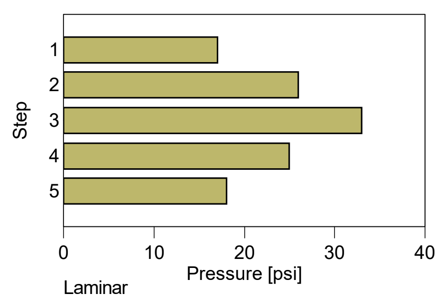
GEMTEC Consulting Engineers and Scientists	**Lugeon Test Analysis Report**
	Project: Valentine Gold Feasibility Geotechnical Investigation
	Number: 80047.03
	Client: Terrane Geoscience Inc.

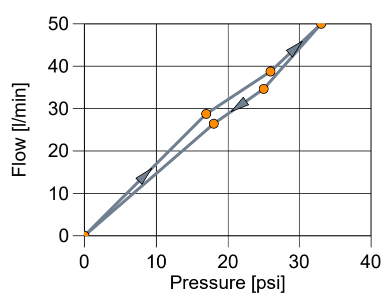
Location: Valentine Lake, NL	Lugeon Test: PT9	Tested bore: VL-GT-20-02
Test Conducted by: Terrane Geoscience Inc.		Test Date: 9/2/2020
Analysis Performed by: C. Anstey-Moore		Analysis Date: 10/26/2020
Lithology:		

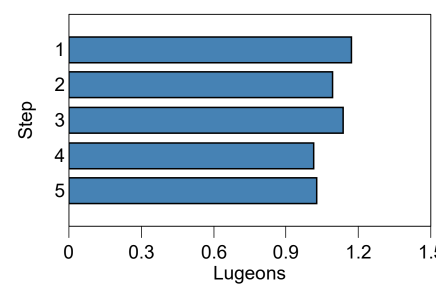


Top of Test Interval: 8.00 m
Bottom of Test Interval: 185.00 m
Length of Test Interval: 177.00 m
Gauge Position: 1.40 m
Depth to Groundwater: 0.75 m
Radius of Test Section: 0.05 m
Dip of bore: 35° from vertical
Vertical Top of Test Interval: 6.55 m
Vertical Bottom of Test Interval: 151.54 m

Step	Pressure [psi]	Flow Meter Readings [l]										Average Flow Rate [l/min]	Hydraulic Conductivity		
		1	2	3	4	5	6	7	8	9	10		[m/s]	[m/d]	Lugeon
1	17	540.00	568.70	597.40	626.10							28.70	2.49×10^{-7}	2.15×10^{-2}	1.17
2	26	680.00	719.50	758.50	797.00	835.50	874.00					38.80	2.33×10^{-7}	2.01×10^{-2}	1.09
3	33	10.00	60.00	110.00	160.00							50.00	2.42×10^{-7}	2.09×10^{-2}	1.14
4	25	110.00	144.50	179.50	214.00	249.00	283.50					34.70	2.15×10^{-7}	1.86×10^{-2}	1.01
5	18	300.00	324.30	350.00	377.30	404.60	431.90					26.38	2.18×10^{-7}	1.89×10^{-2}	1.03
												Average	2.31×10^{-7}	2.00×10^{-2}	1.09







Laminar
Lugeon: 1.089
Hydraulic Conductivity: 2.31E-7 m/s
Hydraulic Conductivity: 2.00E-2 m/d

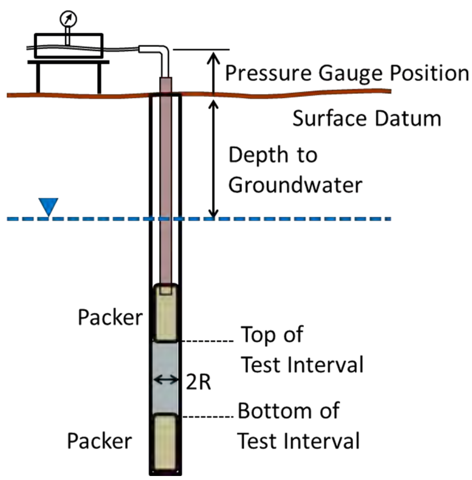
Performed using a single packer test assembly as the borehole was advanced, with the bottom of the test interval bounded by the bottom of the drilled section of the borehole.

~0.12 L/min system losses at 30 psi (during packer inflation); considered negligible in comparison to test flows. Test pressures higher than determined Pmax required to induce flow. Test pressure-flow profile does not suggest dilation and test results at these steps are considered reliable. Test pressures based on transducer data.

Hydraulic conductivity value for test interval derived based on flow classification: Laminar (average for all steps).

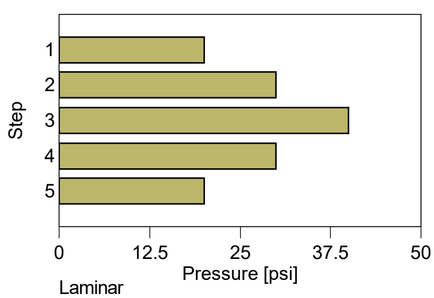
GEMTEC Consulting Engineers and Scientists	**Lugeon Test Analysis Report**
	Project: Valentine Gold Feasibility Geotechnical Investigation
	Number: 80047.03
	Client: Terrane Geoscience Inc.

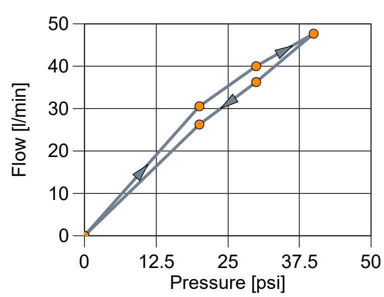
Location: Valentine Lake, NL	Lugeon Test: PT8	Tested bore: VL-GT-20-02
Test Conducted by: Terrane Geoscience Inc.		Test Date: 9/2/2020
Analysis Performed by: C. Anstey-Moore		Analysis Date: 10/26/2020
Lithology:		

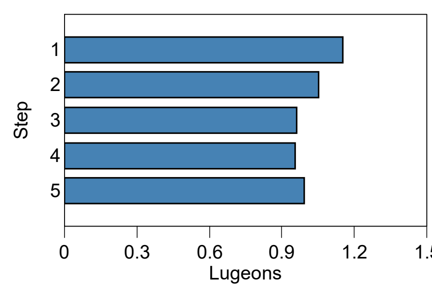


Top of Test Interval: 18.33 m
Bottom of Test Interval: 185.00 m
Length of Test Interval: 166.67 m
Gauge Position: 1.40 m
Depth to Groundwater: 0.75 m
Radius of Test Section: 0.05 m
Dip of bore: 35° from vertical
Vertical Top of Test Interval: 15.02 m
Vertical Bottom of Test Interval: 151.54 m

Step	Pressure [psi]	Flow Meter Readings [l]										Average Flow Rate [l/min]	Hydraulic Conductivity		
		1	2	3	4	5	6	7	8	9	10		[m/s]	[m/d]	Lugeon
1	20	810.00	841.30	872.30	902.80	933.40	963.90	994.00	1024.20	1054.30	1084.50	30.50	2.43×10^{-7}	2.10×10^{-2}	1.15
2	30	230.00	270.50	310.00	350.00	390.00	430.00					40.00	2.22×10^{-7}	1.92×10^{-2}	1.05
3	40	660.00	707.50	755.50	803.00	850.50	898.00					47.60	2.03×10^{-7}	1.75×10^{-2}	0.96
4	30	50.00	86.00	122.00	158.50	195.00	231.50					36.30	2.02×10^{-7}	1.74×10^{-2}	0.96
5	20	300.00	326.10	352.50	378.90	405.30						26.33	2.10×10^{-7}	1.81×10^{-2}	0.99
												Average	2.16×10^{-7}	1.87×10^{-2}	1.02







Laminar
Lugeon: 1.023
Hydraulic Conductivity: 2.16E-7 m/s
Hydraulic Conductivity: 1.87E-2 m/d
Performed using a single packer test assembly as the borehole was advanced, with the bottom of the test interval bounded by the bottom of the drilled section of the borehole.

~0.13 L/min system losses at 40 psi (during packer inflation); considered negligible in comparison to test flows. Test pressures higher than determined Pmax required to induce flow. Test pressure-flow profile does not suggest dilation and test results at these steps are considered reliable. A low (~5 psi) back pressure was noted from steps 3 to 4 to 5 (possible small artesian pressure?).

Hydraulic conductivity value for test interval derived based on flow classification: Laminar (average for all steps).

GEMTEC
Consulting Engineers and Scientists

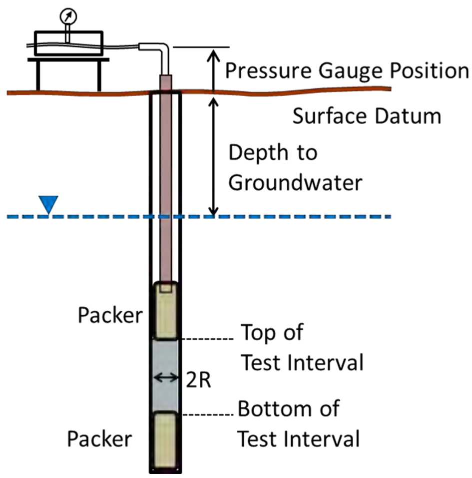
Lugeon Test Analysis Report

Project: Valentine Gold Feasibility Geotechnical Investigation

Number: 80047.03

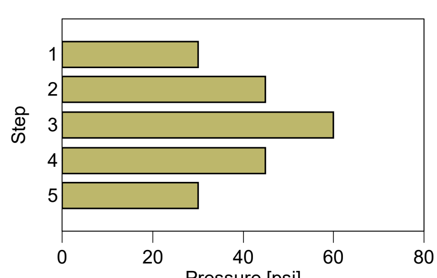
Client: Terrane Geoscience Inc.

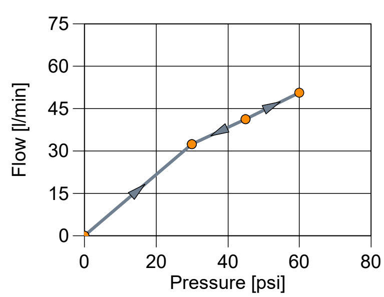
Location: Valentine Lake, NL	Lugeon Test: PT7	Tested bore: VL-GT-20-02
Test Conducted by: Terrane Geoscience Inc.		Test Date: 9/2/2020
Analysis Performed by: C. Anstey-Moore		Analysis Date: 10/26/2020
Lithology:		

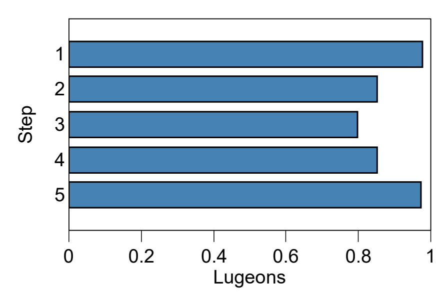


Top of Test Interval: 39.33 m
Bottom of Test Interval: 185.00 m
Length of Test Interval: 145.67 m
Gauge Position: 1.40 m
Depth to Groundwater: 0.75 m
Radius of Test Section: 0.05 m
Dip of bore: 35° from vertical
Vertical Top of Test Interval: 32.22 m
Vertical Bottom of Test Interval: 151.54 m

Step	Pressure [psi]	Flow Meter Readings [l]										Average Flow Rate [l/min]	Hydraulic Conductivity		
		1	2	3	4	5	6	7	8	9	10		[m/s]	[m/d]	Lugeon
1	30	400.00	432.80	465.10	497.40	529.70						32.43	2.03×10^{-7}	1.75×10^{-2}	0.98
2	45	680.00	721.50	762.50	803.50	844.50						41.13	1.77×10^{-7}	1.53×10^{-2}	0.85
3	60	0.00	50.50	101.00	151.50	202.00						50.50	1.65×10^{-7}	1.43×10^{-2}	0.80
4	45	300.00	341.50	382.50	423.50	464.50						41.13	1.77×10^{-7}	1.53×10^{-2}	0.85
5	30	580.00	612.30	644.60	676.90							32.30	2.02×10^{-7}	1.74×10^{-2}	0.97
												Average	1.85×10^{-7}	1.60×10^{-2}	0.89







Laminar
Lugeon: 0.890
Hydraulic Conductivity: 1.85E-7 m/s
Hydraulic Conductivity: 1.60E-2 m/d

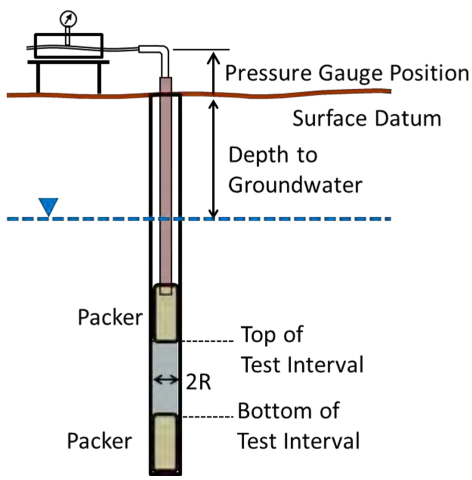
Performed using a single packer test assembly as the borehole was advanced, with the bottom of the test interval bounded by the bottom of the drilled section of the borehole.

~0.03 L/min system losses at 60 psi (during packer inflation); considered negligible in comparison to test flows. Test pressures higher than determined Pmax required to induce flow. Test pressure-flow profile does not suggest dilation and test results at these steps are considered reliable.

Although pressure-flow step profile suggests a Laminar classification, the hydraulic conductivity (K) value determined for step 5 used to calculate the representative K value for the test interval - K = 2.02E-07 m/s.

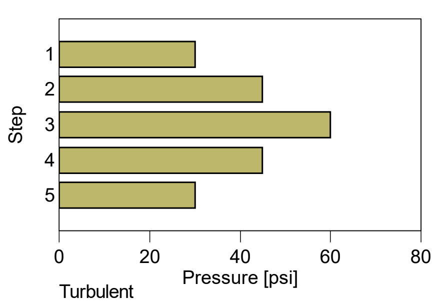
GEMTEC Consulting Engineers and Scientists	**Lugeon Test Analysis Report**
	Project: Valentine Gold Feasibility Geotechnical Investigation
	Number: 80047.03
	Client: Terrane Geoscience Inc.

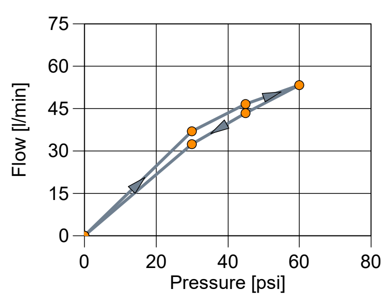
Location: Valentine Lake, NL	Lugeon Test: PT6	Tested bore: VL-GT-20-02
Test Conducted by: Terrane Geoscience Inc.		Test Date: 9/2/2020
Analysis Performed by: C. Anstey-Moore		Analysis Date: 10/26/2020
Lithology:		

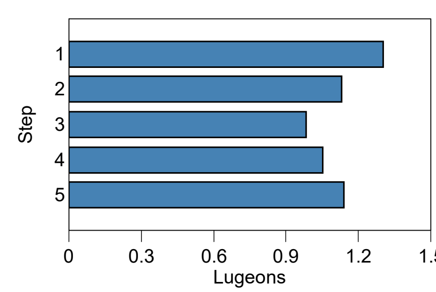


Top of Test Interval: 60.33 m
Bottom of Test Interval: 185.00 m
Length of Test Interval: 124.67 m
Gauge Position: 1.40 m
Depth to Groundwater: 0.75 m
Radius of Test Section: 0.05 m
Dip of bore: 35° from vertical
Vertical Top of Test Interval: 49.42 m
Vertical Bottom of Test Interval: 151.54 m

Step	Pressure [psi]	Flow Meter Readings [l]										Average Flow Rate [l/min]	Hydraulic Conductivity		
		1	2	3	4	5	6	7	8	9	10		[m/s]	[m/d]	Lugeon
1	30	602.50	639.50	676.50	713.50	750.50						37.00	2.65×10^{-7}	2.29×10^{-2}	1.30
2	45	871.00	918.00	965.50	1012.00	1059.00	1106.00	1152.00	1199.00	1245.50	1291.50	46.72	2.30×10^{-7}	1.99×10^{-2}	1.13
3	60	382.00	436.50	489.50	542.50	595.50	648.50					53.30	2.00×10^{-7}	1.73×10^{-2}	0.98
4	45	885.50	929.00	972.50	1016.00							43.50	2.14×10^{-7}	1.85×10^{-2}	1.05
5	30	87.50	120.00	152.00	184.50	217.00	249.50					32.40	2.32×10^{-7}	2.00×10^{-2}	1.14
												Average	2.28×10^{-7}	1.97×10^{-2}	1.12







Turbulent
Lugeon: 1.131
Hydraulic Conductivity: 2.30E-7 m/s
Hydraulic Conductivity: 1.99E-2 m/d

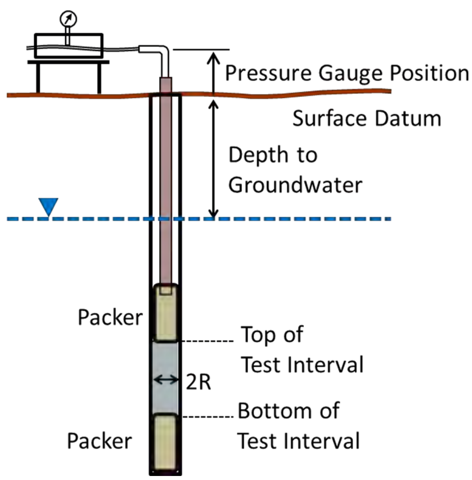
Performed using a single packer test assembly as the borehole was advanced, with the bottom of the test interval bounded by the bottom of the drilled section of the borehole.

~0.25 L/min system losses at 80 psi (during packer inflation); considered negligible in comparison to test flows.

Hydraulic conductivity value for test interval derived based on flow classification: Turbulent (Step 2).

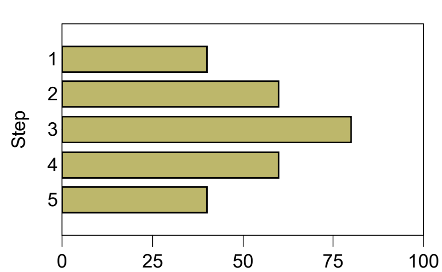
Lugeon Test Analysis Report	
Project:	Valentine Gold Feasibility Geotechnical Investigation
Number:	80047.03
Client:	Terrane Geoscience Inc.

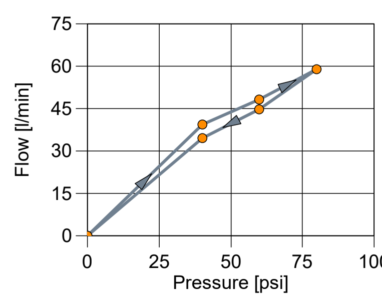
Location: Valentine Lake, NL	Lugeon Test: PT5	Tested bore: VL-GT-20-02
Test Conducted by: Terrane Geoscience Inc.		Test Date: 9/2/2020
Analysis Performed by: C. Anstey-Moore		Analysis Date: 10/26/2020
Lithology:		

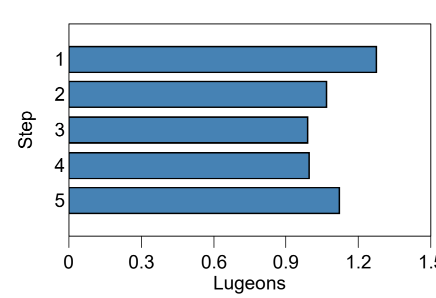


Top of Test Interval: 81.33 m
Bottom of Test Interval: 185.00 m
Length of Test Interval: 103.67 m
Gauge Position: 1.40 m
Depth to Groundwater: 0.75 m
Radius of Test Section: 0.05 m
Dip of bore: 35° from vertical
Vertical Top of Test Interval: 66.62 m
Vertical Bottom of Test Interval: 151.54 m

Step	Pressure [psi]	Flow Meter Readings [l]										Average Flow Rate [l/min]	Hydraulic Conductivity		
		1	2	3	4	5	6	7	8	9	10		[m/s]	[m/d]	Lugeon
1	40	620.00	659.50	699.00	738.50	777.50	816.50	855.50				39.25	2.53×10^{-7}	2.19×10^{-2}	1.28
2	60	922.00	972.50	1021.00	1068.50	1116.50	1164.00	1211.50	1259.00			48.14	2.12×10^{-7}	1.83×10^{-2}	1.07
3	80	393.00	452.50	511.50	571.00	629.50	688.00	747.00	805.50	864.00	922.50	58.83	1.97×10^{-7}	1.70×10^{-2}	0.99
4	60	0.00	45.00	90.00	134.50	179.50	224.50	269.00	314.00			44.86	1.98×10^{-7}	1.71×10^{-2}	1.00
5	40	356.00	390.50	425.00	459.50	494.00						34.50	2.23×10^{-7}	1.92×10^{-2}	1.12
												Average	2.17×10^{-7}	1.87×10^{-2}	1.09







Turbulent
Lugeon: 1.068
Hydraulic Conductivity: 2.12E-7 m/s
Hydraulic Conductivity: 1.83E-2 m/d

Performed using a single packer test assembly as the borehole was advanced, with the bottom of the test interval bounded by the bottom of the drilled section of the borehole.

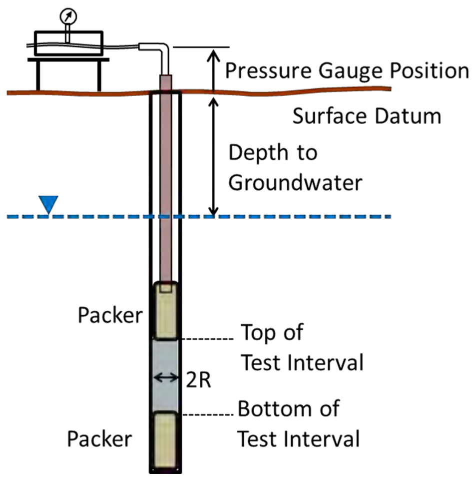
~0.38 L/min system losses at 100 psi (during packer inflation); considered negligible in comparison to test flows. Minor reverse flow after test that stopped within 20 seconds.

Hydraulic conductivity value for test interval derived based on flow classification: Turbulent (Step 2).

Lugeon Test Analysis Report

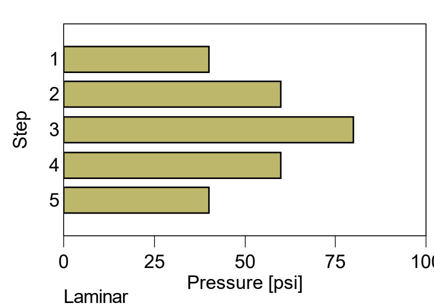
Project:	Valentine Gold Feasibility Geotechnical Investigation
Number:	80047.03
Client:	Terrane Geoscience Inc.

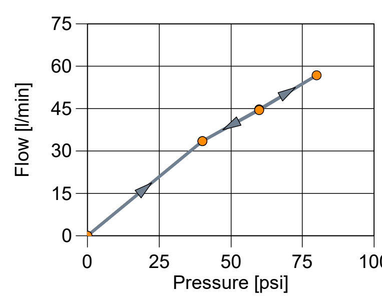
Location: Valentine Lake, NL	Lugeon Test: PT4	Tested bore: VL-GT-20-02
Test Conducted by: Terrane Geoscience Inc.		Test Date: 9/2/2020
Analysis Performed by: C. Anstey-Moore		Analysis Date: 10/26/2020
Lithology:		

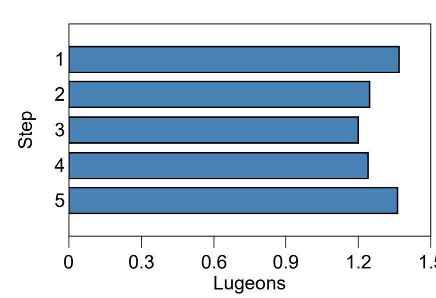


Top of Test Interval: 102.33 m
Bottom of Test Interval: 185.00 m
Length of Test Interval: 82.67 m
Gauge Position: 1.40 m
Depth to Groundwater: 0.75 m
Radius of Test Section: 0.05 m
Dip of bore: 35° from vertical
Vertical Top of Test Interval: 83.82 m
Vertical Bottom of Test Interval: 151.54 m

Step	Pressure [psi]	Flow Meter Readings [l]										Average Flow Rate [l/min]	Hydraulic Conductivity		
		1	2	3	4	5	6	7	8	9	10		[m/s]	[m/d]	Lugeon
1	40	499.00	534.50	568.50	602.50	635.50	669.00	702.50	735.50	768.00	801.00	33.56	2.64×10^{-7}	2.28×10^{-2}	1.4
2	60	870.00	915.50	960.00	1005.00	1049.50	1094.00	1138.50				44.75	2.40×10^{-7}	2.07×10^{-2}	1.2
3	80	212.00	271.50	329.50	387.00	444.00	500.00	555.50	611.00	666.50		56.81	2.31×10^{-7}	2.00×10^{-2}	1.2
4	60	767.00	810.70	855.50	900.00	945.00	989.50	1034.00	1079.00	1123.50	1168.00	44.56	2.39×10^{-7}	2.06×10^{-2}	1.2
5	40	200.00	231.00	264.00	298.50	332.00	366.00	400.00	434.00			33.43	2.63×10^{-7}	2.27×10^{-2}	1.4
												Average	2.47×10^{-7}	2.14×10^{-2}	1.3







Laminar
Lugeon: 1.283
Hydraulic Conductivity: 2.47E-7 m/s
Hydraulic Conductivity: 2.14E-2 m/d

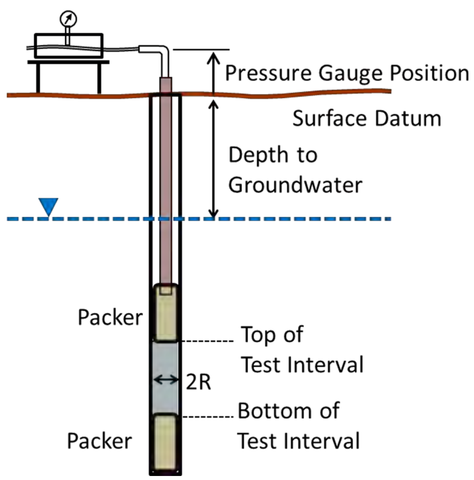
Performed using a single packer test assembly as the borehole was advanced, with the bottom of the test interval bounded by the bottom of the drilled section of the borehole.

~0.11 L/min system losses at 100 psi (during packer inflation); considered negligible in comparison to test flows. Minor reverse flow after test that stopped within 20 seconds.

Hydraulic conductivity value for test interval derived based on flow classification: Laminar (average for all steps).

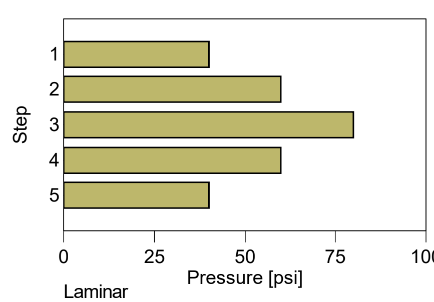
GEMTEC Consulting Engineers and Scientists	**Lugeon Test Analysis Report**
	Project: Valentine Gold Feasibility Geotechnical Investigation
	Number: 80047.03
	Client: Terrane Geoscience Inc.

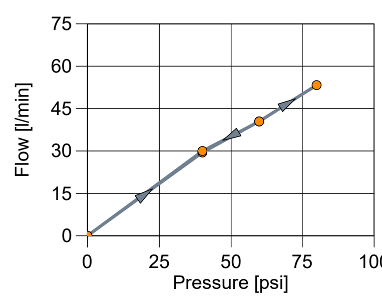
Location: Valentine Lake, NL	Lugeon Test: PT3	Tested bore: VL-GT-20-02
Test Conducted by: Terrane Geoscience Inc.		Test Date: 9/2/2020
Analysis Performed by: C. Anstey-Moore		Analysis Date: 10/26/2020
Lithology:		

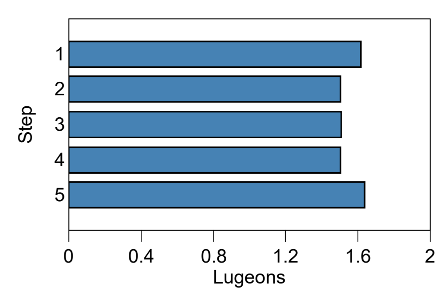


Top of Test Interval: 123.33 m
Bottom of Test Interval: 185.00 m
Length of Test Interval: 61.67 m
Gauge Position: 1.40 m
Depth to Groundwater: 0.75 m
Radius of Test Section: 0.05 m
Dip of bore: 35° from vertical
Vertical Top of Test Interval: 101.03 m
Vertical Bottom of Test Interval: 151.54 m

Step	Pressure [psi]	Flow Meter Readings [l]										Average Flow Rate [l/min]	Hydraulic Conductivity		
		1	2	3	4	5	6	7	8	9	10		[m/s]	[m/d]	Lugeon
1	40	360.00	392.00	422.90	452.10	481.40	510.40	539.50	568.40	597.30	626.20	29.58	2.99×10^{-7}	2.58×10^{-2}	1.6
2	60	743.00	783.50	823.50	864.50	904.70	945.00	985.50	1025.50	1065.50	1106.00	40.33	2.79×10^{-7}	2.41×10^{-2}	1.5
3	80	185.00	240.00	293.50	346.00	399.50	452.50	505.50	558.00	611.00		53.25	2.79×10^{-7}	2.41×10^{-2}	1.5
4	60	675.00	715.00	754.00	794.50	835.50	876.00	917.00	957.50			40.36	2.79×10^{-7}	2.41×10^{-2}	1.5
5	40	995.00	1024.40	1054.40	1084.00	1114.00	1144.00	1174.40	1204.40	1234.90		29.99	3.03×10^{-7}	2.62×10^{-2}	1.6
												Average	2.88×10^{-7}	2.49×10^{-2}	1.6







Laminar
Lugeon: 1.554
Hydraulic Conductivity: 2.88E-7 m/s
Hydraulic Conductivity: 2.49E-2 m/d

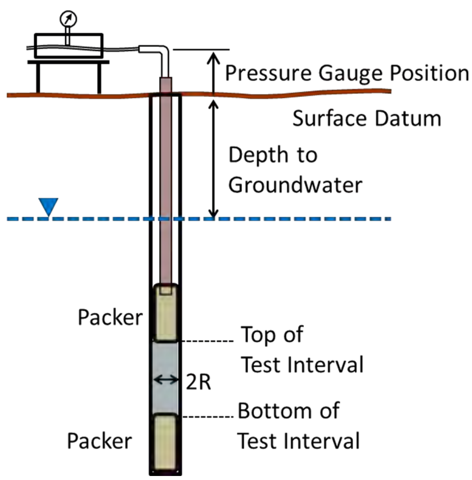
Performed using a single packer test assembly as the borehole was advanced, with the bottom of the test interval bounded by the bottom of the drilled section of the borehole.

~0.15 L/min system losses at 100 psi (during packer inflation); considered negligible in comparison to test flows.

Hydraulic conductivity value for test interval derived based on flow classification: Laminar (average for all steps).

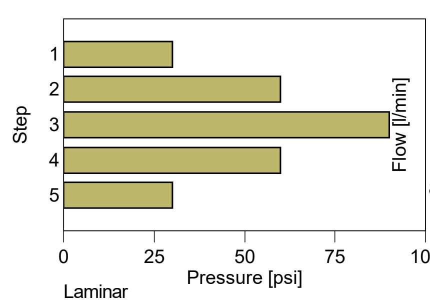
	Lugeon Test Analysis Report
	Project: Valentine Gold Feasibility Geotechnical Investigation
	Number: 80047.03
	Client: Terrane Geoscience Inc.

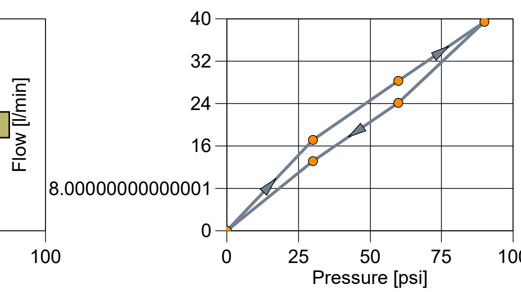
Location: Valentine Lake, NL	Lugeon Test: PT2	Tested bore: VL-GT-20-02
Test Conducted by: Terrane Geoscience Inc.		Test Date: 9/2/2020
Analysis Performed by: C. Anstey-Moore		Analysis Date: 10/26/2020
Lithology:		

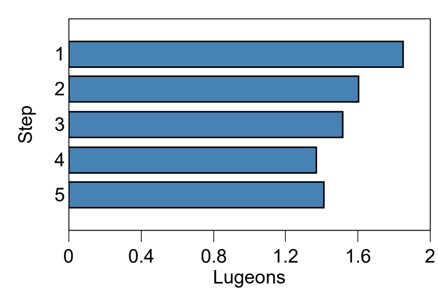


Top of Test Interval: 144.33 m
Bottom of Test Interval: 185.00 m
Length of Test Interval: 40.67 m
Gauge Position: 1.40 m
Depth to Groundwater: 0.75 m
Radius of Test Section: 0.05 m
Dip of bore: 35° from vertical
Vertical Top of Test Interval: 118.23 m
Vertical Bottom of Test Interval: 151.54 m

Step	Pressure [psi]	Flow Meter Readings [l]										Average Flow Rate [l/min]	Hydraulic Conductivity		
		1	2	3	4	5	6	7	8	9	10		[m/s]	[m/d]	Lugeon
1	30	654.00	671.60	689.00	706.20	723.30	740.20	757.10	774.00			17.14	3.22×10^{-7}	2.79×10^{-2}	1.8
2	60	883.30	912.80	941.30	969.70	998.00	1026.20	1054.30	1082.40	1110.30	1138.50	28.36	2.80×10^{-7}	2.42×10^{-2}	1.6
3	90	242.00	282.80	322.10	361.80	400.60	439.70	479.00				39.50	2.64×10^{-7}	2.28×10^{-2}	1.5
4	60	938.00	961.70	986.00	1010.30	1034.60	1058.90					24.18	2.38×10^{-7}	2.06×10^{-2}	1.4
5	30	83.00	95.45	108.10	121.05	134.30	147.60	160.80	174.10	187.40	200.70	13.08	2.46×10^{-7}	2.12×10^{-2}	1.4
												Average	2.70×10^{-7}	2.33×10^{-2}	1.5







Laminar
Lugeon: 1.55
Hydraulic Conductivity: 2.70E-7 m/s
Hydraulic Conductivity: 2.33E-2 m/d

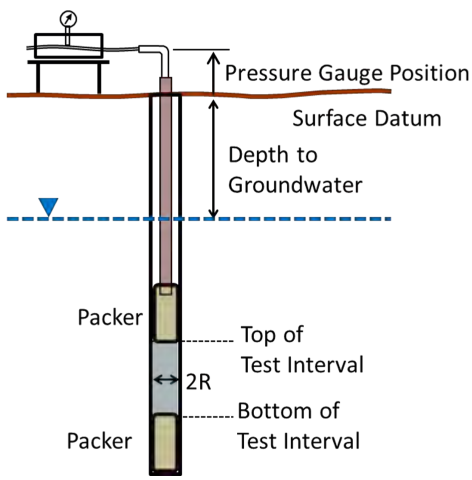
Performed using a single packer test assembly as the borehole was advanced, with the bottom of the test interval bounded by the bottom of the drilled section of the borehole.

~0.06 L/min system losses at 120 psi (during packer inflation); considered negligible in comparison to test flows. Reverse flow when going from steps 3 to 4 to 5; then downhole flow once stable pressure. Surface gauge pressure readings checked with transducer data.

Hydraulic conductivity value for test interval derived based on flow classification: Laminar (average for all steps).

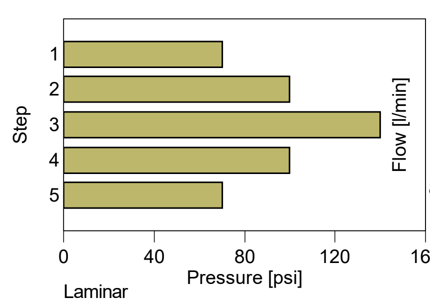
Lugeon Test Analysis Report	
Project:	Valentine Gold Feasibility Geotechnical Investigation
Number:	80047.03
Client:	Terrane Geoscience Inc.

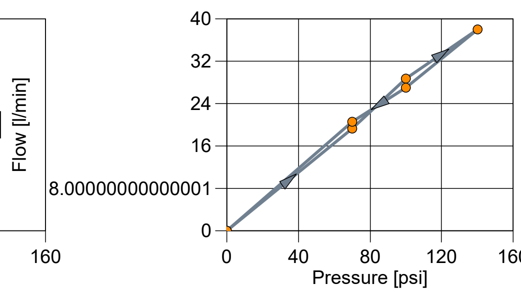
Location: Valentine Lake, NL	Lugeon Test: PT1	Tested bore: VL-GT-20-02
Test Conducted by: Terrane Geoscience Inc.		Test Date: 9/2/2020
Analysis Performed by: C. Anstey-Moore		Analysis Date: 10/26/2020
Lithology:		

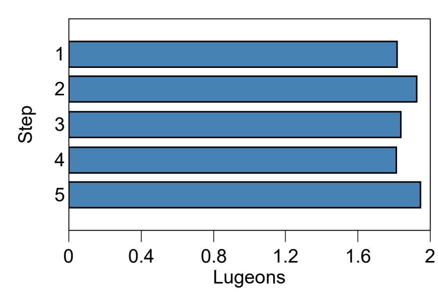


Top of Test Interval: 164.00 m
Bottom of Test Interval: 185.00 m
Length of Test Interval: 21.00 m
Gauge Position: 1.40 m
Depth to Groundwater: 0.75 m
Radius of Test Section: 0.05 m
Dip of bore: 35° from vertical
Vertical Top of Test Interval: 134.34 m
Vertical Bottom of Test Interval: 151.54 m

Step	Pressure [psi]	Flow Meter Readings [l]										Average Flow Rate [l/min]	Hydraulic Conductivity		
		1	2	3	4	5	6	7	8	9	10		[m/s]	[m/d]	Lugeon
1	70	145.00	166.80	187.80	207.30	225.60	243.60	261.60	279.60			19.23	2.86×10^{-7}	2.47×10^{-2}	1.8
2	100	331.00	362.80	391.80	419.80	447.90	475.90	504.10	532.20			28.74	3.03×10^{-7}	2.62×10^{-2}	1.9
3	140	676.40	715.40	753.40	791.70	830.10	868.70	906.60	944.00	981.40	1018.80	38.04	2.89×10^{-7}	2.49×10^{-2}	1.8
4	100	72.00	98.50	125.40	152.40	179.50	206.60	233.80	261.00	288.20		27.03	2.85×10^{-7}	2.46×10^{-2}	1.8
5	70	314.00	332.80	352.75	373.10	393.80	414.70	435.70	456.85	478.10	499.40	20.60	3.06×10^{-7}	2.64×10^{-2}	1.9
												Average	2.93×10^{-7}	2.54×10^{-2}	1.9







Laminar
Lugeon: 1.868
Hydraulic Conductivity: 2.93E-7 m/s
Hydraulic Conductivity: 2.54E-2 m/d

Performed using a single packer test assembly as the borehole was advanced, with the bottom of the test interval bounded by the bottom of the drilled section of the borehole.

~0.03 L/min system losses at 140 psi (during packer inflation); considered negligible in comparison to test flows. Reverse flow for a short period after opening valve after step 5. Surface gauge pressure readings checked with transducer data.

Hydraulic conductivity value for test interval derived based on flow classification: Laminar (average for all steps).

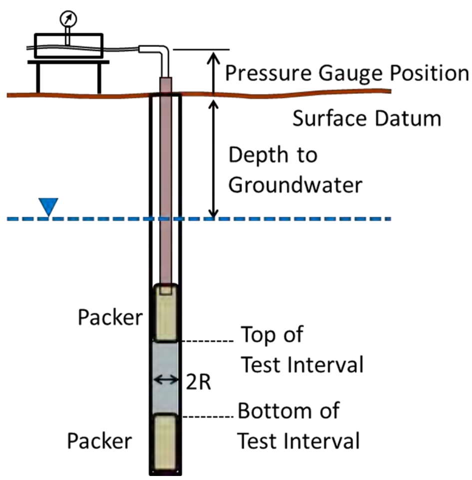
Lugeon Test Analysis Report

Project: Valentine Gold Feasibility Geotechnical Investigation

Number: 80047.03

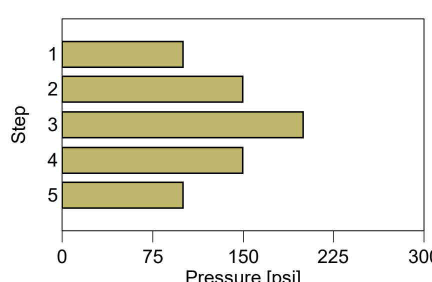
Client: Terrane Geoscience Inc.

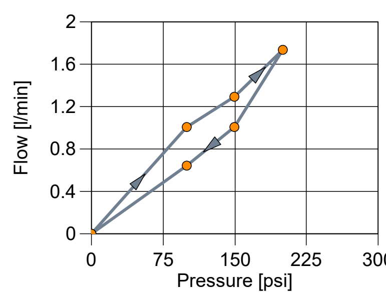
Location: Valentine Lake, NL	Lugeon Test: PT17	Tested bore: VL-GT-20-02
Test Conducted by: Terrane Geoscience Inc.		Test Date: 9/6/2020
Analysis Performed by: C. Anstey-Moore		Analysis Date: 10/26/2020
Lithology:		

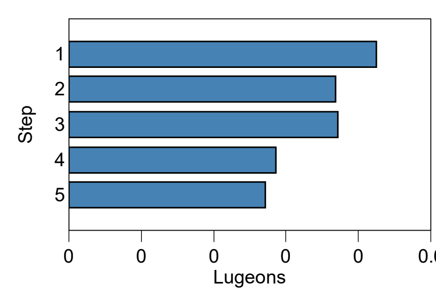


Top of Test Interval: 207.33 m
Bottom of Test Interval: 374.00 m
Length of Test Interval: 166.67 m
Gauge Position: 1.45 m
Depth to Groundwater: 0.75 m
Radius of Test Section: 0.05 m
Dip of bore: 35° from vertical
Vertical Top of Test Interval: 169.83 m
Vertical Bottom of Test Interval: 306.36 m

Step	Pressure [psi]	Flow Meter Readings [l]										Average Flow Rate [l/min]	Hydraulic Conductivity		
		1	2	3	4	5	6	7	8	9	10		[m/s]	[m/d]	Lugeon
1	100	28.00	29.06	30.09	31.09	32.07	33.03					1.01	1.79×10^{-9}	1.55×10^{-4}	0.008
2	150	43.55	44.89	46.17	47.45	48.73						1.30	1.55×10^{-9}	1.34×10^{-4}	0.007
3	200	63.87	65.66	67.42	69.15	70.85	72.54					1.73	1.57×10^{-9}	1.35×10^{-4}	0.007
4	150	1.55	2.53	3.53	4.54	5.57						1.01	1.21×10^{-9}	1.04×10^{-4}	0.006
5	100	76.50	77.12	77.76	78.40	79.07						0.64	1.14×10^{-9}	9.88×10^{-5}	0.005
												Average	1.45×10^{-9}	1.25×10^{-4}	0.007







Void filling
Lugeon: 0.005
Hydraulic Conductivity: 1.14E-9 m/s
Hydraulic Conductivity: 9.88E-5 m/d

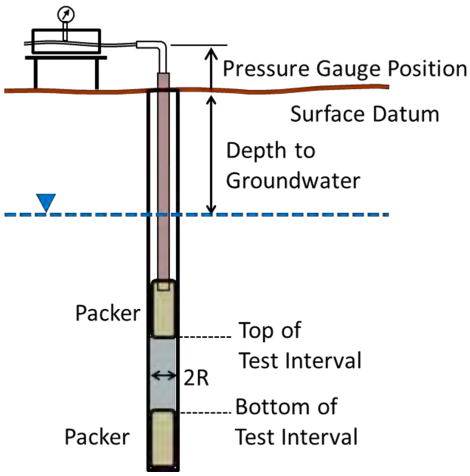
Performed using a single packer test assembly as the borehole was advanced, with the bottom of the test interval bounded by the bottom of the drilled section of the borehole.

~0.33 L/min system losses at 220 psi (during packer inflation); not accounted for in test flow data.

Although pressure-flow step profile suggests a Void Filling classification, the arithmetic mean (average) of the hydraulic conductivity (K) values determined for all steps used to calculate the representative K value for the test interval - K = 1.45E-09 m/s.

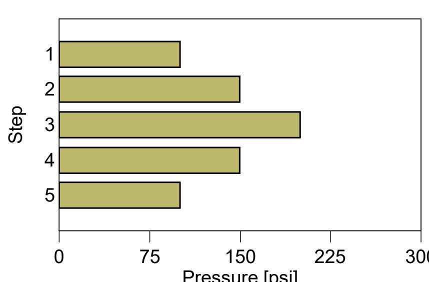
Lugeon Test Analysis Report	
Project:	Valentine Gold Feasibility Geotechnical Investigation
Number:	80047.03
Client:	Terrane Geoscience Inc.

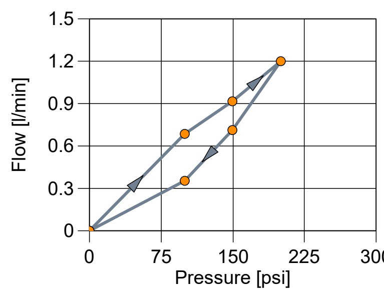
Location: Valentine Lake, NL	Lugeon Test: PT16	Tested bore: VL-GT-20-02
Test Conducted by: Terrane Geoscience Inc.		Test Date: 9/6/2020
Analysis Performed by: C. Anstey-Moore		Analysis Date: 10/26/2020
Lithology:		

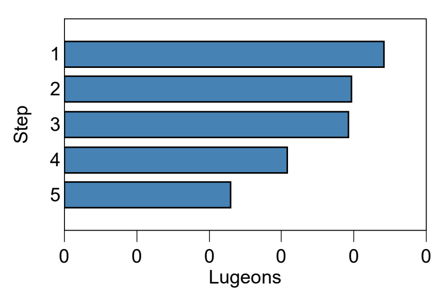


Top of Test Interval: 228.33 m
Bottom of Test Interval: 374.00 m
Length of Test Interval: 145.67 m
Gauge Position: 1.45 m
Depth to Groundwater: 0.75 m
Radius of Test Section: 0.05 m
Dip of bore: 35° from vertical
Vertical Top of Test Interval: 187.04 m
Vertical Bottom of Test Interval: 306.36 m

Step	Pressure [psi]	Flow Meter Readings [l]										Average Flow Rate [l/min]	Hydraulic Conductivity		
		1	2	3	4	5	6	7	8	9	10		[m/s]	[m/d]	Lugeon
1	100	70.50	71.23	71.94	72.62	73.28	73.93					0.69	1.37×10^{-9}	1.19×10^{-4}	0.007
2	150	84.50	85.47	86.41	87.31	88.21	89.08					0.92	1.24×10^{-9}	1.07×10^{-4}	0.006
3	200	102.11	103.35	104.59	105.78	106.96	108.11					1.20	1.22×10^{-9}	1.05×10^{-4}	0.006
4	150	6.75	7.48	8.19	8.91	9.61	10.31	11.01				0.71	9.58×10^{-10}	8.28×10^{-5}	0.005
5	100	10.37	10.71	11.07	11.42	11.79	12.15					0.36	7.13×10^{-10}	6.16×10^{-5}	0.003
												Average	1.10×10^{-9}	9.51×10^{-5}	0.005







Void filling
Lugeon: 0.003
Hydraulic Conductivity: 7.13E-10 m/s
Hydraulic Conductivity: 6.16E-5 m/d

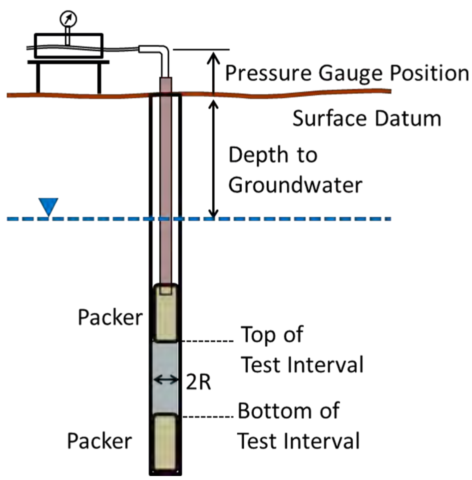
Performed using a single packer test assembly as the borehole was advanced, with the bottom of the test interval bounded by the bottom of the drilled section of the borehole.

~0.32 L/min system losses at 200 psi (during packer inflation); not accounted for in test flow data. Surface gauge pressure readings checked with transducer data.

Although pressure-flow step profile suggests a Void Filling classification, the hydraulic conductivity (K) values determined for step 1 used to calculate the representative K value for the test interval - K = 1.37E-9 m/s.

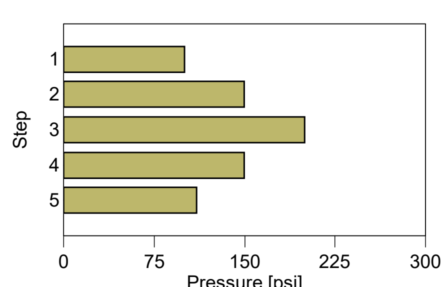
Lugeon Test Analysis Report
Project: Valentine Gold Feasibility Geotechnical Investigation
Number: 80047.03
Client: Terrane Geoscience Inc.

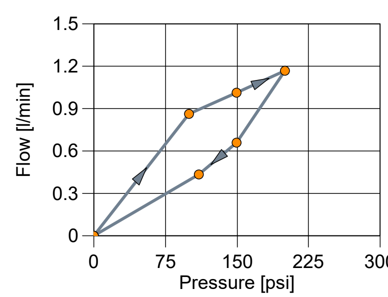
Location: Valentine Lake, NL	Lugeon Test: PT15	Tested bore: VL-GT-20-02
Test Conducted by: Terrane Geoscience Inc.		Test Date: 9/6/2020
Analysis Performed by: C. Anstey-Moore		Analysis Date: 10/26/2020
Lithology:		

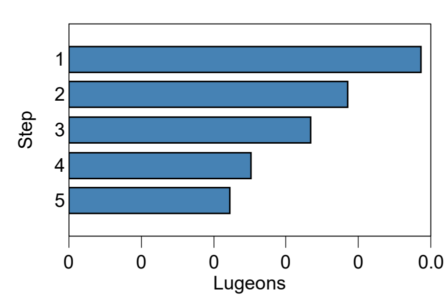


Top of Test Interval: 249.33 m
Bottom of Test Interval: 374.00 m
Length of Test Interval: 124.67 m
Gauge Position: 1.45 m
Depth to Groundwater: 0.75 m
Radius of Test Section: 0.05 m
Dip of bore: 35° from vertical
Vertical Top of Test Interval: 204.24 m
Vertical Bottom of Test Interval: 306.36 m

Step	Pressure [psi]	Flow Meter Readings [l]										Average Flow Rate [l/min]	Hydraulic Conductivity		
		1	2	3	4	5	6	7	8	9	10		[m/s]	[m/d]	Lugeon
1	100	6.22	7.29	8.27	9.19	10.06	10.90	11.71	12.49	13.24	13.98	0.86	1.98×10^{-9}	1.71×10^{-4}	0.010
2	150	18.55	19.71	20.82	21.88	22.91	23.91	24.86	25.83	26.76	27.68	1.01	1.57×10^{-9}	1.35×10^{-4}	0.008
3	200	32.73	34.08	35.32	36.53	37.70	38.84	39.96	41.08	42.16	43.23	1.17	1.36×10^{-9}	1.17×10^{-4}	0.007
4	150	3.15	3.80	4.45	5.11	5.77	6.44	7.11	7.78			0.66	1.02×10^{-9}	8.83×10^{-5}	0.005
5	110	7.15	7.55	7.97	8.39	8.84	9.29	9.74				0.43	9.03×10^{-10}	7.80×10^{-5}	0.004
												Average	1.37×10^{-9}	1.18×10^{-4}	0.007







Void filling
Lugeon: 0.004
Hydraulic Conductivity: 9.03E-10 m/s
Hydraulic Conductivity: 7.80E-5 m/d

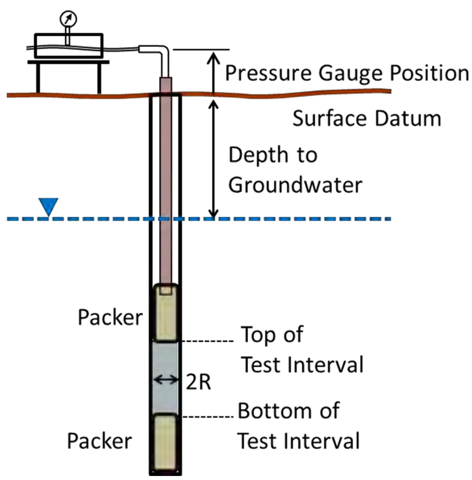
Performed using a single packer test assembly as the borehole was advanced, with the bottom of the test interval bounded by the bottom of the drilled section of the borehole.

~0.34 L/min system losses at 200 psi (during packer inflation); not accounted for in test flow data.

Although pressure-flow step profile suggests a Void Filling classification, the arithmetic mean (average) of the hydraulic conductivity (K) values determined for all steps used to calculate the representative K value for the test interval - K = 1.37E-9 m/s.

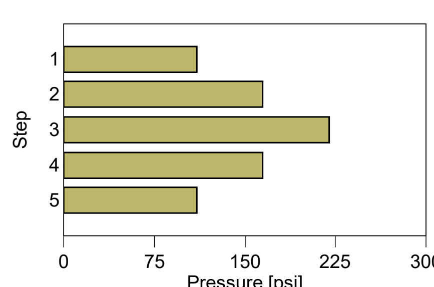
Lugeon Test Analysis Report	
Project:	Valentine Gold Feasibility Geotechnical Investigation
Number:	80047.03
Client:	Terrane Geoscience Inc.

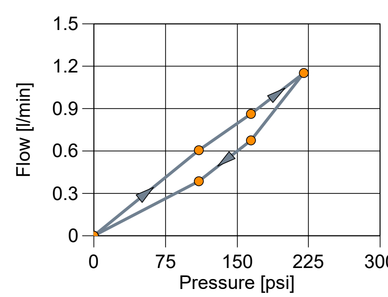
Location: Valentine Lake, NL	Lugeon Test: PT14	Tested bore: VL-GT-20-02
Test Conducted by: Terrane Geoscience Inc.		Test Date: 9/6/2020
Analysis Performed by: C. Anstey-Moore		Analysis Date: 10/26/2020
Lithology:		

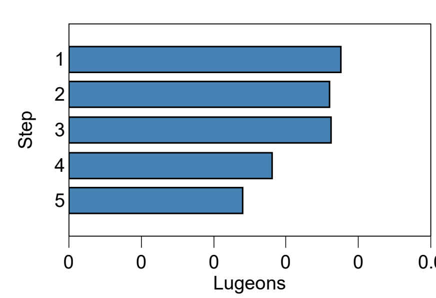


Top of Test Interval: 270.33 m
Bottom of Test Interval: 374.00 m
Length of Test Interval: 103.67 m
Gauge Position: 1.45 m
Depth to Groundwater: 0.75 m
Radius of Test Section: 0.05 m
Dip of bore: 35° from vertical
Vertical Top of Test Interval: 221.44 m
Vertical Bottom of Test Interval: 306.36 m

Step	Pressure [psi]	Flow Meter Readings [l]										Average Flow Rate [l/min]	Hydraulic Conductivity		
		1	2	3	4	5	6	7	8	9	10		[m/s]	[m/d]	Lugeon
1	110	55.06	55.76	56.41	57.04	57.63	58.19	58.75	59.31			0.61	1.49×10^{-9}	1.29×10^{-4}	0.008
2	165	65.86	66.76	67.62	68.48	69.32						0.86	1.43×10^{-9}	1.24×10^{-4}	0.007
3	220	80.65	81.87	83.04	84.19	85.31	86.42					1.15	1.44×10^{-9}	1.24×10^{-4}	0.007
4	165	88.00	88.66	89.31	89.99	90.68	91.36	92.05	92.73			0.68	1.12×10^{-9}	9.65×10^{-5}	0.006
5	110	93.00	93.37	93.74	94.12	94.51	94.90	95.30	95.70	96.10		0.39	9.52×10^{-10}	8.23×10^{-5}	0.005
												Average	1.29×10^{-9}	1.11×10^{-4}	0.006







Void filling
Lugeon: 0.005
Hydraulic Conductivity: 9.52E-10 m/s
Hydraulic Conductivity: 8.23E-5 m/d

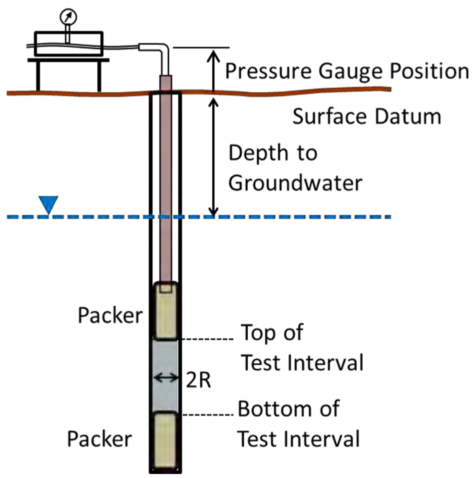
Performed using a single packer test assembly as the borehole was advanced, with the bottom of the test interval bounded by the bottom of the drilled section of the borehole.

No leaks were noticed during packer inflation or testing.

Although pressure-flow step profile suggests a Void Filling classification, the hydraulic conductivity (K) values determined for step 1 used to calculate the representative K value for the test interval - K = 1.49E-9 m/s.

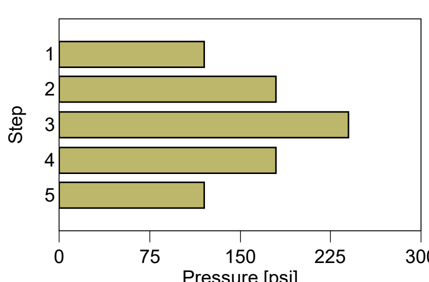
GEMTEC Consulting Engineers and Scientists	**Lugeon Test Analysis Report**
	Project: Valentine Gold Feasibility Geotechnical Investigation
	Number: 80047.03
	Client: Terrane Geoscience Inc.

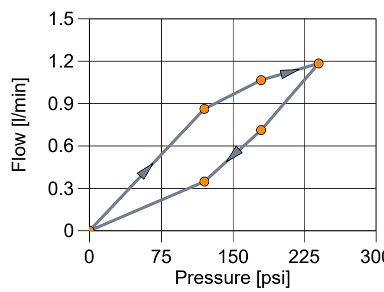
Location: Valentine Lake, NL	Lugeon Test: PT13	Tested bore: VL-GT-20-02
Test Conducted by: Terrane Geoscience Inc.		Test Date: 9/6/2020
Analysis Performed by: C. Anstey-Moore		Analysis Date: 10/26/2020
Lithology:		

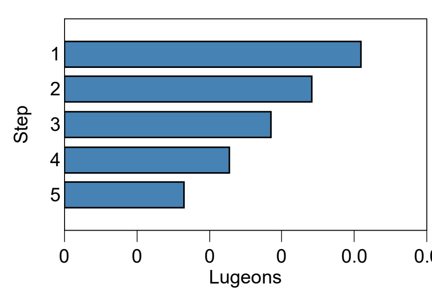


Top of Test Interval: 291.33 m
Bottom of Test Interval: 374.00 m
Length of Test Interval: 82.67 m
Gauge Position: 1.45 m
Depth to Groundwater: 0.75 m
Radius of Test Section: 0.05 m
Dip of bore: 35° from vertical
Vertical Top of Test Interval: 238.64 m
Vertical Bottom of Test Interval: 306.36 m

Step	Pressure [psi]	Flow Meter Readings [l]										Average Flow Rate [l/min]	Hydraulic Conductivity		
		1	2	3	4	5	6	7	8	9	10		[m/s]	[m/d]	Lugeon
1	120	97.38	98.28	99.15	100.00	100.83						0.86	2.37×10^{-9}	2.05×10^{-4}	0.012
2	180	11.07	12.18	13.26	14.32	15.37	16.41					1.07	1.97×10^{-9}	1.70×10^{-4}	0.010
3	240	28.51	29.74	30.94	32.12	33.28	34.43					1.18	1.65×10^{-9}	1.42×10^{-4}	0.009
4	180	36.30	36.98	37.68	38.41	39.13	39.85	40.57				0.71	1.31×10^{-9}	1.14×10^{-4}	0.007
5	120	40.29	40.63	40.98	41.33	41.68						0.35	9.55×10^{-10}	8.25×10^{-5}	0.005
												Average	1.65×10^{-9}	1.43×10^{-4}	0.009







Void filling
Lugeon: 0.005
Hydraulic Conductivity: 9.55E-10 m/s
Hydraulic Conductivity: 8.25E-5 m/d

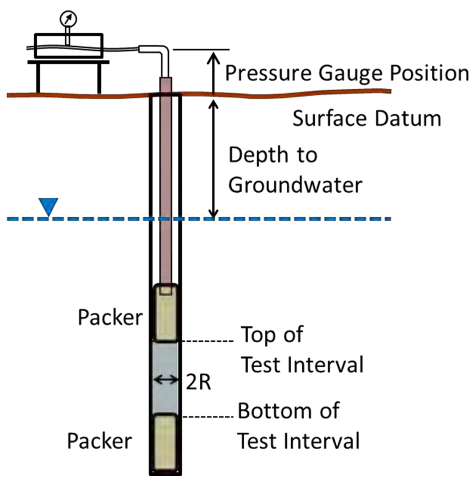
Performed using a single packer test assembly as the borehole was advanced, with the bottom of the test interval bounded by the bottom of the drilled section of the borehole.

~0.19 L/min system losses at 240 psi (during packer inflation); not accounted for in test flow data.

Although pressure-flow step profile suggests a Void Filling classification, the arithmetic mean (average) of the hydraulic conductivity (K) values determined for all steps used to calculate the representative K value for the test interval - K = 1.65E-9 m/s.

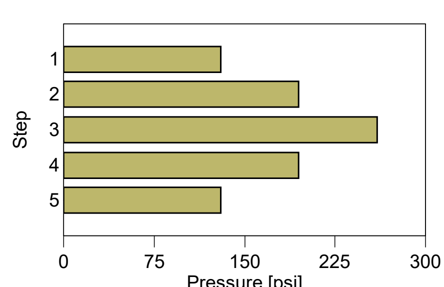
GEMTEC Consulting Engineers and Scientists	**Lugeon Test Analysis Report**
	Project: Valentine Gold Feasibility Geotechnical Investigation
	Number: 80047.03
	Client: Terrane Geoscience Inc.

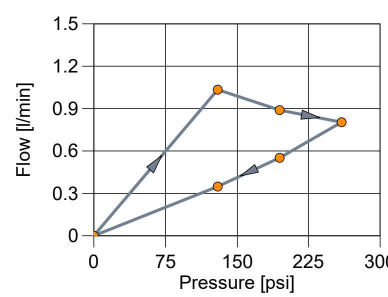
Location: Valentine Lake, NL	Lugeon Test: PT12	Tested bore: VL-GT-20-02
Test Conducted by: Terrane Geoscience Inc.		Test Date: 9/6/2020
Analysis Performed by: C. Anstey-Moore		Analysis Date: 10/26/2020
Lithology:		

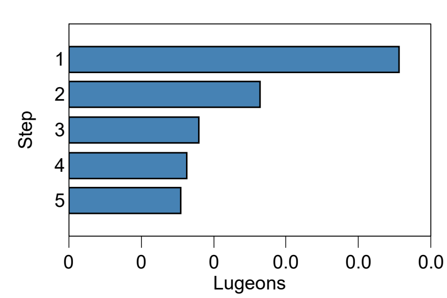


Top of Test Interval: 312.33 m
Bottom of Test Interval: 374.00 m
Length of Test Interval: 61.67 m
Gauge Position: 1.45 m
Depth to Groundwater: 0.75 m
Radius of Test Section: 0.05 m
Dip of bore: 35° from vertical
Vertical Top of Test Interval: 255.85 m
Vertical Bottom of Test Interval: 306.36 m

Step	Pressure [psi]	Flow Meter Readings [l]										Average Flow Rate [l/min]	Hydraulic Conductivity		
		1	2	3	4	5	6	7	8	9	10		[m/s]	[m/d]	Lugeon
1	130	23.71	24.78	25.80	26.82	27.84						1.03	3.38×10^{-9}	2.92×10^{-4}	0.018
2	195	44.69	45.60	46.50	47.39	48.25						0.89	1.96×10^{-9}	1.69×10^{-4}	0.011
3	260	56.50	57.34	58.13	58.92	59.71						0.80	1.33×10^{-9}	1.15×10^{-4}	0.007
4	195	61.00	61.55	62.10	62.65							0.55	1.21×10^{-9}	1.04×10^{-4}	0.007
5	130	61.80	62.10	62.44	62.81	63.18	63.55					0.35	1.14×10^{-9}	9.89×10^{-5}	0.006
												Average	1.80×10^{-9}	1.56×10^{-4}	0.010







Void filling
Lugeon: 0.006
Hydraulic Conductivity: 1.14E-9 m/s
Hydraulic Conductivity: 9.89E-5 m/d

Performed using a single packer test assembly as the borehole was advanced, with the bottom of the test interval bounded by the bottom of the drilled section of the borehole.

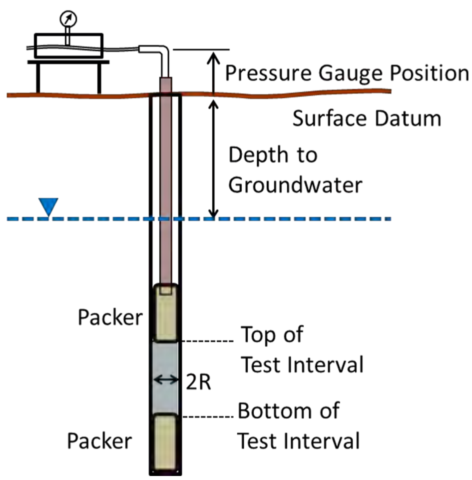
~0.30 L/min system losses at 260 psi (during packer inflation); not accounted for in test flow data.

Although pressure-flow step profile suggests a Void Filling classification, the arithmetic mean (average) of the hydraulic conductivity (K) values determined for all steps used to calculate the representative K value for the test interval - K = 1.80E-9 m/s.

GEMTEC
Consulting Engineers and Scientists

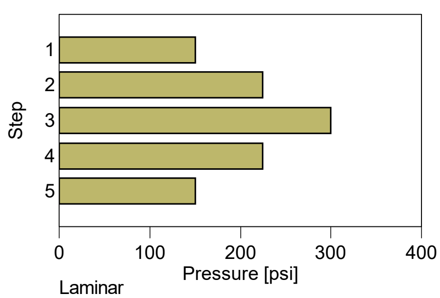
Lugeon Test Analysis Report
Project: Valentine Gold Feasibility Geotechnical Investigation
Number: 80047.03
Client: Terrane Geoscience Inc.

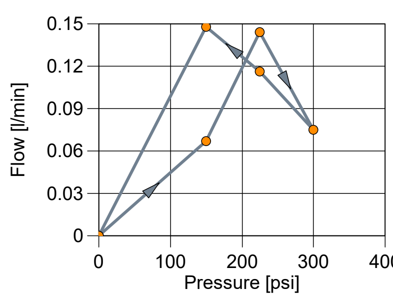
Location: Valentine Lake, NL	Lugeon Test: PT10	Tested bore: VL-GT-20-02
Test Conducted by: Terrane Geoscience Inc.		Test Date: 9/5/2020
Analysis Performed by: C. Anstey-Moore		Analysis Date: 10/26/2020
Lithology:		

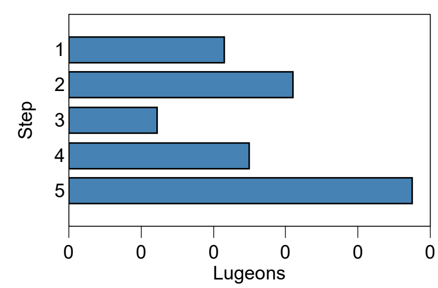


Top of Test Interval: 354.33 m
Bottom of Test Interval: 374.00 m
Length of Test Interval: 19.67 m
Gauge Position: 1.45 m
Depth to Groundwater: 0.75 m
Radius of Test Section: 0.05 m
Dip of bore: 35° from vertical
Vertical Top of Test Interval: 290.25 m
Vertical Bottom of Test Interval: 306.36 m

Step	Pressure [psi]	Flow Meter Readings [l]										Average Flow Rate [l/min]	Hydraulic Conductivity		
		1	2	3	4	5	6	7	8	9	10		[m/s]	[m/d]	Lugeon
1	150	496.56	496.73	496.86	496.97	497.03	497.03	497.03	497.03			0.07	5.03×10^{-10}	4.34×10^{-5}	0.003
2	225	497.97	498.12	498.27	498.41	498.55	498.69					0.14	7.23×10^{-10}	6.25×10^{-5}	0.005
3	300	499.75	499.81	499.89	499.97	500.05						0.08	2.84×10^{-10}	2.45×10^{-5}	0.002
4	225	500.95	501.07	501.18	501.30	501.41	501.53					0.12	5.83×10^{-10}	5.03×10^{-5}	0.004
5	150	499.37	499.51	499.67	499.81	499.97	500.11					0.15	1.11×10^{-9}	9.57×10^{-5}	0.007
												Average	6.40×10^{-10}	5.53×10^{-5}	0.004







Laminar
Lugeon: 0.004
Hydraulic Conductivity: 6.40E-10 m/s
Hydraulic Conductivity: 5.53E-5 m/d

Performed using a single packer test assembly as the borehole was advanced, with the bottom of the test interval bounded by the bottom of the drilled section of the borehole.

~0.43 L/min system losses at 300 psi (during packer inflation); not accounted for in test flow data. Surface gauge pressure readings checked with transducer data.

Irregular, non-linear pressure-flow profile. The hydraulic conductivity (K) value determined for step 3 used to calculate the representative K value for the test interval - K = 2.84E-10 m/s.

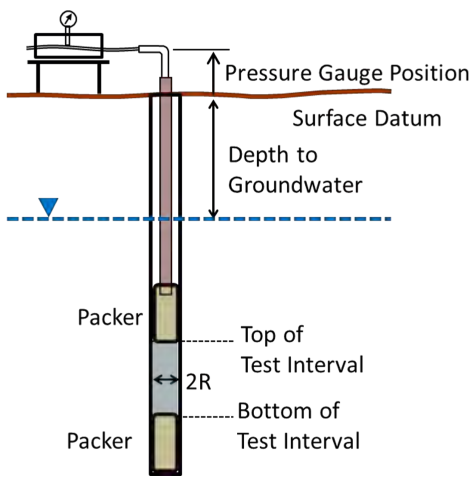
Lugeon Test Analysis Report

Project: Valentine Gold Feasibility Geotechnical Investigation

Number: 80047.03

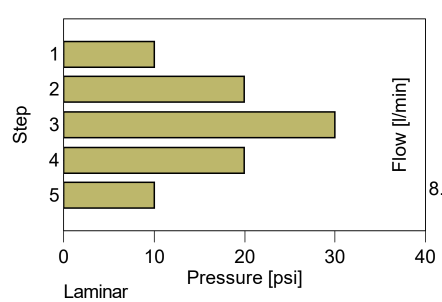
Client: Terrane Geoscience Inc.

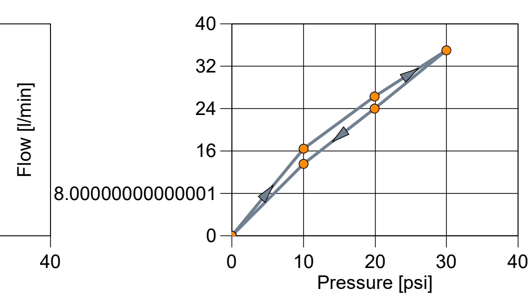
Location: Valentine Lake, NL	Lugeon Test: PT1	Tested bore: VL-GT-20-04
Test Conducted by: Terrane Geoscience Inc.		Test Date: 8/9/2020
Analysis Performed by: C. Anstey-Moore		Analysis Date: 10/26/2020
Lithology:		

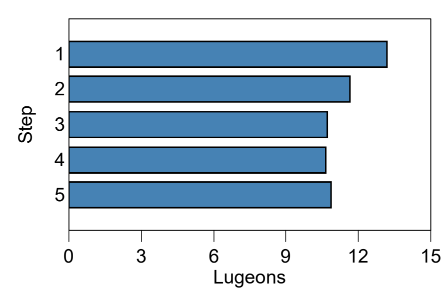


Top of Test Interval: 38.33 m
Bottom of Test Interval: 53.00 m
Length of Test Interval: 14.67 m
Gauge Position: 1.63 m
Depth to Groundwater: 0.00 m
Radius of Test Section: 0.05 m
Dip of bore: 20° from vertical
Vertical Top of Test Interval: 36.02 m
Vertical Bottom of Test Interval: 49.80 m

Step	Pressure [psi]	Flow Meter Readings [l]										Average Flow Rate [l/min]	Hydraulic Conductivity		
		1	2	3	4	5	6	7	8	9	10		[m/s]	[m/d]	Lugeon
1	10	806.00	823.50	840.50	857.10	873.55	889.90	906.00	922.10	938.10	954.00	16.44	1.95×10^{-6}	1.69×10^{-1}	13
2	20	23.00	50.50	77.00	103.50	129.25	155.00	180.75				26.29	1.72×10^{-6}	1.49×10^{-1}	12
3	30	272.00	307.50	342.50	377.50	412.00	447.00	482.00				35.00	1.58×10^{-6}	1.37×10^{-1}	11
4	20	516.00	539.50	563.75	588.00	612.25						24.06	1.58×10^{-6}	1.36×10^{-1}	11
5	10	632.00	644.10	657.00	670.30	684.00	697.75	711.75	725.65	739.60	753.70	13.52	1.60×10^{-6}	1.39×10^{-1}	11
												Average	1.69×10^{-6}	1.46×10^{-1}	11







Laminar
Lugeon: 11.413
Hydraulic Conductivity: 1.69E-6 m/s
Hydraulic Conductivity: 1.46E-1 m/d

Performed using a straddle double packer test assembly to isolate test interval.

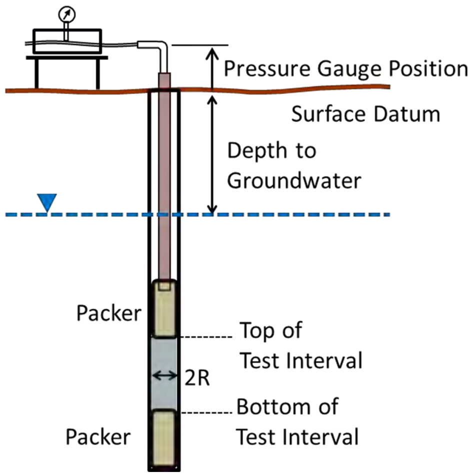
No leaks were noticed during packer inflation or testing.

Hydraulic conductivity value for test interval derived based on flow classification: Laminar (average for all steps).

GEMTEC CONSULTING ENGINEERS AND SCIENTISTS

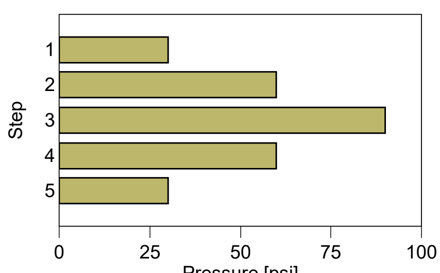
Lugeon Test Analysis Report	
Project:	Valentine Gold Feasibility Geotechnical Investigation
Number:	80047.03
Client:	Terrane Geoscience Inc.

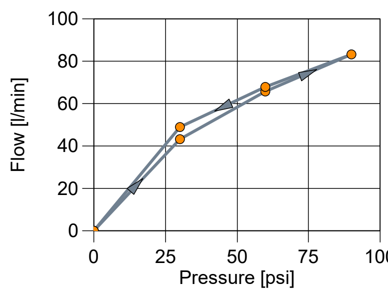
Location: Valentine Lake, NL	Lugeon Test: PT2	Tested bore: VL-GT-20-04
Test Conducted by: Terrane Geoscience Inc.		Test Date: 8/11/2020
Analysis Performed by: C. Anstey-Moore		Analysis Date: 10/26/2020
Lithology:		

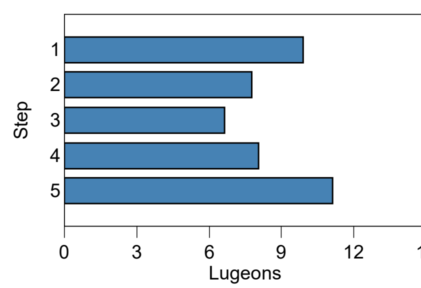


Top of Test Interval: 105.33 m
Bottom of Test Interval: 125.00 m
Length of Test Interval: 19.67 m
Gauge Position: 1.63 m
Depth to Groundwater: 0.00 m
Radius of Test Section: 0.05 m
Dip of bore: 20° from vertical
Vertical Top of Test Interval: 98.98 m
Vertical Bottom of Test Interval: 117.46 m

Step	Pressure [psi]	Flow Meter Readings [l]										Average Flow Rate [l/min]	Hydraulic Conductivity		
		1	2	3	4	5	6	7	8	9	10		[m/s]	[m/d]	Lugeon
1	30	5887.50	5930.50	5974.00	6017.50	6061.00						43.38	1.54×10^{-6}	1.33×10^{-1}	9.9
2	60	208.00	275.00	338.00	404.00	470.00	536.00					65.60	1.21×10^{-6}	1.04×10^{-1}	7.8
3	90	6635.00	6718.00	6802.00	6885.00	6967.00	7051.00	7134.00	7217.00	7300.00		83.13	1.03×10^{-6}	8.92×10^{-2}	6.6
4	60	382.00	450.00	518.00	586.00							68.00	1.25×10^{-6}	1.08×10^{-1}	8.0
5	30	7684.00	7732.00	7781.50	7830.00	7879.00	7927.50	7976.00	8025.00	8074.00	8123.00	48.78	1.73×10^{-6}	1.49×10^{-1}	11.1
												Average	1.35×10^{-6}	1.17×10^{-1}	8.7







Turbulent
Lugeon: 7.8
Hydraulic Conductivity: 1.21E-6 m/s
Hydraulic Conductivity: 1.04E-1 m/d

Performed using a straddle double packer test assembly to isolate test interval.

~0.03 L/min system losses at 100 psi (during packer inflation); considered negligible in comparison to test flows.

Hydraulic conductivity value for test interval derived based on flow classification: Turbulent (Step 2).

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CONSULTING ENGINEERS AND SCIENTISTS

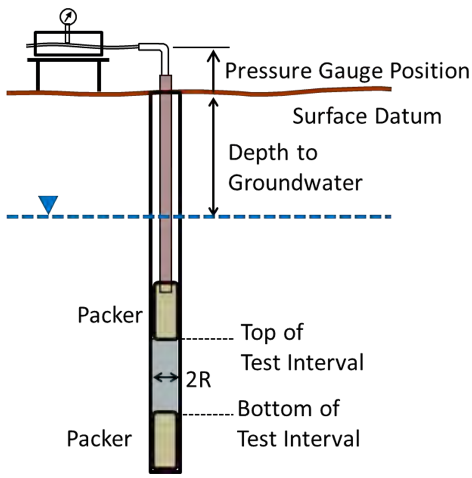
Lugeon Test Analysis Report

Project: Valentine Gold Feasibility Geotechnical Investigation

Number: 80047.03

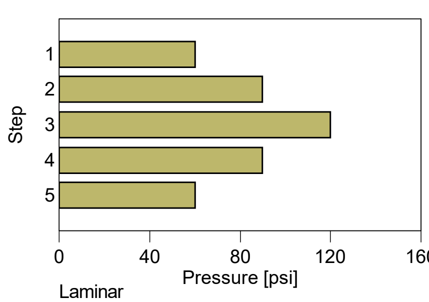
Client: Terrane Geoscience Inc.

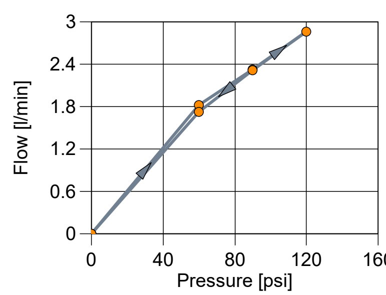
Location: Valentine Lake, NL	Lugeon Test: PT3	Tested bore: VL-GT-20-04
Test Conducted by: Terrane Geoscience Inc.		Test Date: 8/12/2020
Analysis Performed by: C. Anstey-Moore		Analysis Date: 10/26/2020
Lithology:		

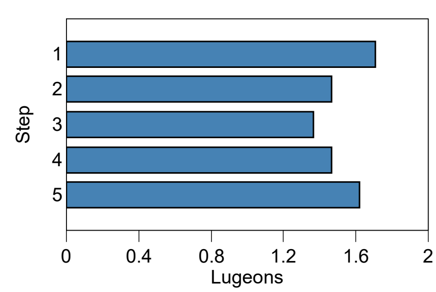


Top of Test Interval: 145.33 m
Bottom of Test Interval: 147.82 m
Length of Test Interval: 2.49 m
Gauge Position: 1.52 m
Depth to Groundwater: 0.00 m
Radius of Test Section: 0.05 m
Dip of bore: 20° from vertical
Vertical Top of Test Interval: 136.57 m
Vertical Bottom of Test Interval: 138.91 m

Step	Pressure [psi]	Flow Meter Readings [l]										Average Flow Rate [l/min]	Hydraulic Conductivity		
		1	2	3	4	5	6	7	8	9	10		[m/s]	[m/d]	Lugeon
1	60	194.60	196.50	198.36	200.21	202.03	203.84	205.62	207.40	209.17		1.82	1.73×10^{-7}	1.50×10^{-2}	1.7
2	90	211.20	213.55	215.86	218.17	220.48						2.32	1.49×10^{-7}	1.29×10^{-2}	1.5
3	120	222.50	225.40	228.25	231.10	233.95						2.86	1.39×10^{-7}	1.20×10^{-2}	1.4
4	90	236.60	238.97	241.32	243.66	245.97	248.32	250.67	252.95	255.20	257.45	2.32	1.49×10^{-7}	1.29×10^{-2}	1.5
5	60	260.60	262.35	264.09	265.81	267.53	269.25					1.73	1.65×10^{-7}	1.42×10^{-2}	1.6
												Average	1.55×10^{-7}	1.34×10^{-2}	1.5







Laminar
Lugeon: 1.525
Hydraulic Conductivity: 1.55E-7 m/s
Hydraulic Conductivity: 1.34E-2 m/d

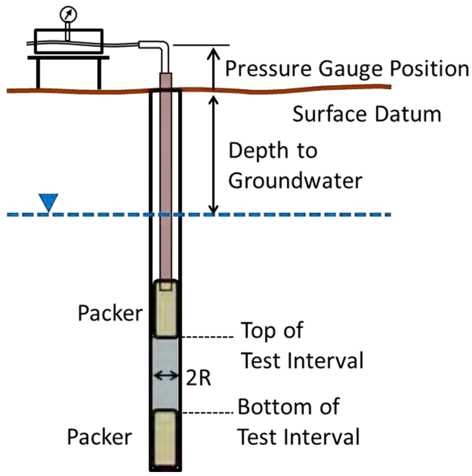
Performed using a straddle double packer test assembly to isolate test interval.

~0.05 L/min system losses at 120 psi (during packer inflation); considered negligible in comparison to test flows.

Hydraulic conductivity value for test interval derived based on flow classification: Laminar (average for all steps).

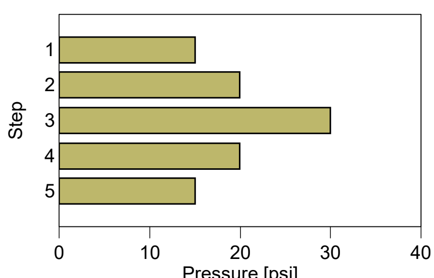
GEMTEC Consulting Engineers and Scientists	**Lugeon Test Analysis Report**
	Project: Valentine Gold Feasibility Geotechnical Investigation
	Number: 80047.03
	Client: Terrane Geoscience Inc.

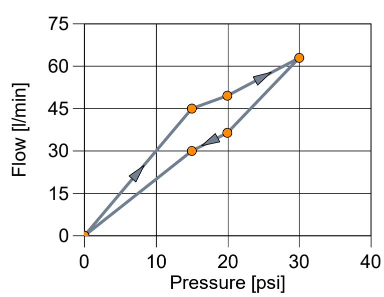
Location: Valentine Lake, NL	Lugeon Test: PT9	Tested bore: VL-GT-20-05
Test Conducted by: Terrane Geoscience Inc.		Test Date: 8/26/2020
Analysis Performed by: C. Anstey-Moore		Analysis Date: 10/26/2020
Lithology:		

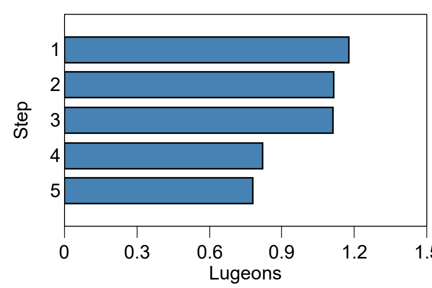


Top of Test Interval: 4.33 m
Bottom of Test Interval: 182.00 m
Length of Test Interval: 177.67 m
Gauge Position: 1.34 m
Depth to Groundwater: 10.10 m
Radius of Test Section: 0.05 m
Dip of bore: 35° from vertical
Vertical Top of Test Interval: 3.55 m
Vertical Bottom of Test Interval: 149.09 m

Step	Pressure [psi]	Flow Meter Readings [l]										Average Flow Rate [l/min]	Hydraulic Conductivity		
		1	2	3	4	5	6	7	8	9	10		[m/s]	[m/d]	Lugeon
1	15	893.00	940.50	986.50	1030.50	1074.50	1118.50					45.10	2.50×10^{-7}	2.16×10^{-2}	1.2
2	20	330.00	379.50	429.00	478.50							49.50	2.37×10^{-7}	2.05×10^{-2}	1.1
3	30	730.00	793.00	856.00	919.00							63.00	2.36×10^{-7}	2.04×10^{-2}	1.1
4	20	160.00	196.50	232.50	269.00	305.50	342.00					36.40	1.74×10^{-7}	1.51×10^{-2}	0.8
5	15	500.00	529.50	559.50	589.50	619.50						29.88	1.66×10^{-7}	1.43×10^{-2}	0.8
												Average	2.13×10^{-7}	1.84×10^{-2}	1.0







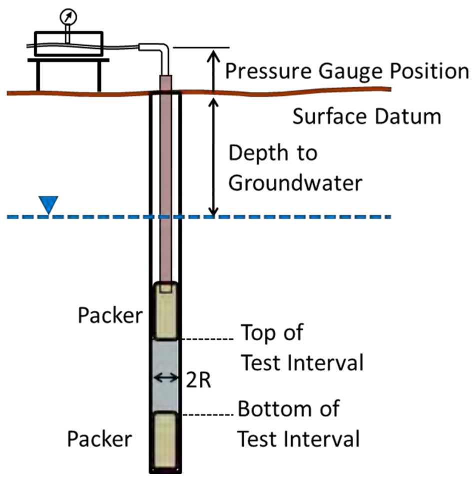
Void filling
Lugeon: 0.780
Hydraulic Conductivity: 1.66E-7 m/s
Hydraulic Conductivity: 1.43E-2 m/d

Performed using a single packer test assembly as the borehole was advanced, with the bottom of the test interval bounded by the bottom of the drilled section of the borehole.
~0.18 L/min system losses at 90 psi (during packer inflation); considered negligible in comparison to test flows. Test pressures higher than determined Pmax required to induce flow. Test pressure-flow profile does not suggest dilation. Difficulty maintaining constant pressure during steps. Following testing and bladder removal, hole flowing. Possible artesian pressures in the test interval.

Although pressure-flow step profile suggests a Void Filling classification, the arithmetic mean (average) of the hydraulic conductivity (K) values determined for steps 1, 2, and 3 used to calculate the representative K value for the test interval - K = 2.50E-07 m/s.

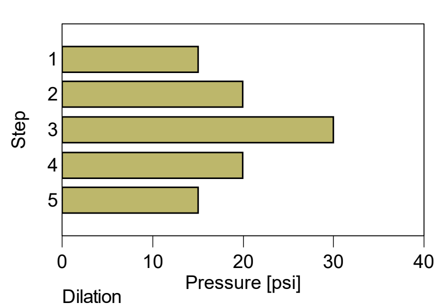
Lugeon Test Analysis Report	
Project:	Valentine Gold Feasibility Geotechnical Investigation
Number:	80047.03
Client:	Terrane Geoscience Inc.

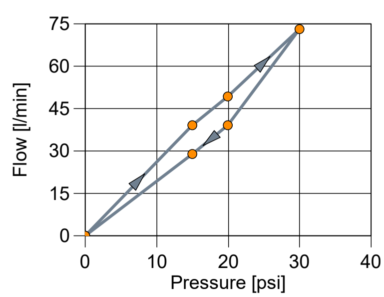
Location: Valentine Lake, NL	Lugeon Test: PT8	Tested bore: VL-GT-20-05
Test Conducted by: Terrane Geoscience Inc.		Test Date: 8/26/2020
Analysis Performed by: C. Anstey-Moore		Analysis Date: 10/26/2020
Lithology:		

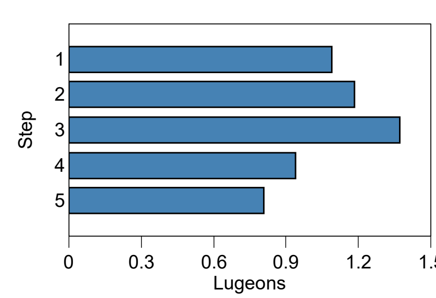


Top of Test Interval: 15.33 m
Bottom of Test Interval: 182.00 m
Length of Test Interval: 166.67 m
Gauge Position: 1.34 m
Depth to Groundwater: 10.10 m
Radius of Test Section: 0.05 m
Dip of bore: 35° from vertical
Vertical Top of Test Interval: 12.56 m
Vertical Bottom of Test Interval: 149.09 m

Step	Pressure [psi]	Flow Meter Readings [l]										Average Flow Rate [l/min]	Hydraulic Conductivity		
		1	2	3	4	5	6	7	8	9	10		[m/s]	[m/d]	Lugeon
1	15	300.00	340.50	379.50	419.50	457.50	496.50	535.50	574.50			39.21	2.30×10^{-7}	1.99×10^{-2}	1.1
2	20	600.00	650.50	700.00	749.00	798.00	847.00					49.40	2.50×10^{-7}	2.16×10^{-2}	1.2
3	30	900.00	973.00	1046.00	1119.00							73.00	2.90×10^{-7}	2.50×10^{-2}	1.4
4	20	200.00	239.50	278.50	317.50	356.50						39.13	1.98×10^{-7}	1.71×10^{-2}	0.9
5	15	450.00	479.00	508.00	537.00							29.00	1.70×10^{-7}	1.47×10^{-2}	0.8
												Average	2.28×10^{-7}	1.97×10^{-2}	1.1







Dilation
Lugeon: 1.091
Hydraulic Conductivity: 2.30E-7 m/s
Hydraulic Conductivity: 1.99E-2 m/d

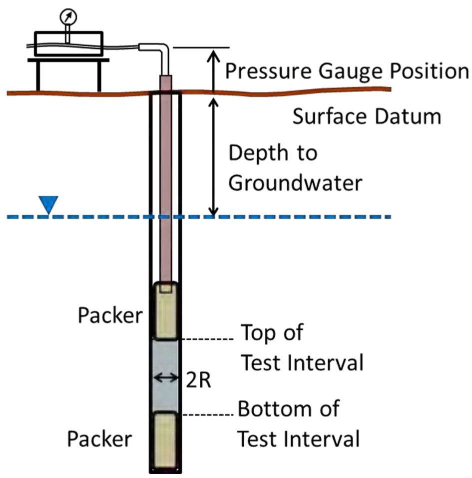
Performed using a single packer test assembly as the borehole was advanced, with the bottom of the test interval bounded by the bottom of the drilled section of the borehole.

No leaks were noticed during packer inflation or testing. Test pressures higher than determined Pmax required to induce flow. Test pressure-flow profile suggests some potential dilation that may result in enhanced hydraulic conductivity value determined for this test interval.

Hydraulic conductivity value for test interval derived based on flow classification: Dilation (step 1).

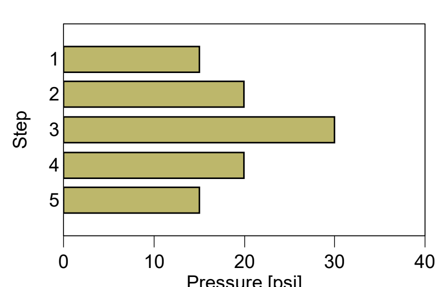
GEMTEC Consulting Engineers and Scientists	**Lugeon Test Analysis Report**
	Project: Valentine Gold Feasibility Geotechnical Investigation
	Number: 80047.03
	Client: Terrane Geoscience Inc.

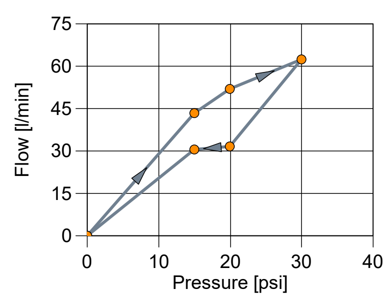
Location: Valentine Lake, NL	Lugeon Test: PT7	Tested bore: VL-GT-20-05
Test Conducted by: Terrane Geoscience Inc.		Test Date: 8/26/2020
Analysis Performed by: C. Anstey-Moore		Analysis Date: 10/26/2020
Lithology:		

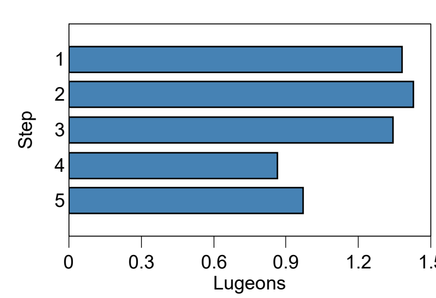


Top of Test Interval: 36.33 m
Bottom of Test Interval: 182.00 m
Length of Test Interval: 145.67 m
Gauge Position: 1.34 m
Depth to Groundwater: 10.10 m
Radius of Test Section: 0.05 m
Dip of bore: 35° from vertical
Vertical Top of Test Interval: 29.76 m
Vertical Bottom of Test Interval: 149.09 m

Step	Pressure [psi]	Flow Meter Readings [l]										Average Flow Rate [l/min]	Hydraulic Conductivity		
		1	2	3	4	5	6	7	8	9	10		[m/s]	[m/d]	Lugeon
1	15	435.50	479.50	523.50	566.50	609.50	652.50					43.40	2.87×10^{-7}	2.48×10^{-2}	1.4
2	20	700.00	752.00	804.00	856.00							52.00	2.96×10^{-7}	2.56×10^{-2}	1.4
3	30	900.00	966.00	1031.00	1095.00	1158.00	1220.00	1280.00	1340.00	1400.00		62.50	2.79×10^{-7}	2.41×10^{-2}	1.3
4	20	430.00	461.50	493.00	524.50							31.50	1.79×10^{-7}	1.55×10^{-2}	0.9
5	15	660.00	690.50	721.00	751.50							30.50	2.02×10^{-7}	1.74×10^{-2}	1.0
												Average	2.49×10^{-7}	2.15×10^{-2}	1.2







Void filling
Lugeon: 0.971
Hydraulic Conductivity: 2.02E-7 m/s
Hydraulic Conductivity: 1.74E-2 m/d

Performed using a single packer test assembly as the borehole was advanced, with the bottom of the test interval bounded by the bottom of the drilled section of the borehole.

No leaks were noticed during packer inflation or testing. Difficulty maintaining constant pressure during steps. Following testing, and bladder removal hole flowing. Possible artesian pressures in the test interval.

Although pressure-flow step profile suggests a Void Filling classification, the arithmetic mean (average) of the hydraulic conductivity (K) values determined for all steps used to calculate the representative K value for the test interval - K = 2.49E-7 m/s.

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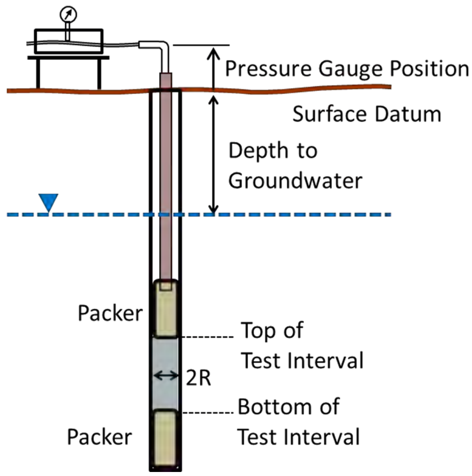
Lugeon Test Analysis Report

Project: Valentine Gold Feasibility Geotechnical Investigation

Number: 80047.03

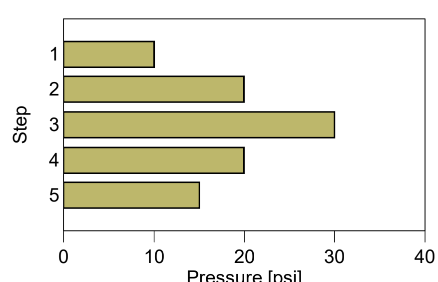
Client: Terrane Geoscience Inc.

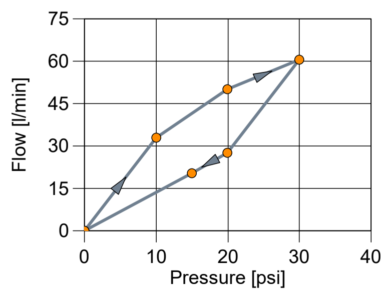
Location: Valentine Lake, NL	Lugeon Test: PT6	Tested bore: VL-GT-20-05
Test Conducted by: Terrane Geoscience Inc.		Test Date: 8/26/2020
Analysis Performed by: C. Anstey-Moore		Analysis Date: 10/26/2020
Lithology:		

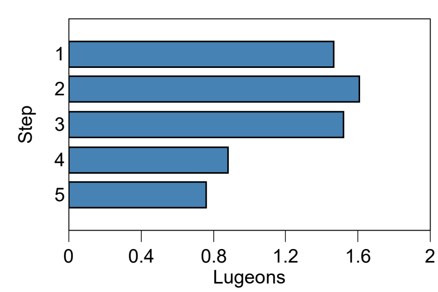


Top of Test Interval: 57.33 m
Bottom of Test Interval: 182.00 m
Length of Test Interval: 124.67 m
Gauge Position: 1.34 m
Depth to Groundwater: 10.10 m
Radius of Test Section: 0.05 m
Dip of bore: 35° from vertical
Vertical Top of Test Interval: 46.96 m
Vertical Bottom of Test Interval: 149.09 m

Step	Pressure [psi]	Flow Meter Readings [l]										Average Flow Rate [l/min]	Hydraulic Conductivity		
		1	2	3	4	5	6	7	8	9	10		[m/s]	[m/d]	Lugeon
1	10	750.00	786.00	821.50	856.50	890.50	924.00	956.00	986.50	1017.00	1047.50	33.06	2.98×10^{-7}	2.57×10^{-2}	1.5
2	20	100.00	150.50	200.50	250.50	300.50						50.13	3.27×10^{-7}	2.83×10^{-2}	1.6
3	30	350.00	413.50	475.00	536.00	596.00	655.00	714.00	773.00			60.43	3.09×10^{-7}	2.67×10^{-2}	1.5
4	20	800.00	827.50	855.00	882.50							27.50	1.79×10^{-7}	1.55×10^{-2}	0.9
5	15	35.00	55.60	75.90	96.20	116.50						20.38	1.54×10^{-7}	1.33×10^{-2}	0.8
												Average	2.54×10^{-7}	2.19×10^{-2}	1.2







Void filling
Lugeon: 0.758
Hydraulic Conductivity: 1.54E-7 m/s
Hydraulic Conductivity: 1.33E-2 m/d

Performed using a single packer test assembly as the borehole was advanced, with the bottom of the test interval bounded by the bottom of the drilled section of the borehole.

No leaks were noticed during packer inflation or testing. Surface gauge pressure readings checked with transducer data. Difficulty maintaining constant pressure during steps. Following step 5, ~20 L/min backflow with pump off; dissipated once bladder was deflated. Possible artesian pressures in the test interval.

Although pressure-flow step profile suggests a Void Filling classification, the arithmetic mean (average) of the hydraulic conductivity (K) values determined for all steps used to calculate the representative K value for the test interval - K = 2.54E-7 m/s.

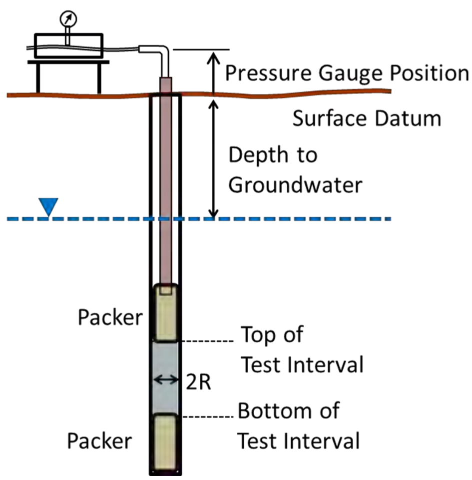
Lugeon Test Analysis Report

Project: Valentine Gold Feasibility Geotechnical Investigation

Number: 80047.03

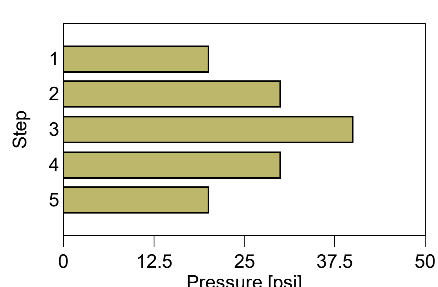
Client: Terrane Geoscience Inc.

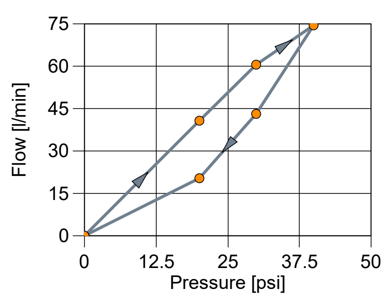
Location: Valentine Lake, NL	Lugeon Test: PT5	Tested bore: VL-GT-20-05
Test Conducted by: Terrane Geoscience Inc.		Test Date: 8/26/2020
Analysis Performed by: C. Anstey-Moore		Analysis Date: 10/26/2020
Lithology:		

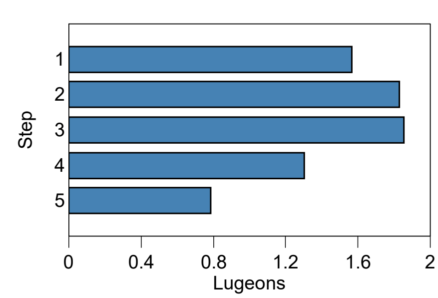


Top of Test Interval: 78.33 m
Bottom of Test Interval: 182.00 m
Length of Test Interval: 103.67 m
Gauge Position: 1.34 m
Depth to Groundwater: 10.10 m
Radius of Test Section: 0.05 m
Dip of bore: 35° from vertical
Vertical Top of Test Interval: 64.16 m
Vertical Bottom of Test Interval: 149.09 m

Step	Pressure [psi]	Flow Meter Readings [l]										Average Flow Rate [l/min]	Hydraulic Conductivity		
		1	2	3	4	5	6	7	8	9	10		[m/s]	[m/d]	Lugeon
1	20	310.00	351.00	391.50	432.00	472.50						40.63	3.11×10^{-7}	2.69×10^{-2}	1.6
2	30	510.00	570.50	631.00	691.50							60.50	3.63×10^{-7}	3.14×10^{-2}	1.8
3	40	750.00	824.50	899.00	973.50							74.50	3.68×10^{-7}	3.18×10^{-2}	1.9
4	30	50.00	93.00	136.50	179.50	222.50	265.50					43.10	2.59×10^{-7}	2.24×10^{-2}	1.3
5	20	90.00	109.80	128.80	148.20	167.90	187.30	209.30	230.30	251.80	273.30	20.37	1.56×10^{-7}	1.35×10^{-2}	0.8
												Average	2.92×10^{-7}	2.52×10^{-2}	1.5







Void filling
Lugeon: 0.8
Hydraulic Conductivity: 1.56E-7 m/s
Hydraulic Conductivity: 1.35E-2 m/d

Performed using a single packer test assembly as the borehole was advanced, with the bottom of the test interval bounded by the bottom of the drilled section of the borehole.

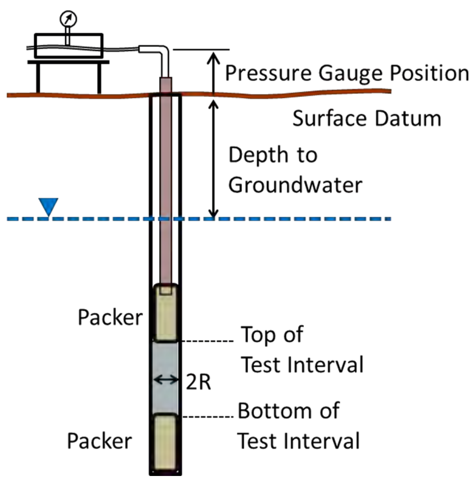
~0.04 L/min system losses at 80 psi (during packer inflation); considered negligible in comparison to test flows. Difficulty maintaining constant pressure during steps. Possible artesian pressures in the test interval. Surface gauge pressure readings checked with transducer data.

Although pressure-flow step profile suggests a Void Filling classification, the arithmetic mean (average) of the hydraulic conductivity (K) values determined for all steps used to calculate the representative K value for the test interval - K = 2.92E-7 m/s.

GEMTEC
Consulting Engineers and Scientists

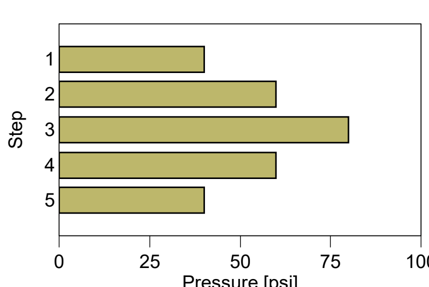
Lugeon Test Analysis Report	
Project:	Valentine Gold Feasibility Geotechnical Investigation
Number:	80047.03
Client:	Terrane Geoscience Inc.

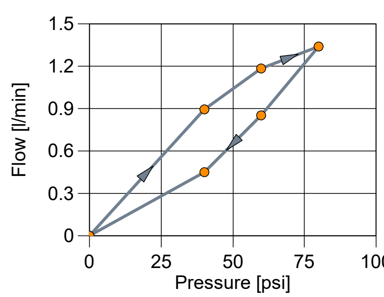
Location: Valentine Lake, NL	Lugeon Test: PT4	Tested bore: VL-GT-20-05
Test Conducted by: Terrane Geoscience Inc.		Test Date: 8/26/2020
Analysis Performed by: C. Anstey-Moore		Analysis Date: 10/26/2020
Lithology:		

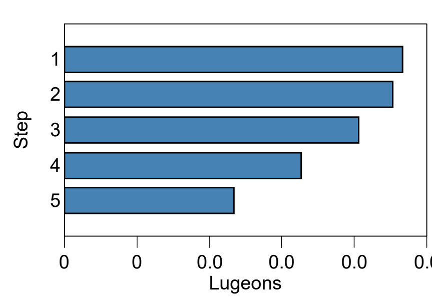


Top of Test Interval: 99.33 m
Bottom of Test Interval: 182.00 m
Length of Test Interval: 82.67 m
Gauge Position: 1.34 m
Depth to Groundwater: 10.10 m
Radius of Test Section: 0.05 m
Dip of bore: 35° from vertical
Vertical Top of Test Interval: 81.37 m
Vertical Bottom of Test Interval: 149.09 m

Step	Pressure [psi]	Flow Meter Readings [l]										Average Flow Rate [l/min]	Hydraulic Conductivity		
		1	2	3	4	5	6	7	8	9	10		[m/s]	[m/d]	Lugeon
1	40	39.00	39.95	40.88	41.78	42.67	43.54	44.41	45.28			0.90	5.39×10^{-9}	4.66×10^{-4}	0.03
2	60	54.22	55.44	56.65	57.83	58.99	60.13					1.18	5.24×10^{-9}	4.53×10^{-4}	0.03
3	80	75.73	77.12	78.41	79.74	81.10	82.42	83.76				1.34	4.70×10^{-9}	4.06×10^{-4}	0.02
4	60	86.50	87.36	88.23	89.11	89.93	90.80	91.69	92.53	93.34	94.18	0.85	3.78×10^{-9}	3.27×10^{-4}	0.02
5	40	94.80	95.20	95.63	96.09	96.54	97.01	97.48	97.95			0.45	2.70×10^{-9}	2.34×10^{-4}	0.01
												Average	4.36×10^{-9}	3.77×10^{-4}	0.02







Void filling
Lugeon: 0.014
Hydraulic Conductivity: 2.70E-9 m/s
Hydraulic Conductivity: 2.34E-4 m/d

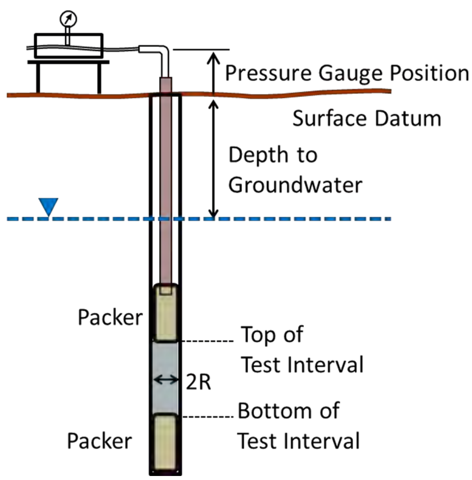
Performed using a single packer test assembly as the borehole was advanced, with the bottom of the test interval bounded by the bottom of the drilled section of the borehole.

~0.05 L/min system losses at 90 psi (during packer inflation); not accounted for in test flow data. Slightly slowing flows during steps 1, 2, and 3, and increasing flows observed in steps 4 and 5. Pressure adjustments required during testing. Surface gauge pressure readings checked with transducer data. Possible artesian pressures in the test interval.

Although pressure-flow step profile suggests a Void Filling classification, the arithmetic mean (average) of the hydraulic conductivity (K) values determined for all steps used to calculate the representative K value for the test interval - K = 4.36E-09 m/s.

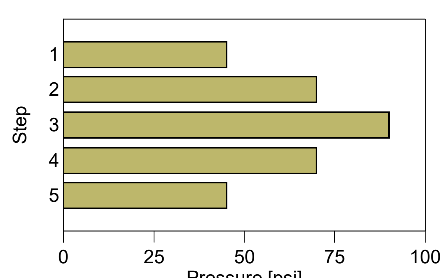
GEMTEC Consulting Engineers and Scientists	**Lugeon Test Analysis Report**
	Project: Valentine Gold Feasibility Geotechnical Investigation
	Number: 80047.03
	Client: Terrane Geoscience Inc.

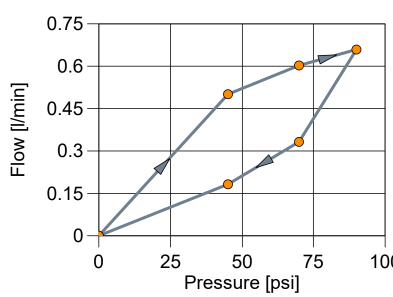
Location: Valentine Lake, NL	Lugeon Test: PT3	Tested bore: VL-GT-20-05
Test Conducted by: Terrane Geoscience Inc.		Test Date: 8/26/2020
Analysis Performed by: C. Anstey-Moore		Analysis Date: 10/26/2020
Lithology:		

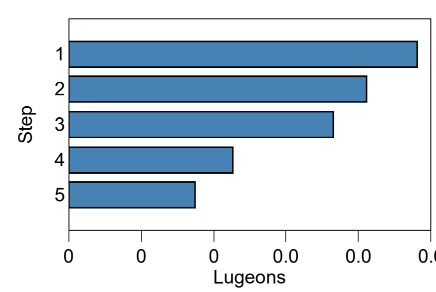


Top of Test Interval: 120.33 m
Bottom of Test Interval: 182.00 m
Length of Test Interval: 61.67 m
Gauge Position: 1.34 m
Depth to Groundwater: 10.10 m
Radius of Test Section: 0.05 m
Dip of bore: 35° from vertical
Vertical Top of Test Interval: 98.57 m
Vertical Bottom of Test Interval: 149.09 m

Step	Pressure [psi]	Flow Meter Readings [l]										Average Flow Rate [l/min]	Hydraulic Conductivity		
		1	2	3	4	5	6	7	8	9	10		[m/s]	[m/d]	Lugeon
1	45	100.92	101.47	102.00	102.50	102.98	103.43					0.50	3.57×10^{-9}	3.08×10^{-4}	0.019
2	70	7.61	8.26	8.89	9.50	10.10	10.69	11.26	11.83			0.60	3.04×10^{-9}	2.63×10^{-4}	0.016
3	90	17.85	18.56	19.26	19.92	20.55	21.15					0.66	2.70×10^{-9}	2.34×10^{-4}	0.015
4	70	21.30	21.55	21.91	22.27	22.63						0.33	1.68×10^{-9}	1.45×10^{-4}	0.009
5	45	21.61	21.77	21.95	22.14	22.33	22.52					0.18	1.29×10^{-9}	1.12×10^{-4}	0.007
												Average	2.46×10^{-9}	2.12×10^{-4}	0.013







Void filling
Lugeon: 0.007
Hydraulic Conductivity: 1.29E-9 m/s
Hydraulic Conductivity: 1.12E-4 m/d

Performed using a single packer test assembly as the borehole was advanced, with the bottom of the test interval bounded by the bottom of the drilled section of the borehole.

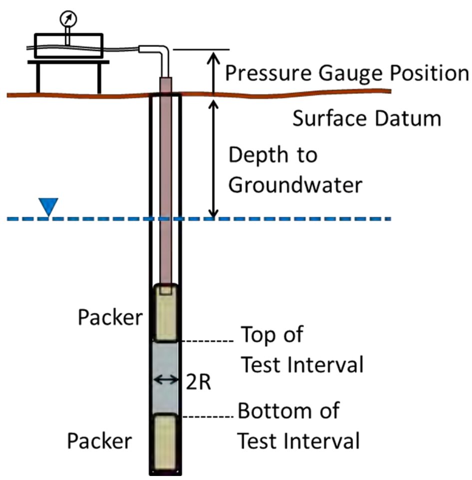
~0.08 L/min system losses at 90 psi (during packer inflation); not accounted for in test flow data. Slowing flows observed in steps 1, 2, 3, and backflow at start of step 5; suggest potential artesian pressures in the test interval.

Although pressure-flow step profile suggests a Void Filling classification, the arithmetic mean (average) of the hydraulic conductivity (K) values determined for all steps used to calculate the representative K value for the test interval - K = 2.46E-9 m/s.

Lugeon Test Analysis Report	
Project:	Valentine Gold Feasibility Geotechnical Investigation
Number:	80047.03
Client:	Terrane Geoscience Inc.

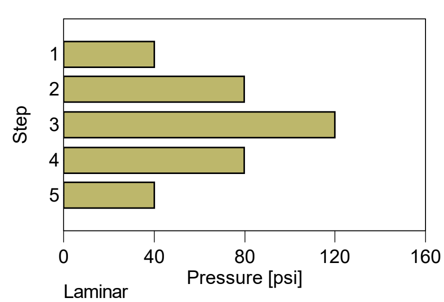
GEMTEC CONSULTING ENGINEERS AND SCIENTISTS

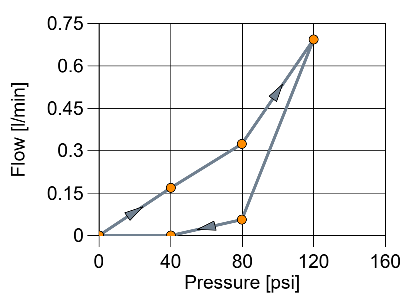
Location: Valentine Lake, NL	Lugeon Test: PT2	Tested bore: VL-GT-20-05
Test Conducted by: Terrane Geoscience Inc.		Test Date: 8/26/2020
Analysis Performed by: C. Anstey-Moore		Analysis Date: 10/26/2020
Lithology:		

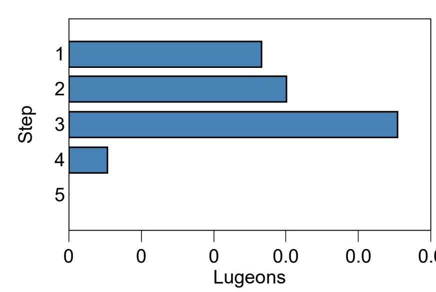


Top of Test Interval: 141.33 m
Bottom of Test Interval: 182.00 m
Length of Test Interval: 40.67 m
Gauge Position: 1.34 m
Depth to Groundwater: 10.10 m
Radius of Test Section: 0.05 m
Dip of bore: 35° from vertical
Vertical Top of Test Interval: 115.77 m
Vertical Bottom of Test Interval: 149.09 m

Step	Pressure [psi]	Flow Meter Readings [l]										Average Flow Rate [l/min]	Hydraulic Conductivity		
		1	2	3	4	5	6	7	8	9	10		[m/s]	[m/d]	Lugeon
1	40	78.14	78.31	78.49	78.66	78.83	78.99	79.15	79.32	79.48	79.65	0.17	1.85×10^{-9}	1.60×10^{-4}	0.011
2	80	83.04	83.43	83.77	84.08	84.41	84.72	85.00	85.29	85.62	85.96	0.32	2.10×10^{-9}	1.81×10^{-4}	0.012
3	120	88.04	88.67	89.27	89.90	90.61	91.33	92.11	92.82	93.58	94.28	0.69	3.16×10^{-9}	2.73×10^{-4}	0.018
4	80	94.97	94.98	95.05	95.12	95.20						0.06	3.71×10^{-10}	3.21×10^{-5}	0.002
5	40														
												Average	1.87×10^{-9}	1.62×10^{-4}	0.011







Laminar
Lugeon: 0.011
Hydraulic Conductivity: 1.87E-9 m/s
Hydraulic Conductivity: 1.62E-4 m/d

Performed using a single packer test assembly as the borehole was advanced, with the bottom of the test interval bounded by the bottom of the drilled section of the borehole.

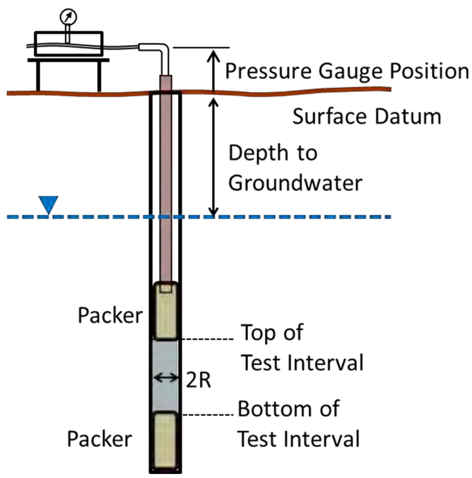
No leaks were noticed during packer inflation or testing. Backflow when decreasing pressure from step 3 to step 4 to step 5. Backflow in step 5; hydraulic conductively not determined for this step.

The arithmetic mean (average) of the hydraulic conductivity (K) values determined for steps 1, 3, 3 and 4 used to calculate the representative K value for the test interval - K = 1.87E-09 m/s.

Lugeon Test Analysis Report	
Project:	Valentine Gold Feasibility Geotechnical Investigation
Number:	80047.03
Client:	Terrane Geoscience Inc.

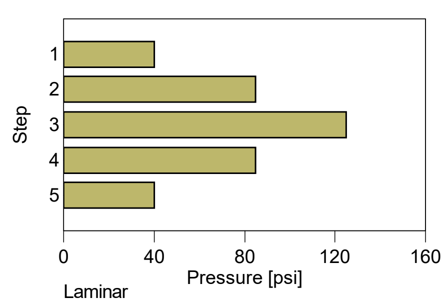
Location: Valentine Lake, NL	Lugeon Test: PT1	Tested bore: VL-GT-20-05
Test Conducted by: Terrane Geoscience Inc.		Test Date: 8/26/2020
Analysis Performed by: C. Anstey-Moore		Analysis Date: 10/26/2020

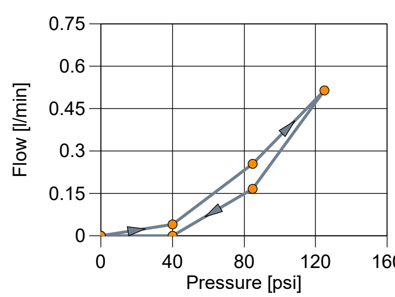
Lithology:

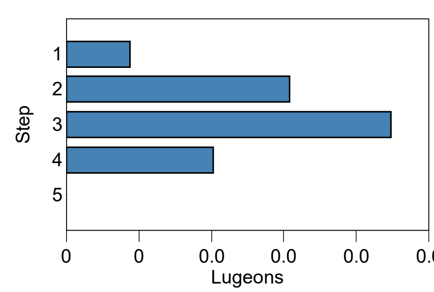


Top of Test Interval: 162.33 m
Bottom of Test Interval: 182.00 m
Length of Test Interval: 19.67 m
Gauge Position: 1.34 m
Depth to Groundwater: 10.10 m
Radius of Test Section: 0.05 m
Dip of bore: 35° from vertical
Vertical Top of Test Interval: 132.97 m
Vertical Bottom of Test Interval: 149.09 m

Step	Pressure [psi]	Flow Meter Readings [l]										Average Flow Rate [l/min]	Hydraulic Conductivity		
		1	2	3	4	5	6	7	8	9	10		[m/s]	[m/d]	Lugeon
1	40	62.27	62.29	62.34	62.39	62.43	62.47	62.51				0.04	8.15×10^{-10}	7.04×10^{-5}	0.005
2	85	63.21	63.56	63.82	64.05	64.29	64.52	64.76	65.00	65.24		0.25	2.87×10^{-9}	2.48×10^{-4}	0.018
3	125	73.40	73.90	74.39	74.90	75.43	75.96	76.48	76.99	77.52		0.51	4.18×10^{-9}	3.61×10^{-4}	0.027
4	85	76.42	76.69	76.87	77.00	77.14	77.28	77.42				0.17	1.89×10^{-9}	1.63×10^{-4}	0.012
5	40														
												Average	2.44×10^{-9}	2.11×10^{-4}	0.016







Laminar
Lugeon: 0.028
Hydraulic Conductivity: 4.34E-9 m/s
Hydraulic Conductivity: 3.75E-4 m/d

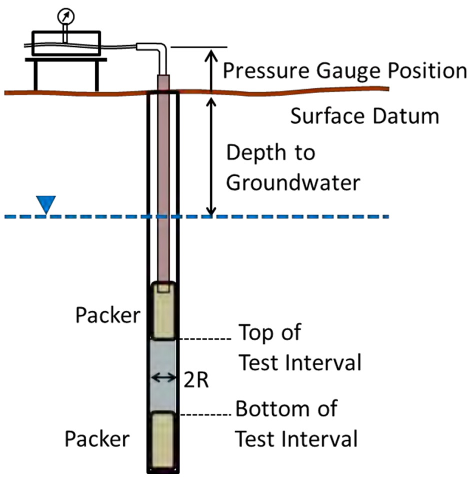
Performed using a single packer test assembly as the borehole was advanced, with the bottom of the test interval bounded by the bottom of the drilled section of the borehole.

No leaks were noticed during packer inflation or testing. Surface gauge pressure readings checked with transducer data. Backflow when decreasing pressure from step 3 to step 4 to step 5. Backflow in step 5; hydraulic conductively not determined for this step.

The arithmetic mean (average) of the hydraulic conductivity (K) values determined for steps 1, 3, 3 and 4 used to calculate the representative K value for the test interval - K = 2.44E-09 m/s.

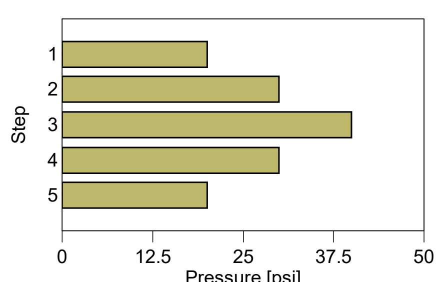
Lugeon Test Analysis Report	
Project:	Valentine Gold Feasibility Geotechnical Investigation
Number:	80047.03
Client:	Terrane Geoscience Inc.

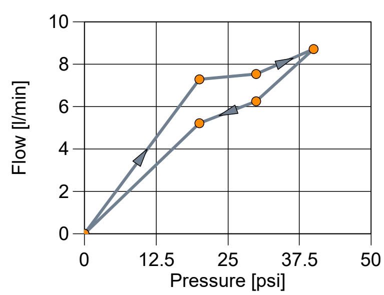
Location: Valentine Lake, NL	Lugeon Test: PT17	Tested bore: VL-GT-20-05
Test Conducted by: Terrane Geoscience Inc.		Test Date: 8/30/2020
Analysis Performed by: C. Anstey-Moore		Analysis Date: 10/26/2020
Lithology:		

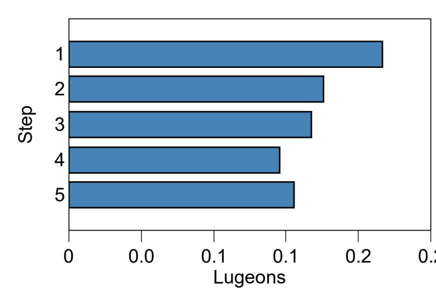


Top of Test Interval: 182.00 m
Bottom of Test Interval: 350.00 m
Length of Test Interval: 168.00 m
Gauge Position: 1.32 m
Depth to Groundwater: 10.10 m
Radius of Test Section: 0.05 m
Dip of bore: 35° from vertical
Vertical Top of Test Interval: 149.09 m
Vertical Bottom of Test Interval: 286.70 m

Step	Pressure [psi]	Flow Meter Readings [l]										Average Flow Rate [l/min]	Hydraulic Conductivity		
		1	2	3	4	5	6	7	8	9	10		[m/s]	[m/d]	Lugeon
1	20	748.00	755.70	763.10	770.35	777.40	784.40					7.28	3.66×10^{-8}	3.16×10^{-3}	0.17
2	30	897.10	904.75	912.40	919.95	927.40	934.80					7.54	2.97×10^{-8}	2.57×10^{-3}	0.14
3	40	1014.55	1023.35	1032.20	1040.90	1049.70	1058.40	1067.15	1075.80	1084.40		8.73	2.83×10^{-8}	2.45×10^{-3}	0.13
4	30	76.00	82.47	88.80	95.02	101.20	107.35	113.50	119.65			6.24	2.46×10^{-8}	2.12×10^{-3}	0.12
5	20	108.85	114.75	120.20	125.50	130.40	135.30	140.20				5.22	2.63×10^{-8}	2.27×10^{-3}	0.12
												Average	2.91×10^{-8}	2.52×10^{-3}	0.14







Void filling
Lugeon: 0.124
Hydraulic Conductivity: 2.63E-8 m/s
Hydraulic Conductivity: 2.27E-3 m/d

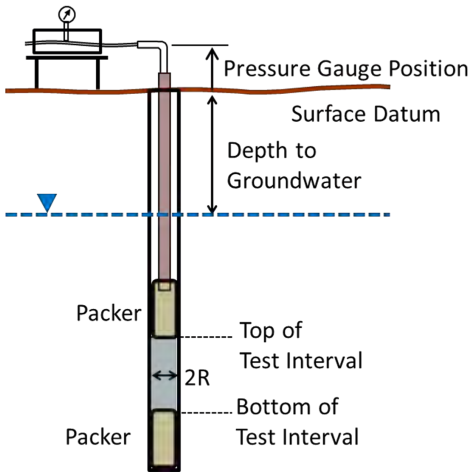
Performed using a single packer test assembly as the borehole was advanced, with the bottom of the test interval bounded by the bottom of the drilled section of the borehole.

~0.25 L/min system losses at 150 psi (during packer inflation); considered negligible in comparison to test flows. Pressure adjustments required during steps 2, 3, and 5. Backflow when decreasing from P3 to P4 to P5, suggesting artesian conditions in the test interval.

Although pressure-flow step profile suggests a Void Filling classification, the arithmetic mean (average) of the hydraulic conductivity (K) values determined for step 1 used to calculate the representative K value for the test interval - K = 3.66E-08 m/s.

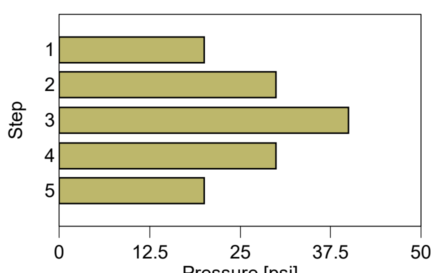
Lugeon Test Analysis Report	
Project:	Valentine Gold Feasibility Geotechnical Investigation
Number:	80047.03
Client:	Terrane Geoscience Inc.

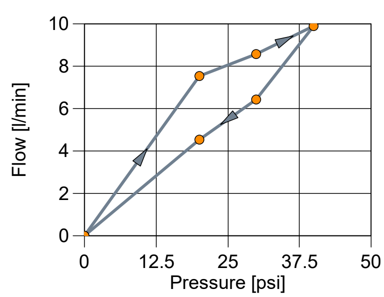
Location: Valentine Lake, NL	Lugeon Test: PT16	Tested bore: VL-GT-20-05
Test Conducted by: Terrane Geoscience Inc.		Test Date: 8/30/2020
Analysis Performed by: C. Anstey-Moore		Analysis Date: 10/26/2020
Lithology:		

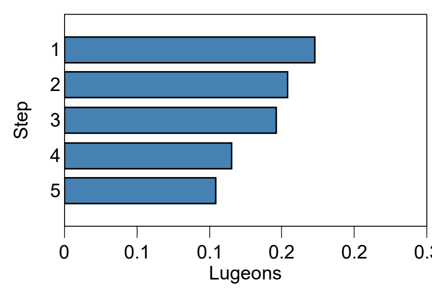


Top of Test Interval: 204.33 m
Bottom of Test Interval: 350.00 m
Length of Test Interval: 145.67 m
Gauge Position: 1.32 m
Depth to Groundwater: 10.10 m
Radius of Test Section: 0.05 m
Dip of bore: 35° from vertical
Vertical Top of Test Interval: 167.38 m
Vertical Bottom of Test Interval: 286.70 m

Step	Pressure [psi]	Flow Meter Readings [l]										Average Flow Rate [l/min]	Hydraulic Conductivity		
		1	2	3	4	5	6	7	8	9	10		[m/s]	[m/d]	Lugeon
1	20	254.70	262.40	270.00	277.60	285.15	292.75	300.17	307.55			7.55	4.30×10^{-8}	3.72×10^{-3}	0.21
2	30	425.20	434.25	442.60	450.99	459.50						8.58	3.83×10^{-8}	3.31×10^{-3}	0.18
3	40	520.85	530.70	540.60	550.50	560.40	570.30					9.89	3.63×10^{-8}	3.14×10^{-3}	0.18
4	30	557.00	563.35	569.65	576.05	582.40	588.90	595.40	601.90	608.40		6.42	2.87×10^{-8}	2.48×10^{-3}	0.14
5	20	606.20	610.50	614.87	619.35	623.80	628.40	633.05	637.75	642.43	647.15	4.55	2.59×10^{-8}	2.24×10^{-3}	0.12
												Average	3.45×10^{-8}	2.98×10^{-3}	0.17







Void filling
Lugeon: 0.125
Hydraulic Conductivity: 2.59E-8 m/s
Hydraulic Conductivity: 2.24E-3 m/d

Performed using a single packer test assembly as the borehole was advanced, with the bottom of the test interval bounded by the bottom of the drilled section of the borehole.

~0.25 L/min system losses at 180 psi (during packer inflation); considered negligible in comparison to test flows. Pressure adjustments required during steps 1, 2, 3, and 5. At the end of the test with value opened measured ~5 - 10 PSI with backflow, suggesting artesian conditions in the test interval.

Although pressure-flow step profile suggests a Void Filling classification, the arithmetic mean (average) of the hydraulic conductivity (K) values determined for all steps used to calculate the representative K value for the test interval - K = 3.45E-8 m/s.

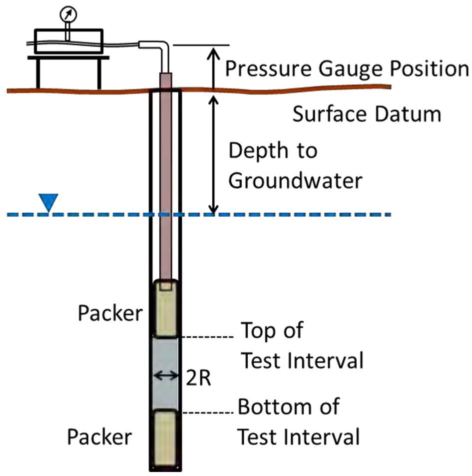
Lugeon Test Analysis Report

Project: Valentine Gold Feasibility Geotechnical Investigation

Number: 80047.03

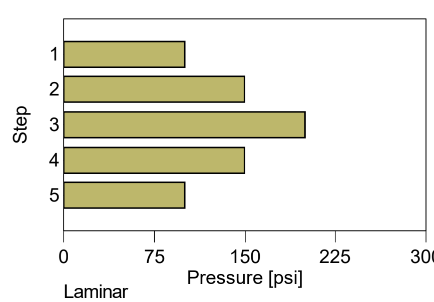
Client: Terrane Geoscience Inc.

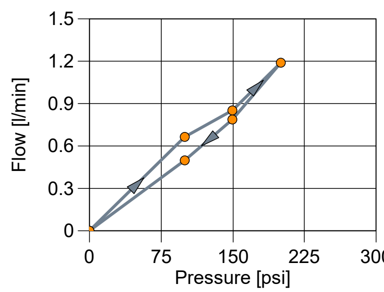
Location: Valentine Lake, NL	Lugeon Test: PT14	Tested bore: VL-GT-20-05
Test Conducted by: Terrane Geoscience Inc.		Test Date: 8/30/2020
Analysis Performed by: C. Anstey-Moore		Analysis Date: 10/26/2020
Lithology:		

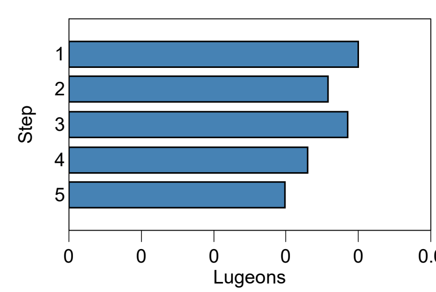


Top of Test Interval: 246.33 m
Bottom of Test Interval: 350.00 m
Length of Test Interval: 103.67 m
Gauge Position: 1.32 m
Depth to Groundwater: 10.10 m
Radius of Test Section: 0.05 m
Dip of bore: 35° from vertical
Vertical Top of Test Interval: 201.78 m
Vertical Bottom of Test Interval: 286.70 m

Step	Pressure [psi]	Flow Meter Readings [l]										Average Flow Rate [l/min]	Hydraulic Conductivity		
		1	2	3	4	5	6	7	8	9	10		[m/s]	[m/d]	Lugeon
1	100	64.11	64.80	65.47	66.12	66.78	67.43					0.66	1.59×10^{-9}	1.37×10^{-4}	0.008
2	150	81.04	81.92	82.79	83.64	84.47	85.30					0.85	1.42×10^{-9}	1.23×10^{-4}	0.007
3	200	95.62	96.86	98.05	99.21	100.36	101.55	102.78	103.98	105.15		1.19	1.53×10^{-9}	1.32×10^{-4}	0.008
4	150	7.68	8.45	9.24	10.03	10.82						0.79	1.31×10^{-9}	1.13×10^{-4}	0.007
5	100	10.00	10.51	11.01	11.50	11.99	12.48					0.50	1.19×10^{-9}	1.02×10^{-4}	0.006
												Average	1.41×10^{-9}	1.22×10^{-4}	0.007







Laminar
Lugeon: 0.007
Hydraulic Conductivity: 1.41E-9 m/s
Hydraulic Conductivity: 1.22E-4 m/d

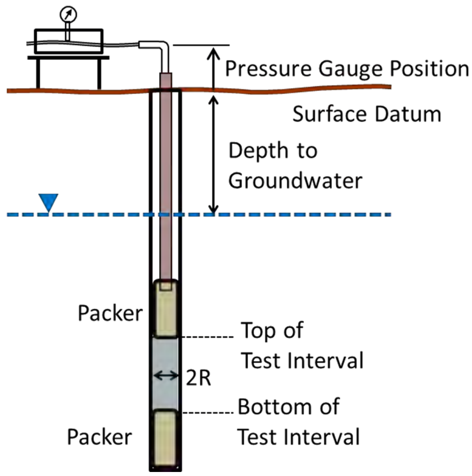
Performed using a single packer test assembly as the borehole was advanced, with the bottom of the test interval bounded by the bottom of the drilled section of the borehole.

~0.16 L/min system losses at 200 psi (during packer inflation); not accounted for in test flow data. Test flows within the same range as leak flows during steps. Potential for enhanced hydraulic conductivity value determined for this test interval. Pressure adjustments required during steps 1, 2, 3, and 4. Pattern of decreasing flow during steps 1, 2 and 3, then increasing flow during steps 4, and 5. Potential artesian pressures affecting step-flow response. Surface gauge pressure readings checked with transducer data.

Hydraulic conductivity value for test interval derived based on flow classification: Laminar (average for all steps).

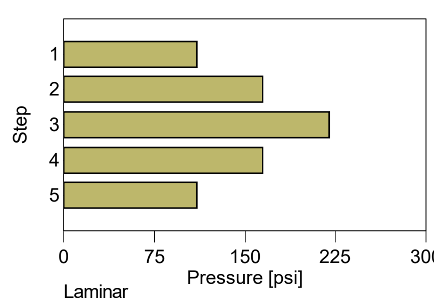
Lugeon Test Analysis Report	
Project:	Valentine Gold Feasibility Geotechnical Investigation
Number:	80047.03
Client:	Terrane Geoscience Inc.

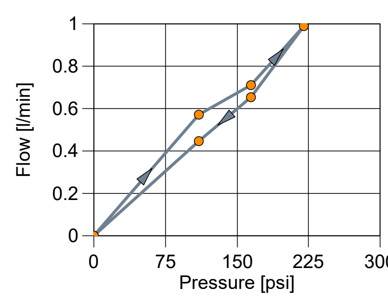
Location: Valentine Lake, NL	Lugeon Test: PT13	Tested bore: VL-GT-20-05
Test Conducted by: Terrane Geoscience Inc.		Test Date: 8/29/2020
Analysis Performed by: C. Anstey-Moore		Analysis Date: 10/26/2020
Lithology:		

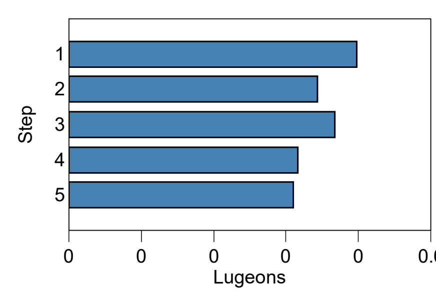


Top of Test Interval: 267.33 m
Bottom of Test Interval: 350.00 m
Length of Test Interval: 82.67 m
Gauge Position: 1.32 m
Depth to Groundwater: 10.10 m
Radius of Test Section: 0.05 m
Dip of bore: 35° from vertical
Vertical Top of Test Interval: 218.98 m
Vertical Bottom of Test Interval: 286.70 m

Step	Pressure [psi]	Flow Meter Readings [l]										Average Flow Rate [l/min]	Hydraulic Conductivity		
		1	2	3	4	5	6	7	8	9	10		[m/s]	[m/d]	Lugeon
1	110	16.30	16.91	17.50	18.09	18.65	19.20	19.76	20.31			0.57	1.53×10^{-9}	1.33×10^{-4}	0.008
2	165	29.54	30.22	30.94	31.66	32.38						0.71	1.32×10^{-9}	1.14×10^{-4}	0.007
3	220	43.33	44.32	45.31	46.30							0.99	1.42×10^{-9}	1.22×10^{-4}	0.007
4	165	45.83	46.46	47.12	47.78	48.44						0.65	1.22×10^{-9}	1.05×10^{-4}	0.006
5	110	46.84	47.26	47.69	48.15	48.61	49.07					0.45	1.19×10^{-9}	1.03×10^{-4}	0.006
												Average	1.34×10^{-9}	1.16×10^{-4}	0.007







Laminar
Lugeon: 0.007
Hydraulic Conductivity: 1.34E-9 m/s
Hydraulic Conductivity: 1.16E-4 m/d

Performed using a single packer test assembly as the borehole was advanced, with the bottom of the test interval bounded by the bottom of the drilled section of the borehole.

~0.05 L/min system losses at 220 psi (during packer inflation); not accounted for in test flow data. Pressure adjustments required during steps 2 and 3. Surface gauge pressure readings checked with transducer data.

Hydraulic conductivity value for test interval derived based on flow classification: Laminar (average for all steps).

GEMTEC
CONSULTING ENGINEERS AND SCIENTISTS

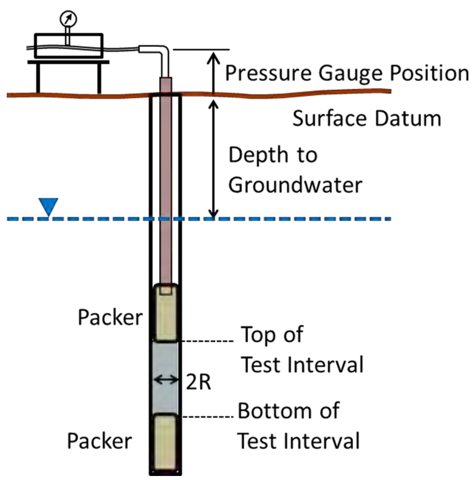
Lugeon Test Analysis Report

Project: Valentine Gold Feasibility Geotechnical Investigation

Number: 80047.03

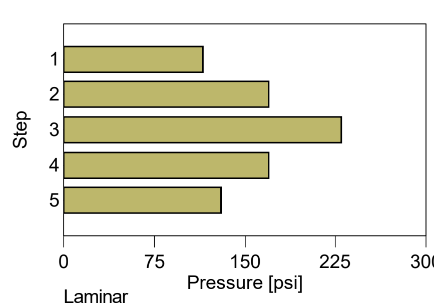
Client: Terrane Geoscience Inc.

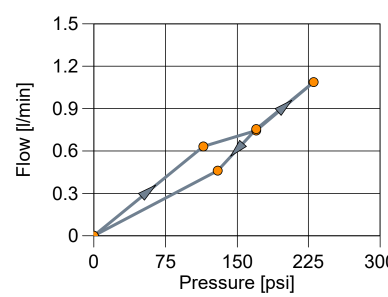
Location: Valentine Lake, NL	Lugeon Test: PT12	Tested bore: VL-GT-20-05
Test Conducted by: Terrane Geoscience Inc.		Test Date: 8/29/2020
Analysis Performed by: C. Anstey-Moore		Analysis Date: 10/26/2020
Lithology:		

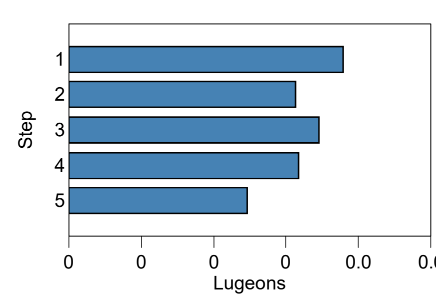


Top of Test Interval: 288.33 m
Bottom of Test Interval: 350.00 m
Length of Test Interval: 61.67 m
Gauge Position: 1.32 m
Depth to Groundwater: 10.10 m
Radius of Test Section: 0.05 m
Dip of bore: 35° from vertical
Vertical Top of Test Interval: 236.19 m
Vertical Bottom of Test Interval: 286.70 m

Step	Pressure [psi]	Flow Meter Readings [l]										Average Flow Rate [l/min]	Hydraulic Conductivity		
		1	2	3	4	5	6	7	8	9	10		[m/s]	[m/d]	Lugeon
1	115	662.42	663.12	663.79	664.43	665.05	665.66	666.26	666.86			0.63	2.10×10^{-9}	1.82×10^{-4}	0.011
2	170	76.06	76.84	77.59	78.33	79.06	79.80	80.53				0.74	1.74×10^{-9}	1.50×10^{-4}	0.009
3	230	693.13	694.22	695.29	696.38	697.47	698.56					1.09	1.92×10^{-9}	1.66×10^{-4}	0.010
4	170	99.36	100.09	100.86	101.62	102.37	103.13	103.89				0.76	1.77×10^{-9}	1.53×10^{-4}	0.010
5	130	1.00	1.46	1.92	2.38							0.46	1.37×10^{-9}	1.18×10^{-4}	0.007
												Average	1.78×10^{-9}	1.54×10^{-4}	0.010







Laminar
Lugeon: 0.010
Hydraulic Conductivity: 1.78E-9 m/s
Hydraulic Conductivity: 1.54E-4 m/d

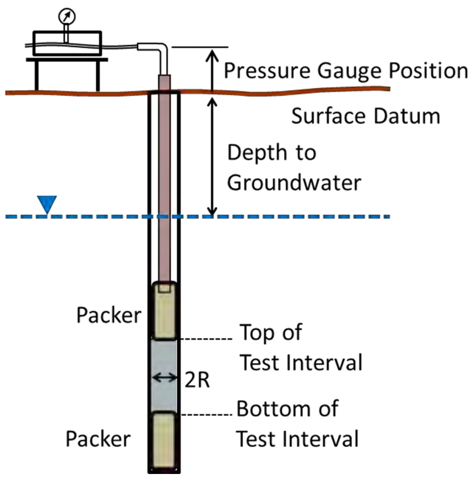
Performed using a single packer test assembly as the borehole was advanced, with the bottom of the test interval bounded by the bottom of the drilled section of the borehole.

No leaks were noticed during packer inflation or testing. Pressure adjustments required during steps 1 and 4.

Hydraulic conductivity value for test interval derived based on flow classification: Laminar (average for all steps).

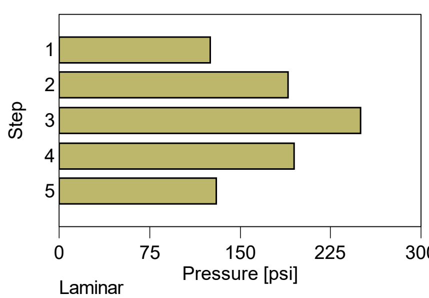
GEMTEC Consulting Engineers and Scientists	**Lugeon Test Analysis Report**
	Project: Valentine Gold Feasibility Geotechnical Investigation
	Number: 80047.03
	Client: Terrane Geoscience Inc.

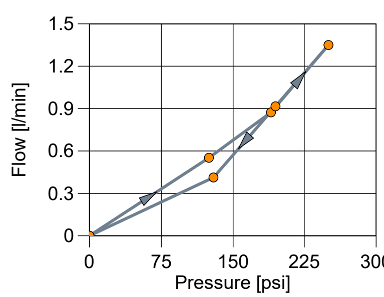
Location: Valentine Lake, NL	Lugeon Test: PT11	Tested bore: VL-GT-20-05
Test Conducted by: Terrane Geoscience Inc.		Test Date: 8/29/2020
Analysis Performed by: C. Anstey-Moore		Analysis Date: 10/26/2020
Lithology:		

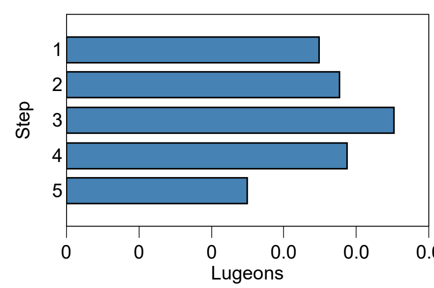


Top of Test Interval: 309.33 m
Bottom of Test Interval: 350.00 m
Length of Test Interval: 40.67 m
Gauge Position: 1.32 m
Depth to Groundwater: 10.10 m
Radius of Test Section: 0.05 m
Dip of bore: 35° from vertical
Vertical Top of Test Interval: 253.39 m
Vertical Bottom of Test Interval: 286.70 m

Step	Pressure [psi]	Flow Meter Readings [l]										Average Flow Rate [l/min]	Hydraulic Conductivity		
		1	2	3	4	5	6	7	8	9	10		[m/s]	[m/d]	Lugeon
1	125	603.13	603.69	604.24	604.79	605.34						0.55	2.43×10^{-9}	2.10×10^{-4}	0.014
2	190	617.67	618.58	619.45	620.29	621.16						0.87	2.63×10^{-9}	2.27×10^{-4}	0.015
3	250	630.00	631.34	632.65	633.92	635.23	636.64	638.10				1.35	3.15×10^{-9}	2.72×10^{-4}	0.018
4	195	643.00	643.95	644.89	645.82	646.74	647.65	648.57	649.46	650.37	651.25	0.92	2.70×10^{-9}	2.33×10^{-4}	0.015
5	130	648.50	648.91	649.32	649.73							0.41	1.74×10^{-9}	1.51×10^{-4}	0.010
												Average	2.53×10^{-9}	2.19×10^{-4}	0.015







Laminar
Lugeon: 0.015
Hydraulic Conductivity: 2.53E-9 m/s
Hydraulic Conductivity: 2.19E-4 m/d

Performed using a single packer test assembly as the borehole was advanced, with the bottom of the test interval bounded by the bottom of the drilled section of the borehole.

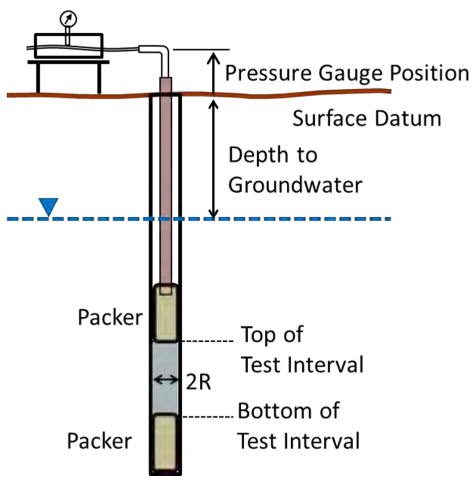
No leaks were noticed during packer inflation or testing. Surface gauge pressure readings checked with transducer data.

Hydraulic conductivity value for test interval derived based on flow classification: Laminar (average for all steps).

Lugeon Test Analysis Report

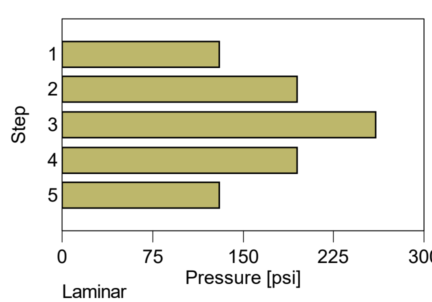
Project:	Valentine Gold Feasibility Geotechnical Investigation
Number:	80047.03
Client:	Terrane Geoscience Inc.

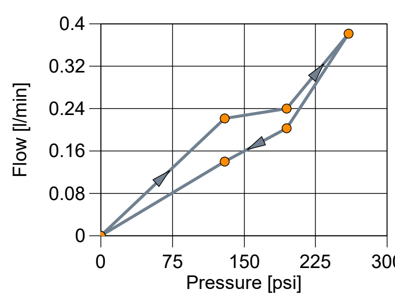
Location: Valentine Lake, NL	Lugeon Test: PT10	Tested bore: VL-GT-20-05
Test Conducted by: Terrane Geoscience Inc.		Test Date: 8/29/2020
Analysis Performed by: C. Anstey-Moore		Analysis Date: 10/26/2020
Lithology:		

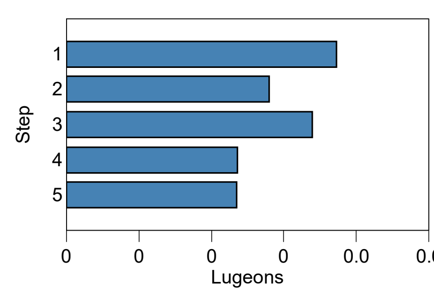


Top of Test Interval: 330.33 m
Bottom of Test Interval: 350.00 m
Length of Test Interval: 19.67 m
Gauge Position: 1.32 m
Depth to Groundwater: 10.10 m
Radius of Test Section: 0.05 m
Dip of bore: 35° from vertical
Vertical Top of Test Interval: 270.59 m
Vertical Bottom of Test Interval: 286.70 m

Step	Pressure [psi]	Flow Meter Readings [l]										Average Flow Rate [l/min]	Hydraulic Conductivity		
		1	2	3	4	5	6	7	8	9	10		[m/s]	[m/d]	Lugeon
1	130	570.70	570.96	571.21	571.45	571.63	571.83	572.03				0.22	1.74×10^{-9}	1.50×10^{-4}	0.011
2	195	572.80	573.11	573.37	573.63	573.87	574.09	574.30	574.51	574.72		0.24	1.30×10^{-9}	1.12×10^{-4}	0.008
3	260	575.40	575.71	576.01	576.89	577.15	577.42	577.69				0.38	1.58×10^{-9}	1.37×10^{-4}	0.010
4	195	577.00	577.21	577.41	577.61	577.81						0.20	1.10×10^{-9}	9.49×10^{-5}	0.007
5	130	577.50	577.64	577.78	577.92							0.14	1.10×10^{-9}	9.48×10^{-5}	0.007
												Average	1.36×10^{-9}	1.18×10^{-4}	0.009







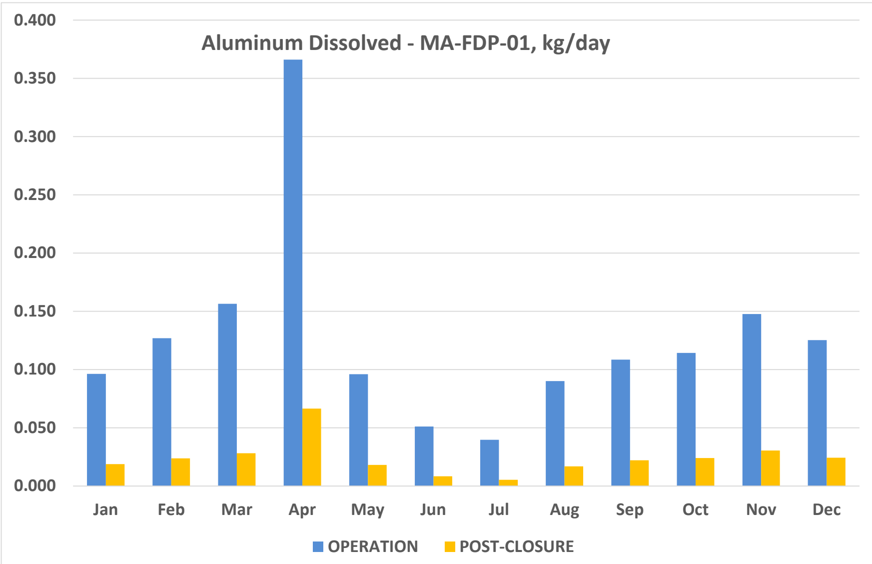
Laminar
Lugeon: 0.009
Hydraulic Conductivity: 1.36E-9 m/s
Hydraulic Conductivity: 1.18E-4 m/d

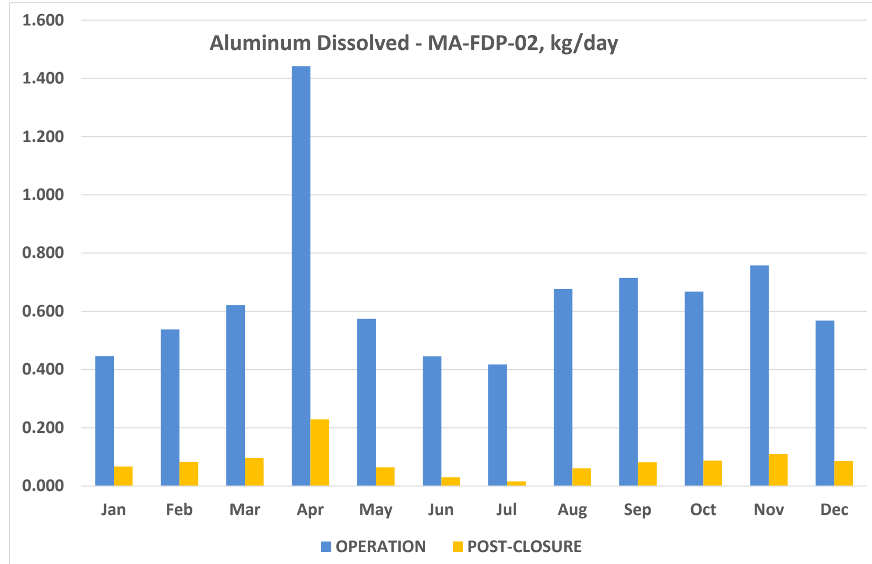
Performed using a single packer test assembly as the borehole was advanced, with the bottom of the test interval bounded by the bottom of the drilled section of the borehole.

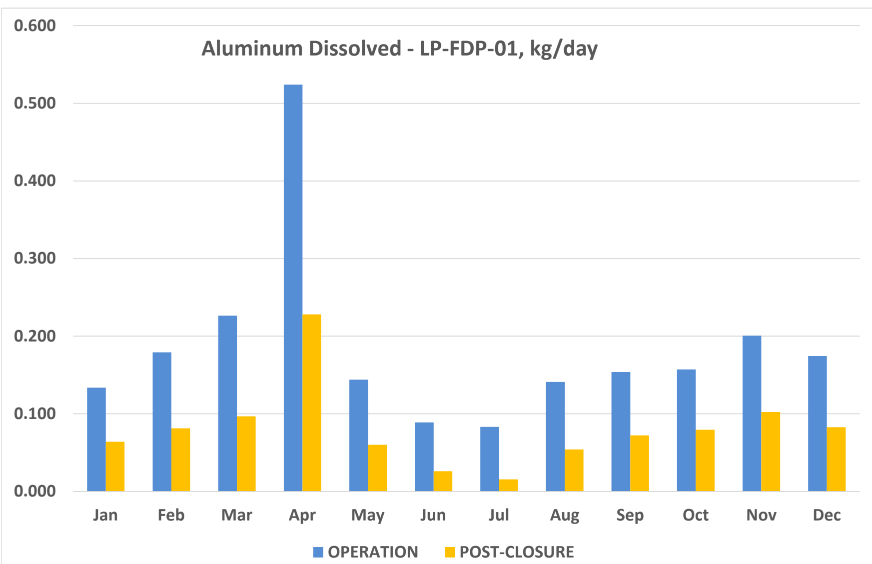
~0.17 L/min system losses at 260 psi (during packer inflation); not accounted for in test flow data. Test flows within the same range as leak flows during steps steps. Potential for enhanced hydraulic conductivity value determined for this test interval.

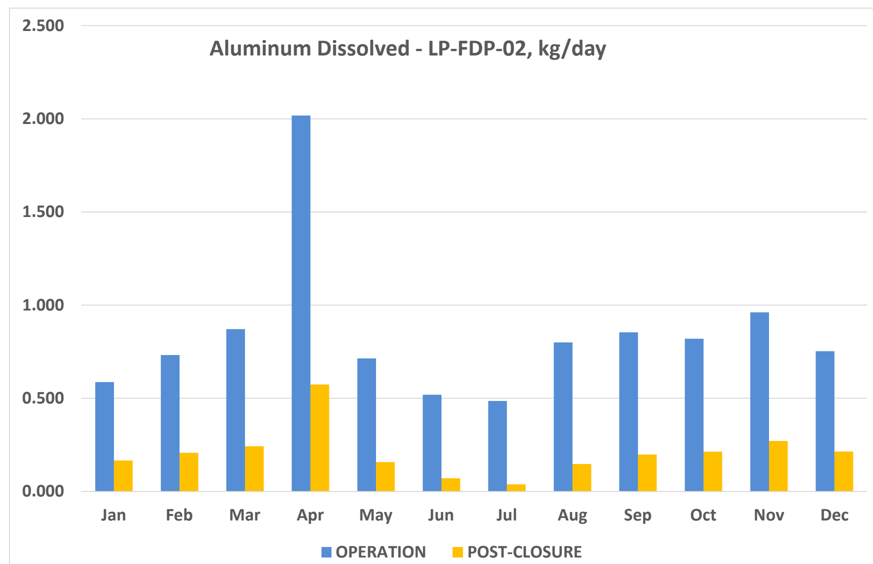
Irregular, non-linear pressure-flow profile. The arithmetic mean (average) of the hydraulic conductivity (K) values determined for all steps used to calculate the representative K value for the test interval - K = 1.36E-9 m/s.

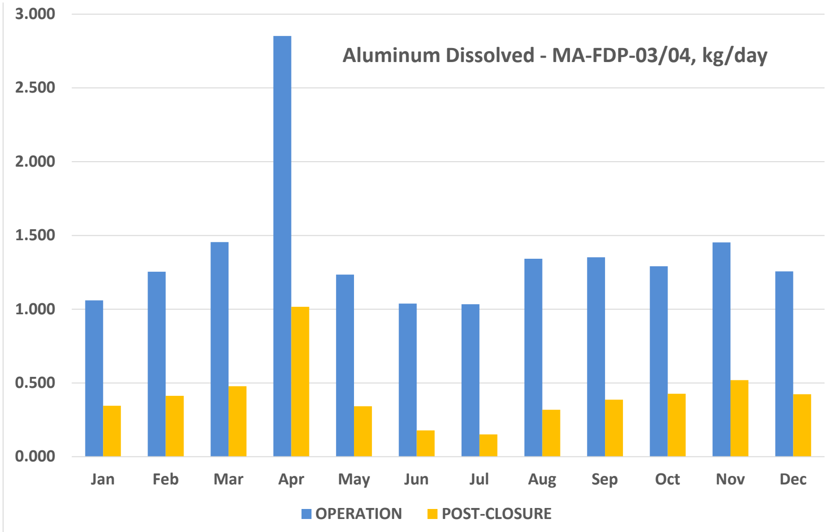
APPENDIX IR-41.A
DISSOLVED LOADING


Aluminum Dissolved - MA-FDP-01, kg/day
0.400
0.350
0.300
0.250
0.200
0.150
0.100
0.050
0.000
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
OPERATION POST-CLOSURE

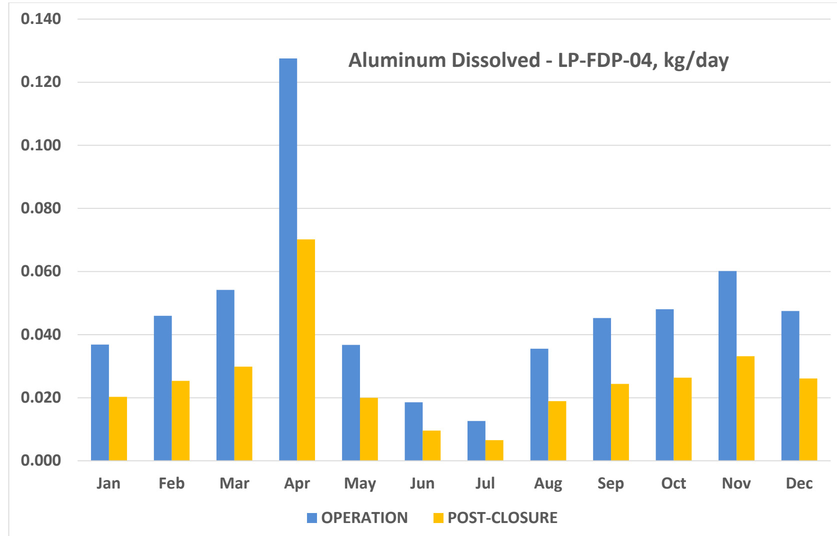

Aluminum Dissolved - MA-FDP-02, kg/day
1.600
1.400
1.200
1.000
0.800
0.600
0.400
0.200
0.000
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
OPERATION POST-CLOSURE


Aluminum Dissolved - LP-FDP-01, kg/day
0.600
0.500
0.400
0.300
0.200
0.100
0.000
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
OPERATION POST-CLOSURE

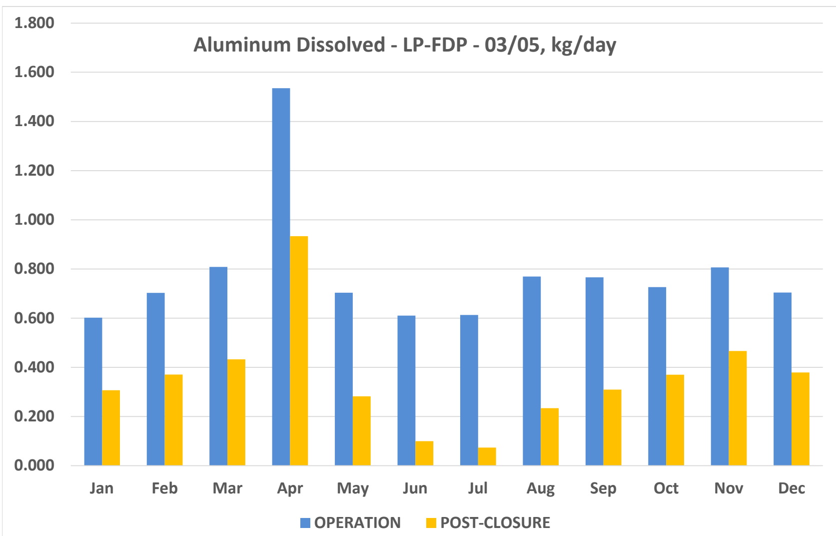

Aluminum Dissolved - LP-FDP-02, kg/day
2.500
2.000
1.500
1.000
0.500
0.000
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
OPERATION POST-CLOSURE



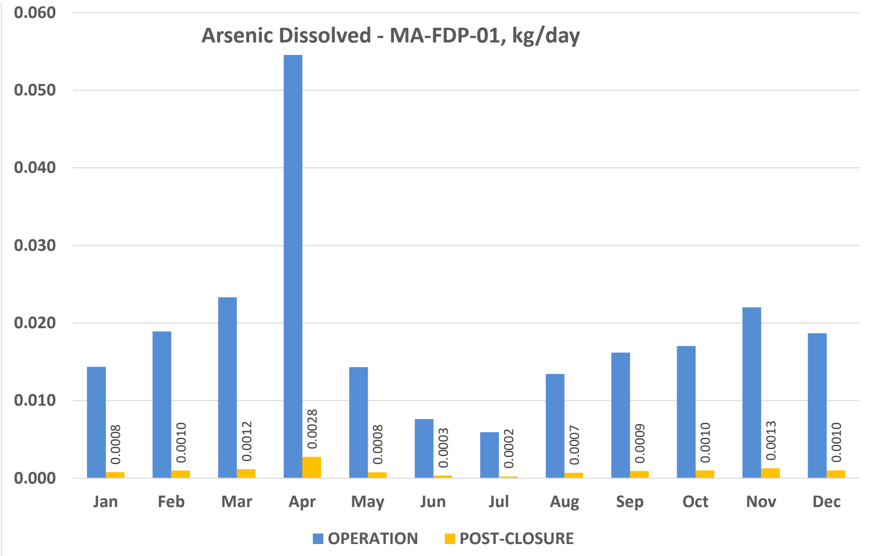
Aluminum Dissolved - MA-FDP-03/04, kg/day
3.000
2.500
2.000
1.500
1.000
0.500
0.000
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
OPERATION
POST-CLOSURE

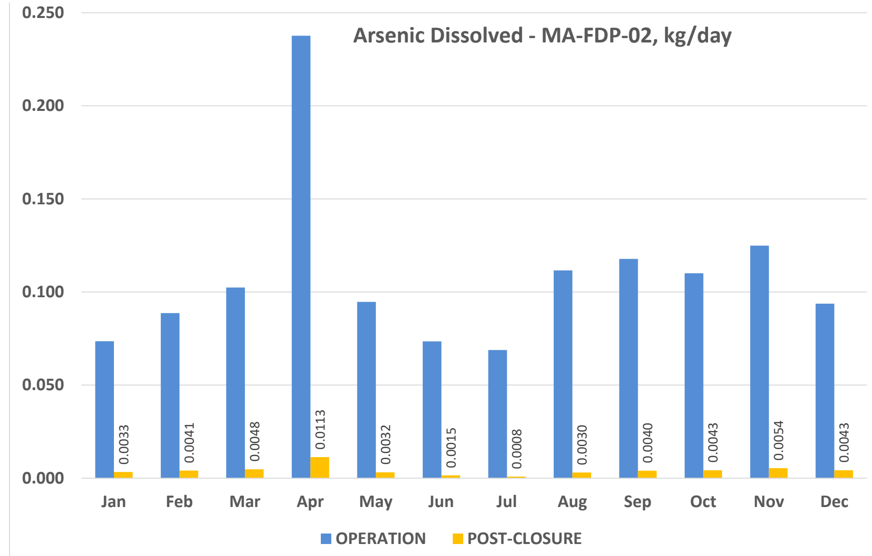


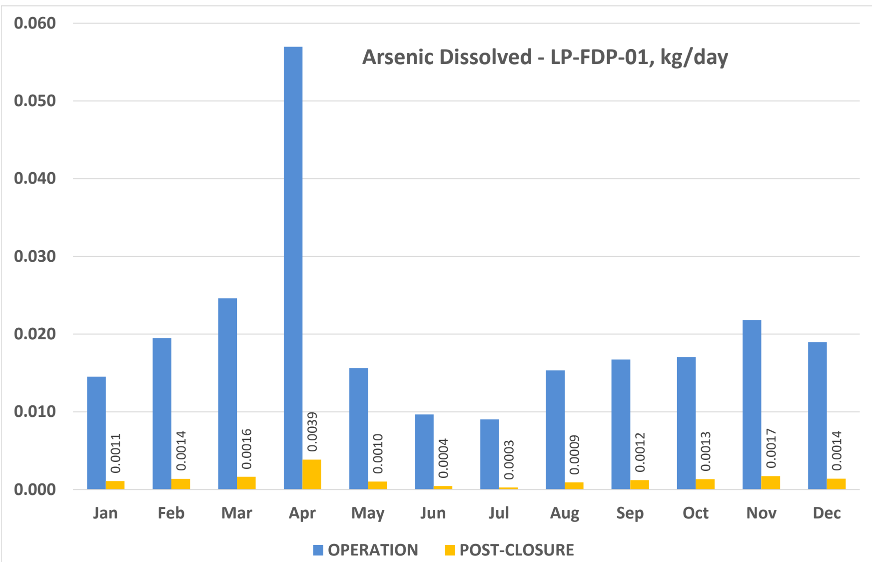
Aluminum Dissolved - LP-FDP-04, kg/day
0.140
0.120
0.100
0.080
0.060
0.040
0.020
0.000
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
OPERATION
POST-CLOSURE

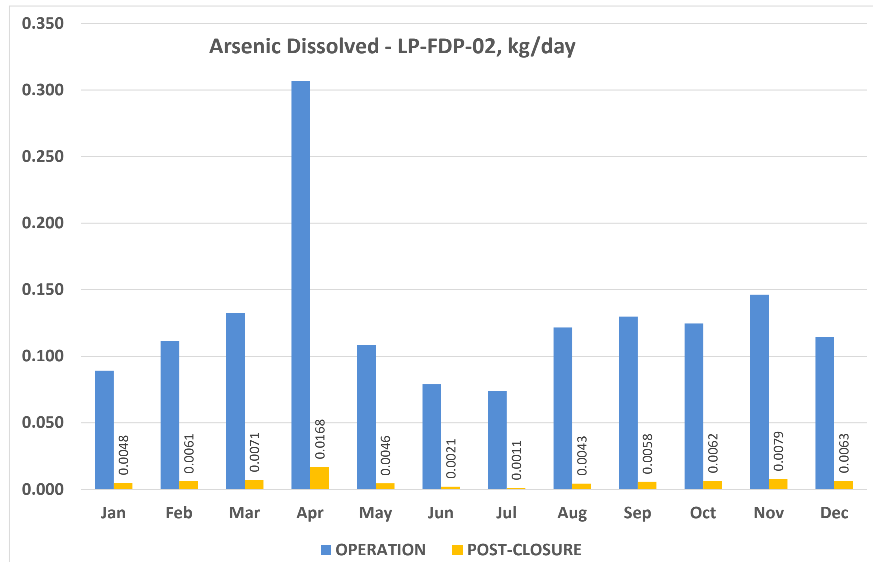


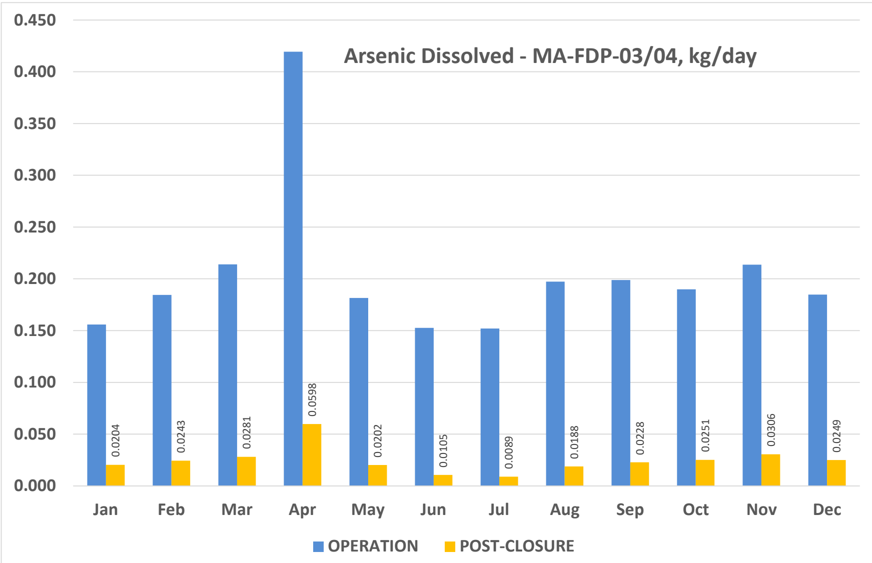
Aluminum Dissolved - LP-FDP - 03/05, kg/day
1.800
1.600
1.400
1.200
1.000
0.800
0.600
0.400
0.200
0.000
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
OPERATION
POST-CLOSURE

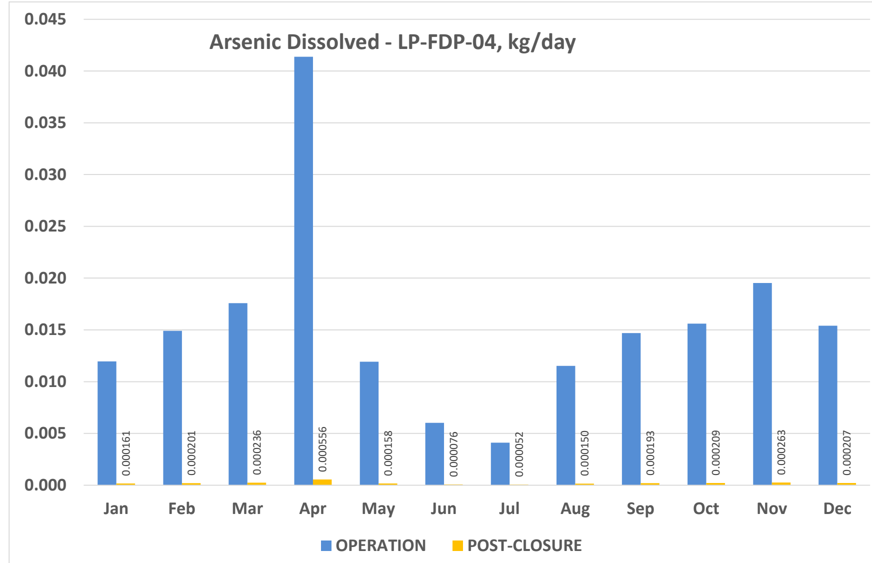

Arsenic Dissolved - MA-FDP-01, kg/day
0.060
0.050
0.040
0.030
0.020
0.010
0.000
0.0008
0.0010
0.0012
0.0028
0.0008
0.0003
0.0002
0.0007
0.0009
0.0010
0.0013
0.0010
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
OPERATION
POST-CLOSURE

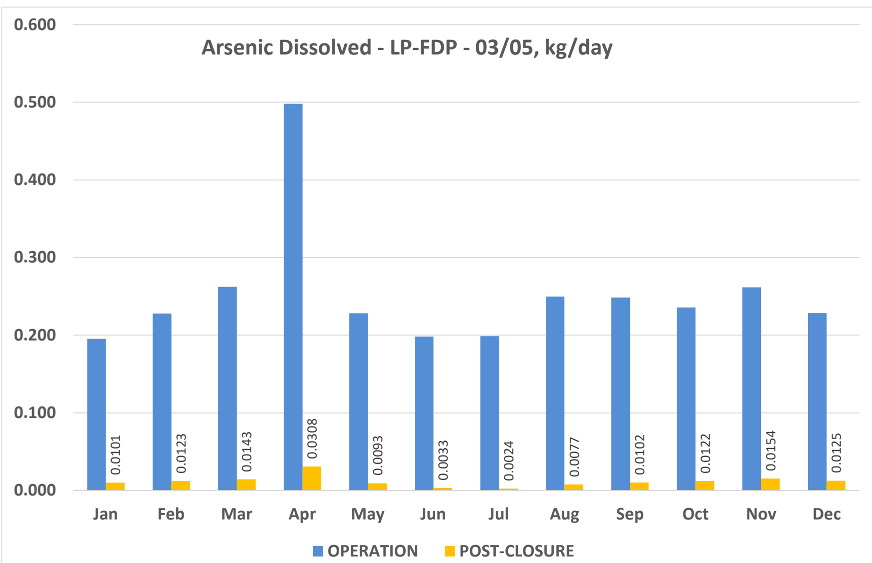

Arsenic Dissolved - MA-FDP-02, kg/day
0.250
0.200
0.150
0.100
0.050
0.000
0.0033
0.0041
0.0048
0.0113
0.0032
0.0015
0.0008
0.0030
0.0040
0.0043
0.0054
0.0043
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
OPERATION
POST-CLOSURE

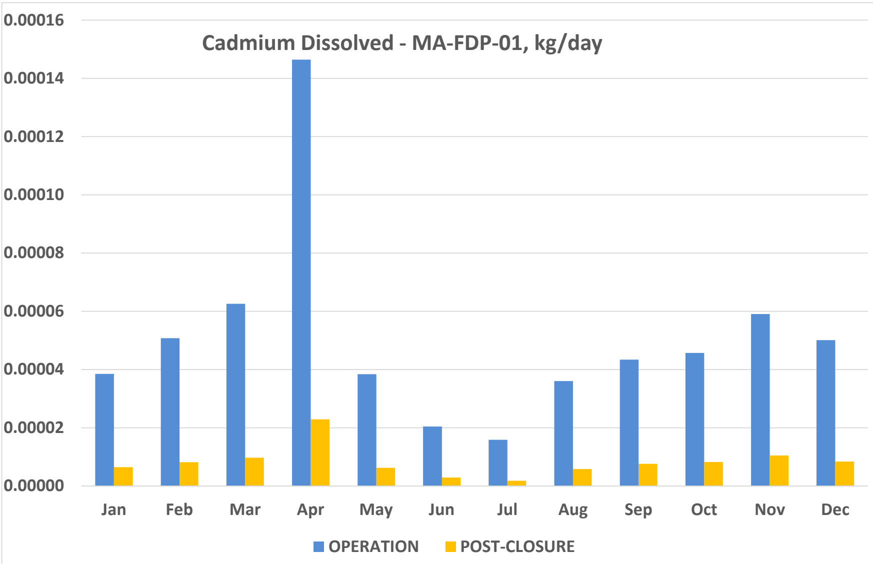

Arsenic Dissolved - LP-FDP-01, kg/day
0.060
0.050
0.040
0.030
0.020
0.010
0.000
0.0011
0.0014
0.0016
0.0039
0.0010
0.0004
0.0003
0.0009
0.0012
0.0013
0.0017
0.0014
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
OPERATION
POST-CLOSURE


Arsenic Dissolved - LP-FDP-02, kg/day
0.350
0.300
0.250
0.200
0.150
0.100
0.050
0.000
0.0048
0.0061
0.0071
0.0168
0.0046
0.0021
0.0011
0.0043
0.0058
0.0062
0.0079
0.0063
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
OPERATION
POST-CLOSURE

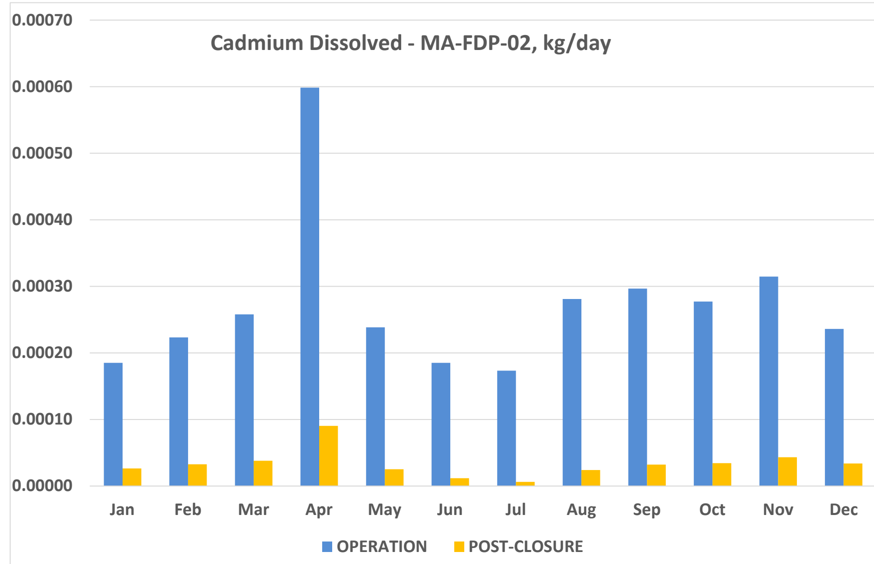

Arsenic Dissolved - MA-FDP-03/04, kg/day
0.450
0.400
0.350
0.300
0.250
0.200
0.150
0.100
0.050
0.000
0.0204
0.0243
0.0281
0.0598
0.0202
0.0105
0.0089
0.0188
0.0228
0.0251
0.0306
0.0249
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
OPERATION
POST-CLOSURE


Arsenic Dissolved - LP-FDP-04, kg/day
0.045
0.040
0.035
0.030
0.025
0.020
0.015
0.010
0.005
0.000
0.000161
0.000201
0.000236
0.000556
0.000158
0.000076
0.000052
0.000150
0.000193
0.000209
0.000263
0.000207
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
OPERATION
POST-CLOSURE

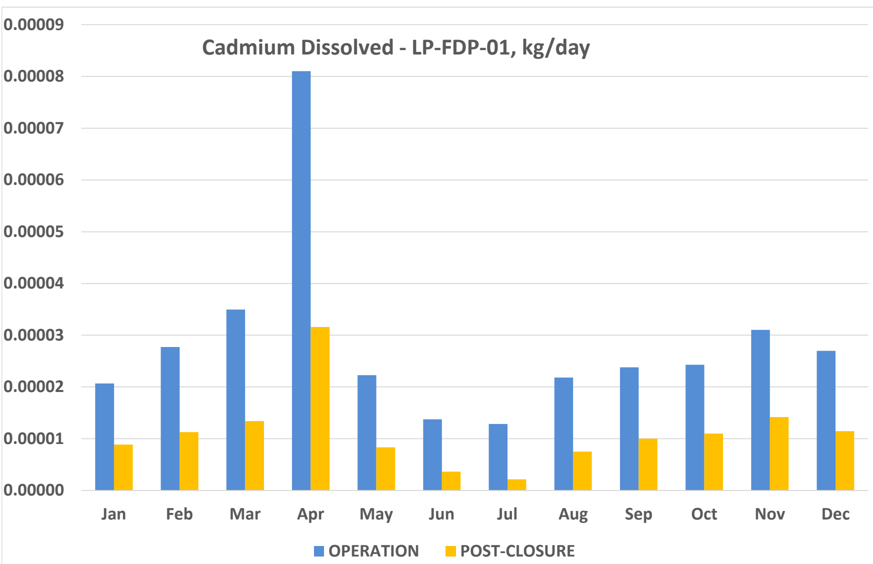

Arsenic Dissolved - LP-FDP - 03/05, kg/day
0.600
0.500
0.400
0.300
0.200
0.100
0.000
0.0101
0.0123
0.0143
0.0308
0.0093
0.0033
0.0024
0.0077
0.0102
0.0122
0.0154
0.0125
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
OPERATION
POST-CLOSURE



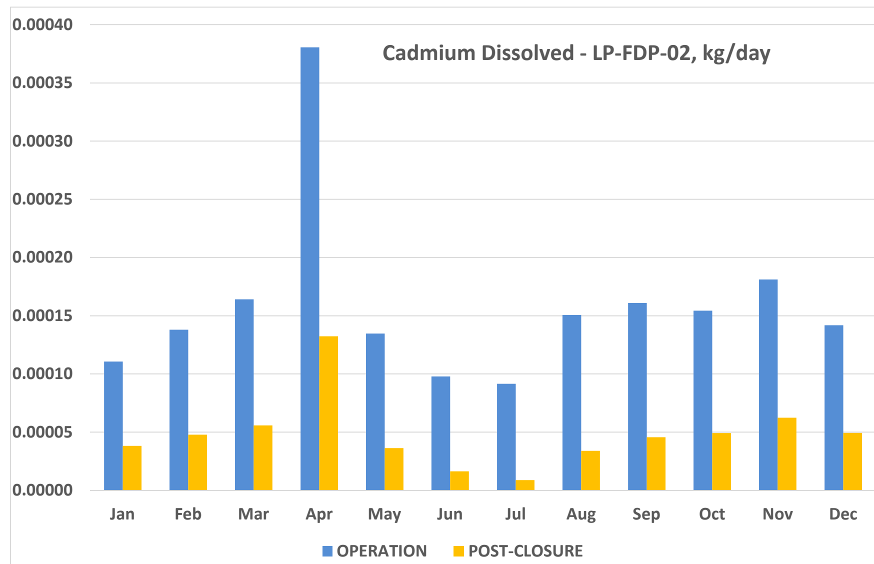
Cadmium Dissolved - MA-FDP-01, kg/day
0.00016
0.00014
0.00012
0.00010
0.00008
0.00006
0.00004
0.00002
0.00000
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
OPERATION
POST-CLOSURE



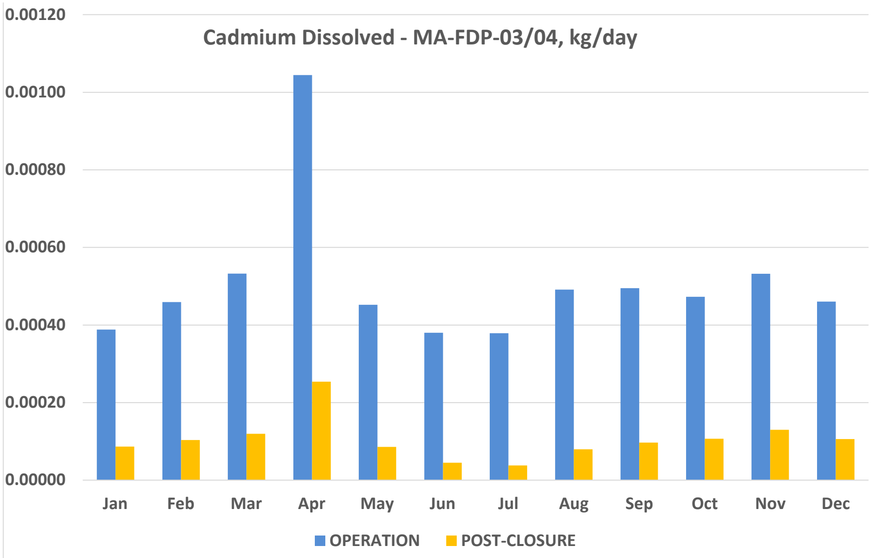
Cadmium Dissolved - MA-FDP-02, kg/day
0.00070
0.00060
0.00050
0.00040
0.00030
0.00020
0.00010
0.00000
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
OPERATION
POST-CLOSURE



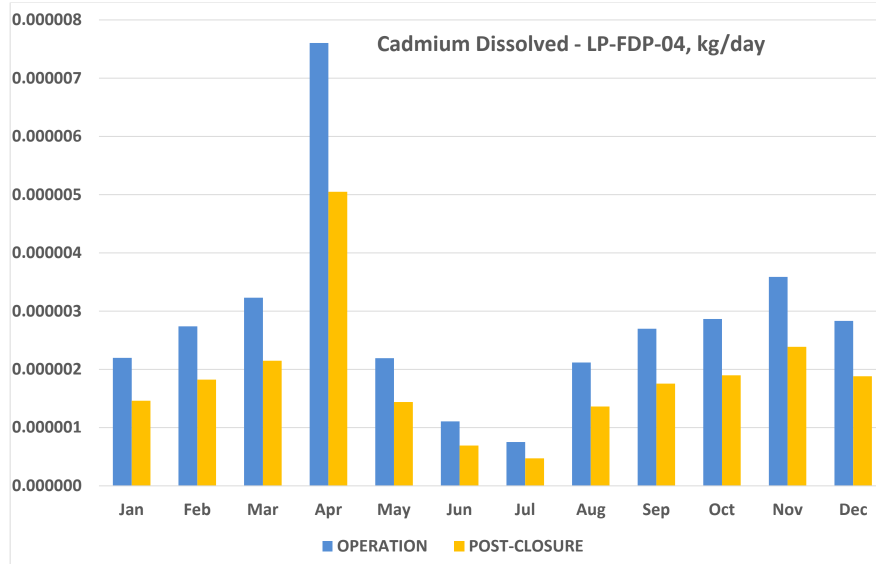
Cadmium Dissolved - LP-FDP-01, kg/day
0.00009
0.00008
0.00007
0.00006
0.00005
0.00004
0.00003
0.00002
0.00001
0.00000
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
OPERATION
POST-CLOSURE



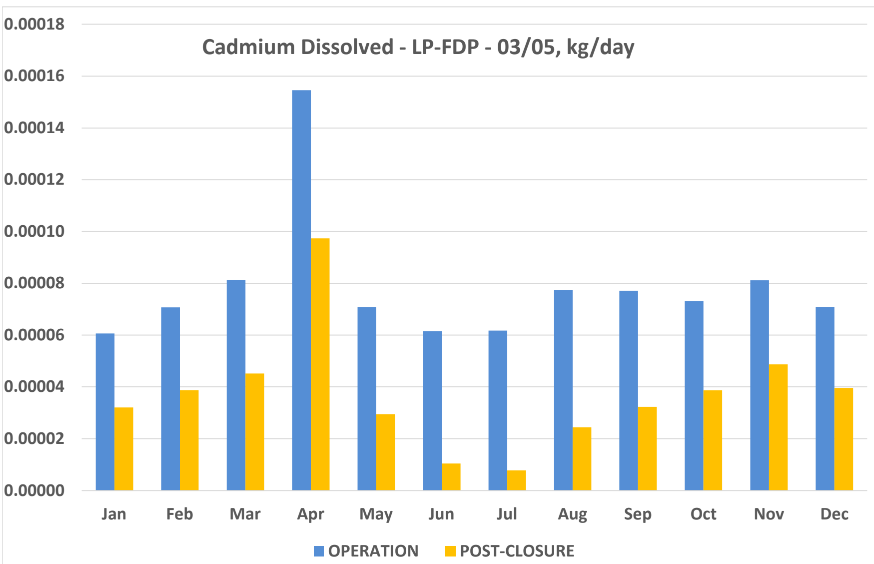
Cadmium Dissolved - LP-FDP-02, kg/day
0.00040
0.00035
0.00030
0.00025
0.00020
0.00015
0.00010
0.00005
0.00000
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
OPERATION
POST-CLOSURE



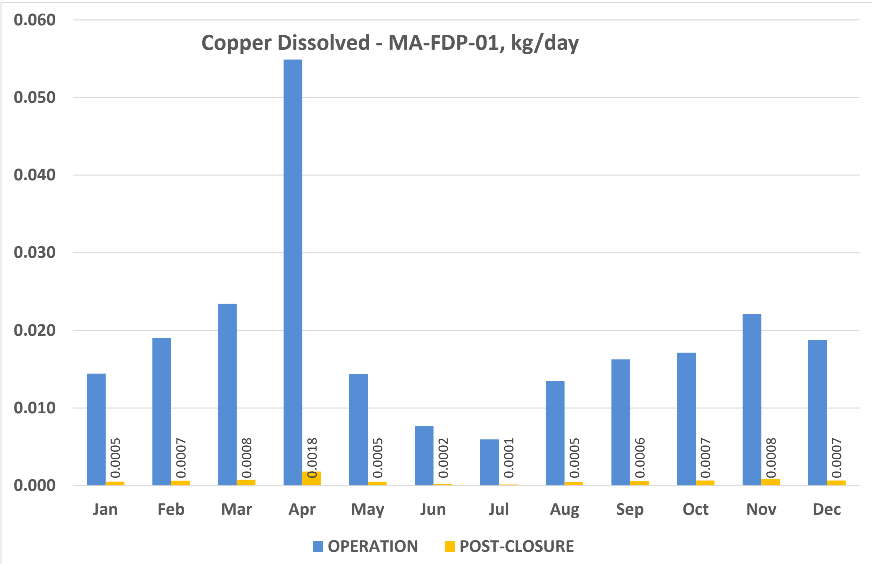
Cadmium Dissolved - MA-FDP-03/04, kg/day
0.00120
0.00100
0.00080
0.00060
0.00040
0.00020
0.00000
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
OPERATION
POST-CLOSURE



Cadmium Dissolved - LP-FDP-04, kg/day
0.000008
0.000007
0.000006
0.000005
0.000004
0.000003
0.000002
0.000001
0.000000
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
OPERATION
POST-CLOSURE



Cadmium Dissolved - LP-FDP - 03/05, kg/day
0.00018
0.00016
0.00014
0.00012
0.00010
0.00008
0.00006
0.00004
0.00002
0.00000
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
OPERATION
POST-CLOSURE


Copper Dissolved - MA-FDP-01, kg/day
0.060
0.050
0.040
0.030
0.020
0.010
0.000
0.0005
0.0007
0.0008
0.0018
0.0005
0.0002
0.0001
0.0005
0.0006
0.0007
0.0008
0.0007
Jan
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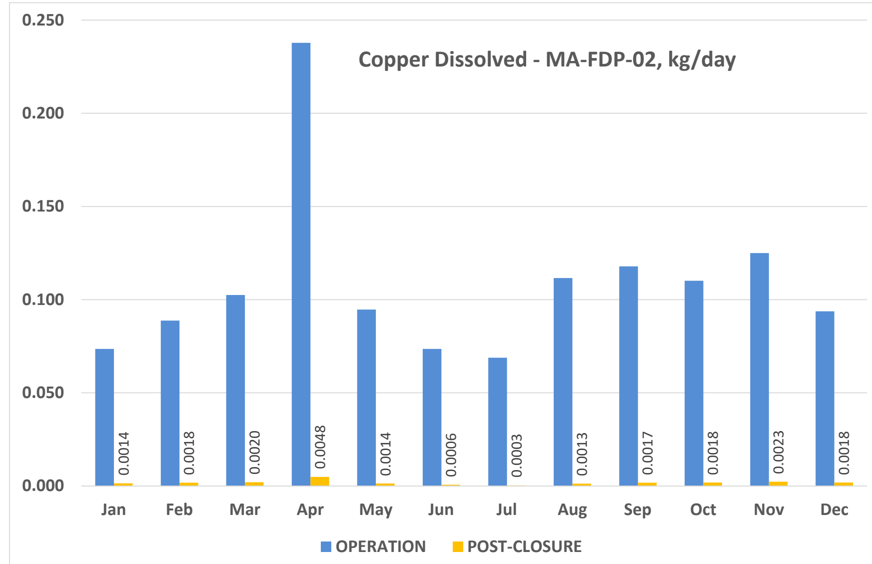
Dec
OPERATION
POST-CLOSURE


Copper Dissolved - MA-FDP-02, kg/day
0.250
0.200
0.150
0.100
0.050
0.000
0.0014
0.0018
0.0020
0.0048
0.0014
0.0006
0.0003
0.0013
0.0017
0.0018
0.0023
0.0018
Jan
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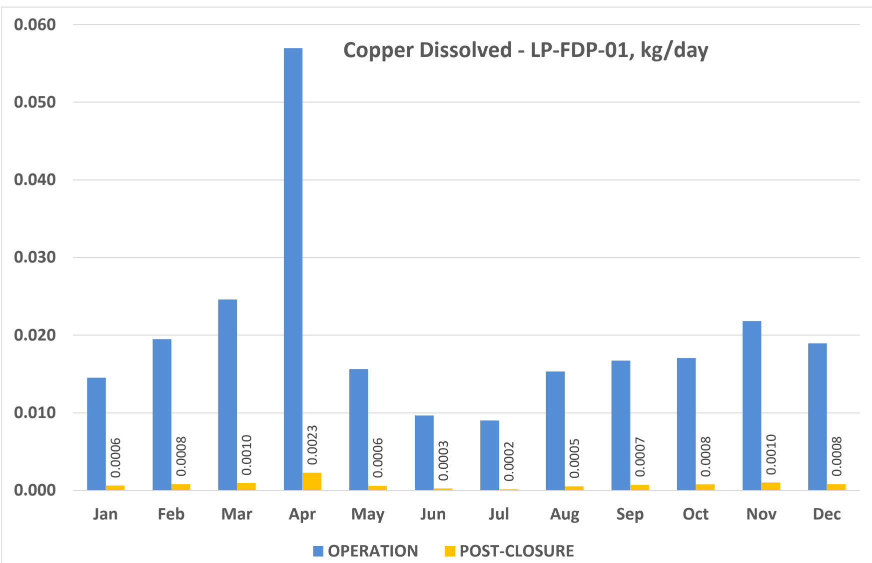
Dec
OPERATION
POST-CLOSURE


Copper Dissolved - LP-FDP-01, kg/day
0.060
0.050
0.040
0.030
0.020
0.010
0.000
0.0006
0.0008
0.0010
0.0023
0.0006
0.0003
0.0002
0.0005
0.0007
0.0008
0.0010
0.0008
Jan
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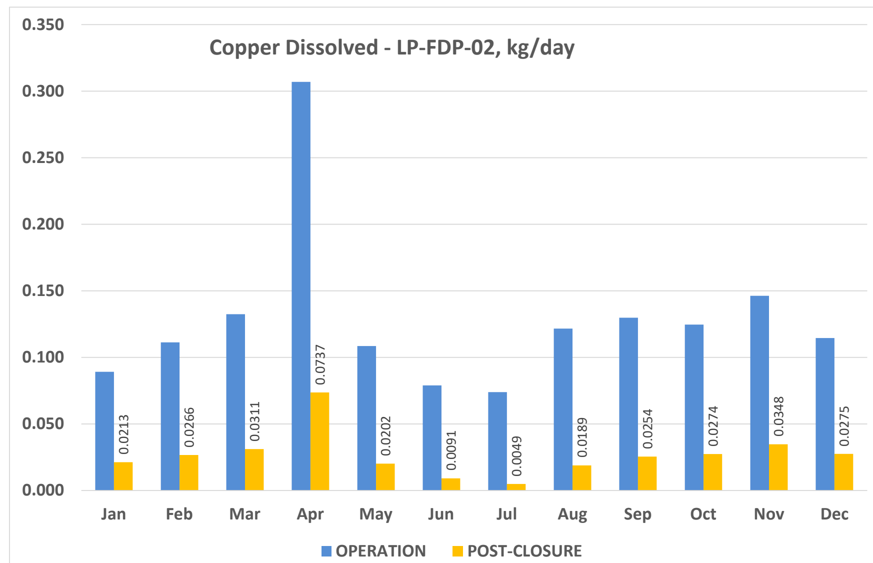
Nov
Dec
OPERATION
POST-CLOSURE


Copper Dissolved - LP-FDP-02, kg/day
0.350
0.300
0.250
0.200
0.150
0.100
0.050
0.000
0.0213
0.0266
0.0311
0.0737
0.0202
0.0091
0.0049
0.0189
0.0254
0.0274
0.0348
0.0275
Jan
Feb
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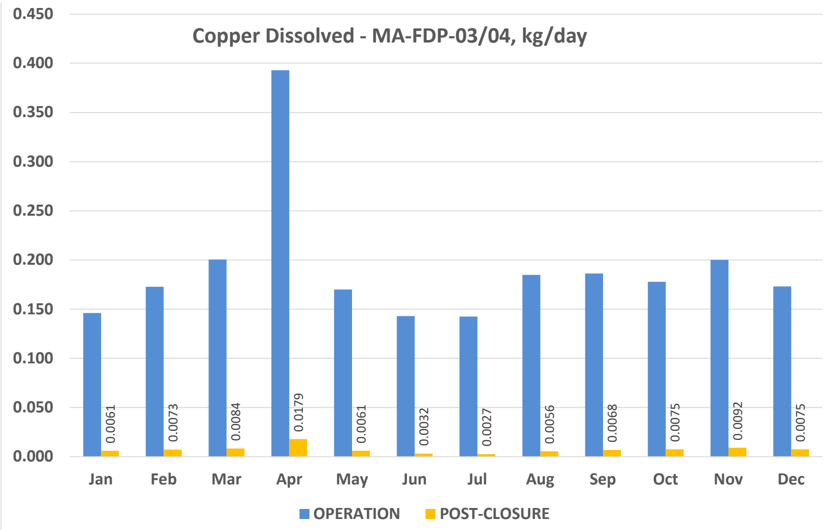
Dec
OPERATION
POST-CLOSURE


Copper Dissolved - MA-FDP-03/04, kg/day
0.450
0.400
0.350
0.300
0.250
0.200
0.150
0.100
0.050
0.000
0.0061
0.0073
0.0084
0.0179
0.0061
0.0032
0.0027
0.0056
0.0068
0.0075
0.0092
0.0075
Jan
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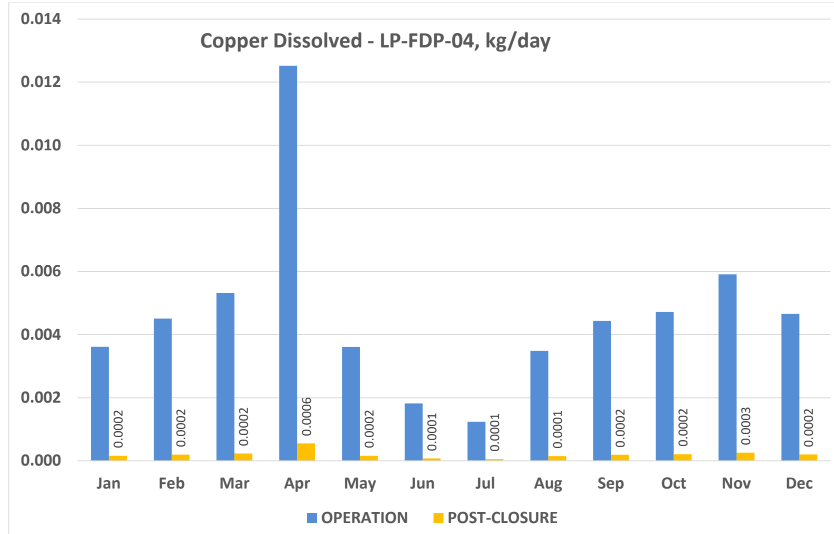
Nov
Dec
OPERATION
POST-CLOSURE


Copper Dissolved - LP-FDP-04, kg/day
0.014
0.012
0.010
0.008
0.006
0.004
0.002
0.000
0.0002
0.0002
0.0002
0.0006
0.0002
0.0001
0.0001
0.0001
0.0002
0.0002
0.0003
0.0002
Jan
Feb
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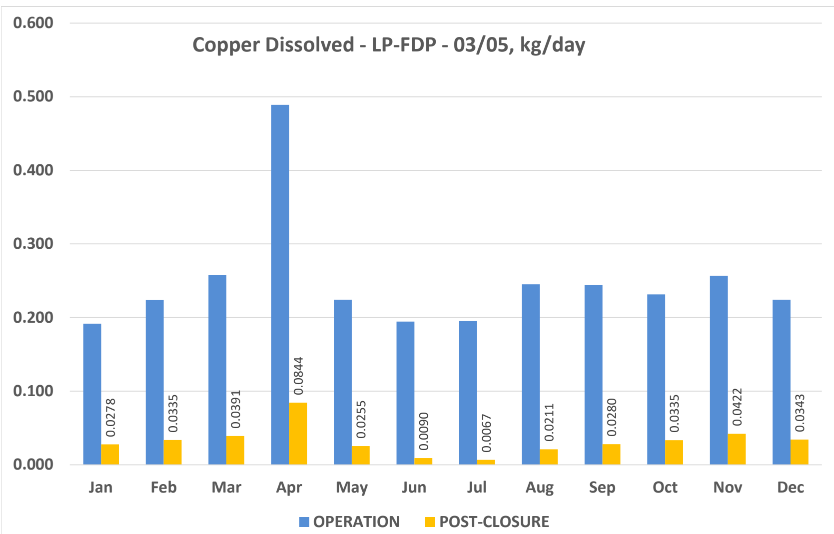
Nov
Dec
OPERATION
POST-CLOSURE


Copper Dissolved - LP-FDP - 03/05, kg/day
0.600
0.500
0.400
0.300
0.200
0.100
0.000
0.0278
0.0335
0.0391
0.0844
0.0255
0.0090
0.0067
0.0211
0.0280
0.0335
0.0422
0.0343
Jan
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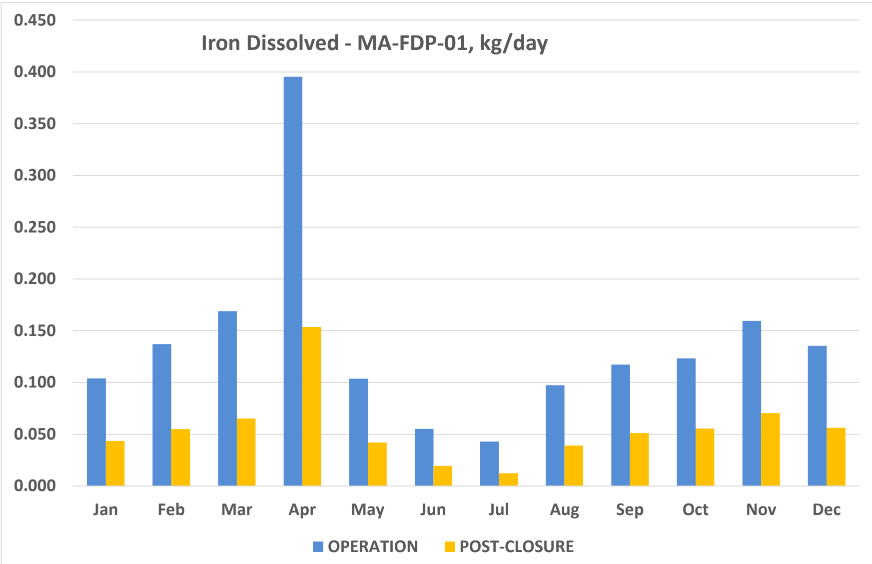
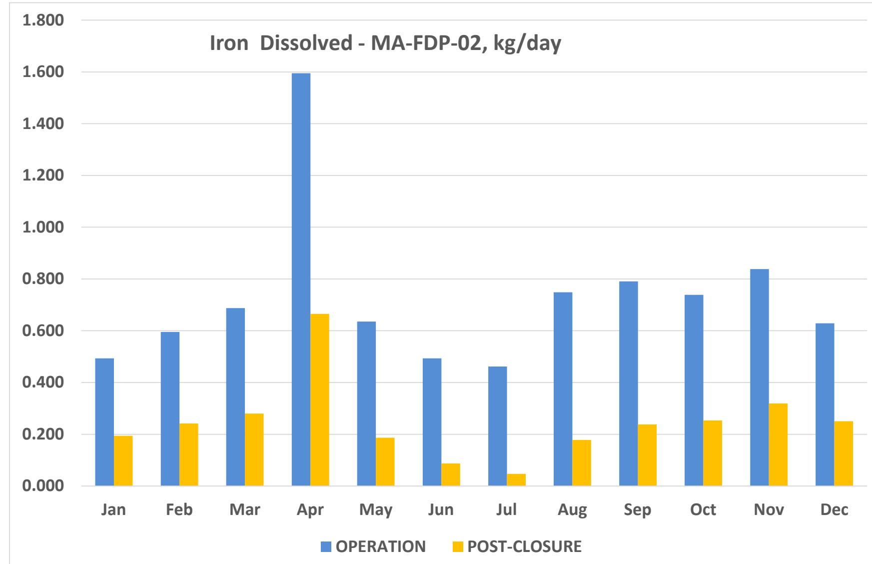
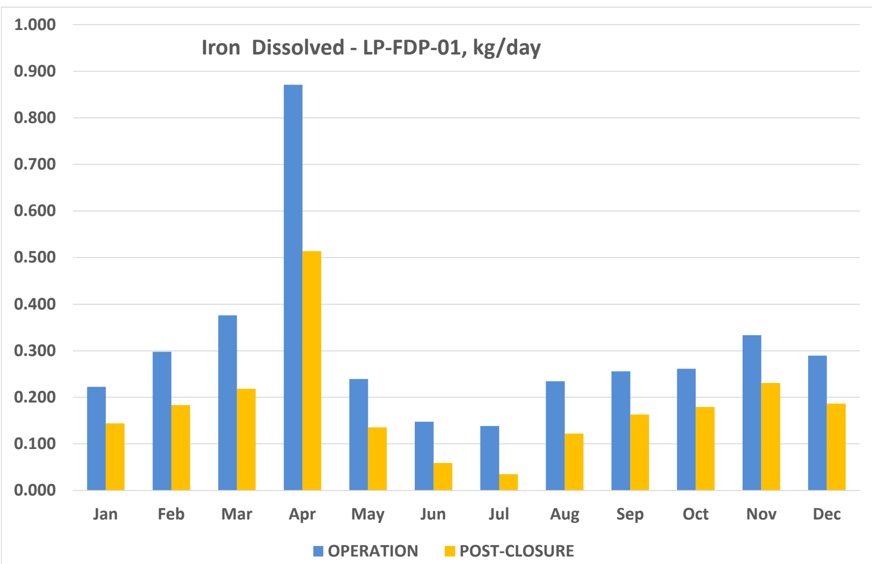
Oct
Nov
Dec
OPERATION
POST-CLOSURE



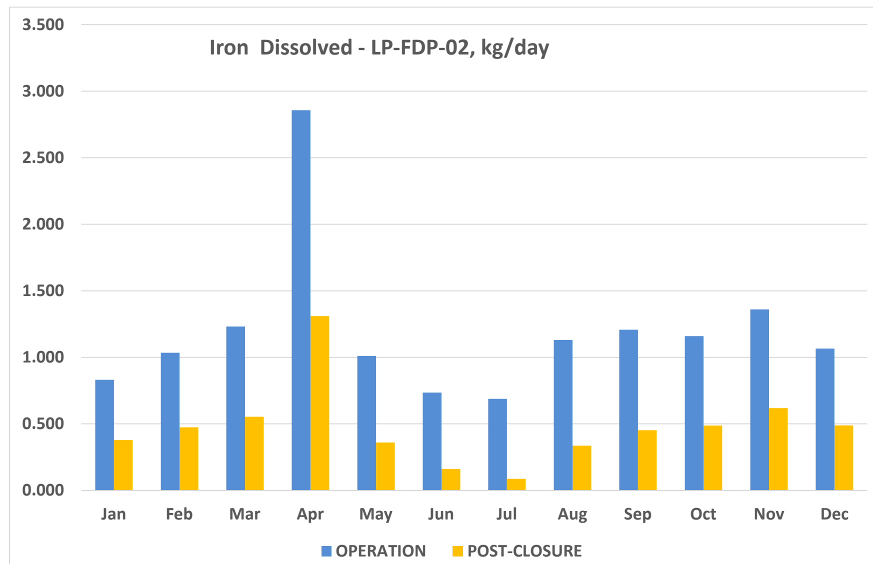
Iron Dissolved - MA-FDP-01, kg/day
0.450
0.400
0.350
0.300
0.250
0.200
0.150
0.100
0.050
0.000
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
OPERATION
POST-CLOSURE



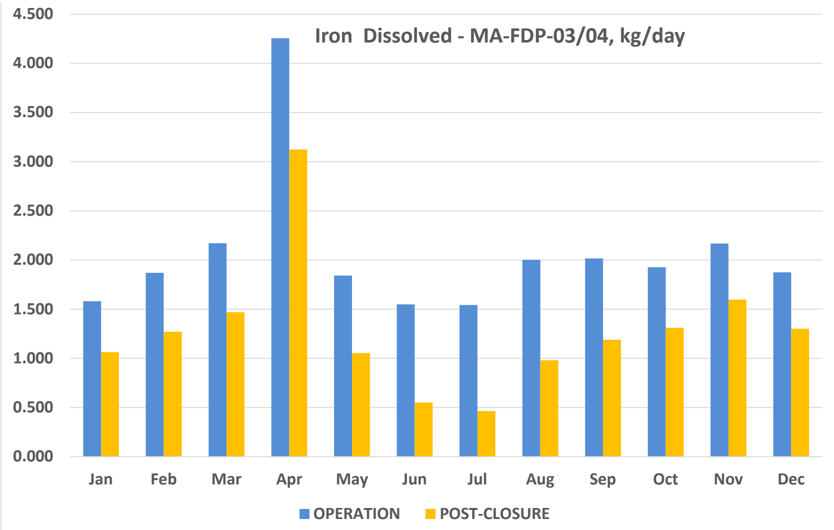
Iron Dissolved - MA-FDP-02, kg/day
1.800
1.600
1.400
1.200
1.000
0.800
0.600
0.400
0.200
0.000
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
OPERATION
POST-CLOSURE



Iron Dissolved - LP-FDP-01, kg/day
1.000
0.900
0.800
0.700
0.600
0.500
0.400
0.300
0.200
0.100
0.000
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
OPERATION
POST-CLOSURE



Iron Dissolved - LP-FDP-02, kg/day
3.500
3.000
2.500
2.000
1.500
1.000
0.500
0.000
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
OPERATION
POST-CLOSURE


Iron Dissolved - MA-FDP-03/04, kg/day
4.500
4.000
3.500
3.000
2.500
2.000
1.500
1.000
0.500
0.000
Jan
Feb
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May
Jun
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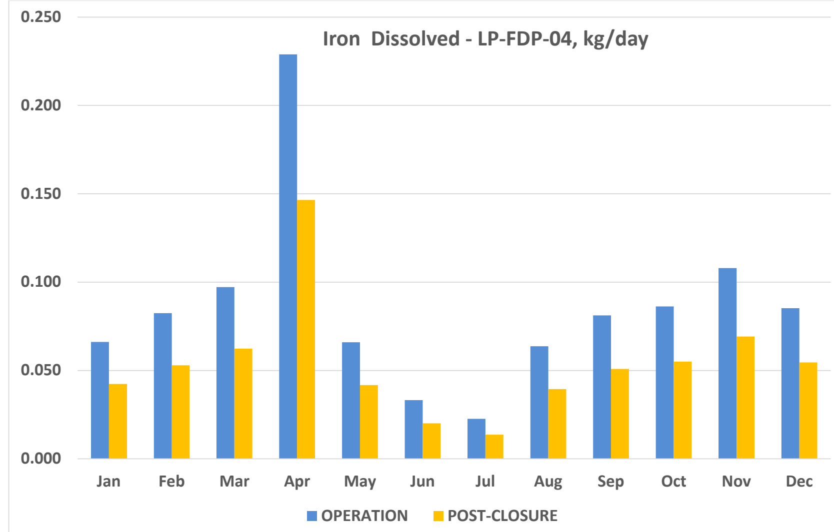
Sep
Oct
Nov
Dec
OPERATION
POST-CLOSURE


Iron Dissolved - LP-FDP-04, kg/day
0.250
0.200
0.150
0.100
0.050
0.000
Jan
Feb
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May
Jun
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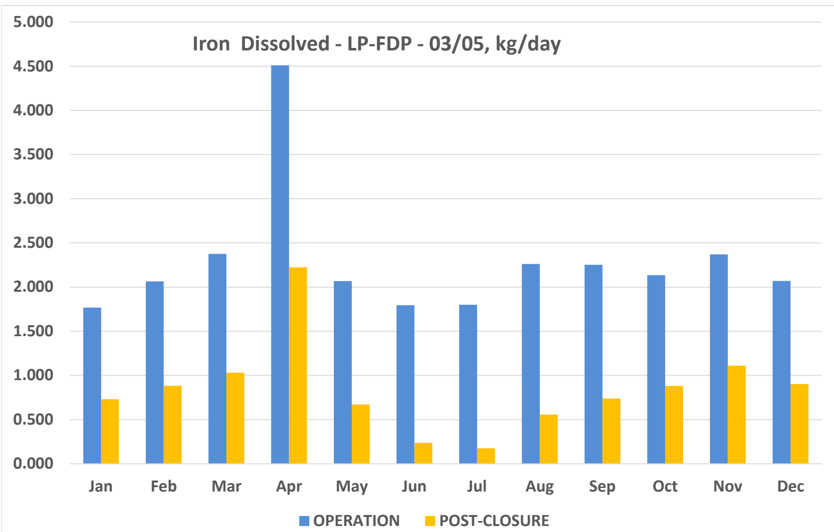
Oct
Nov
Dec
OPERATION
POST-CLOSURE


Iron Dissolved - LP-FDP - 03/05, kg/day
5.000
4.500
4.000
3.500
3.000
2.500
2.000
1.500
1.000
0.500
0.000
Jan
Feb
Mar
Apr
May
Jun
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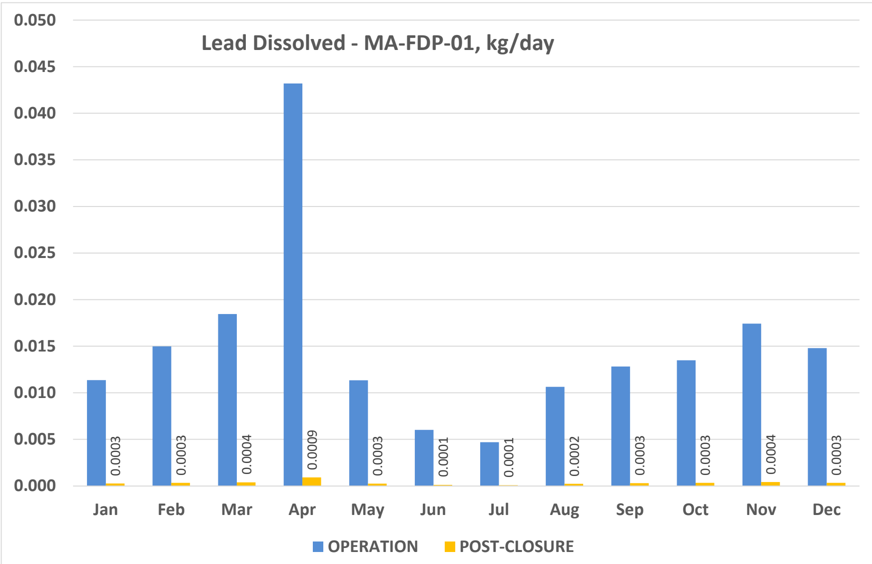
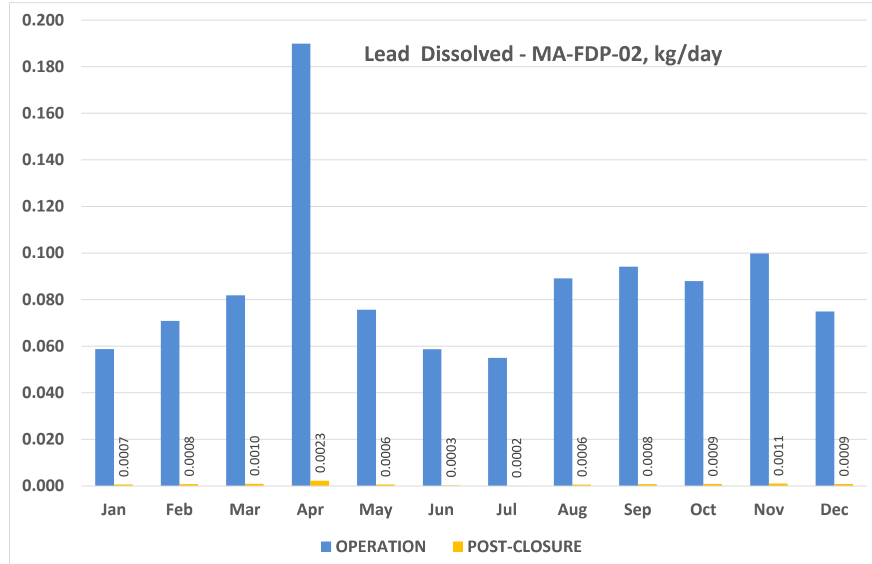
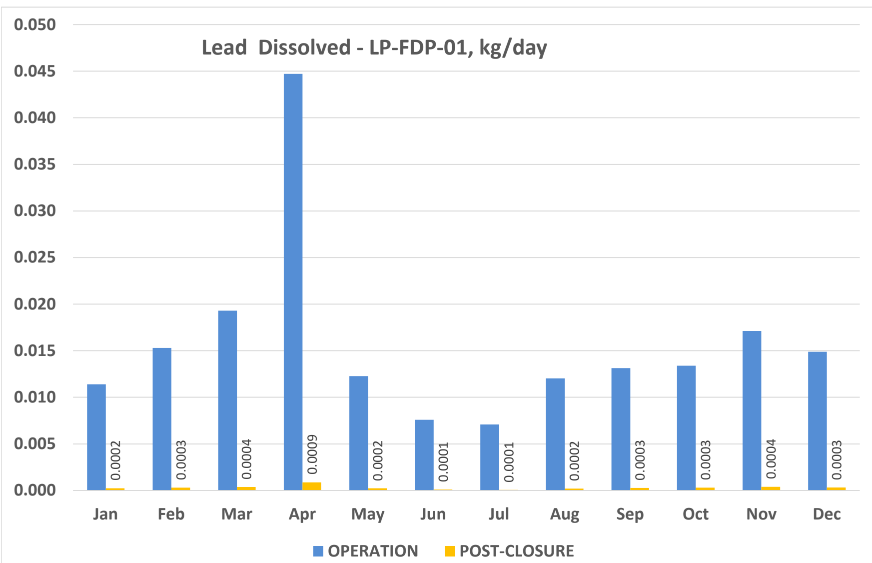
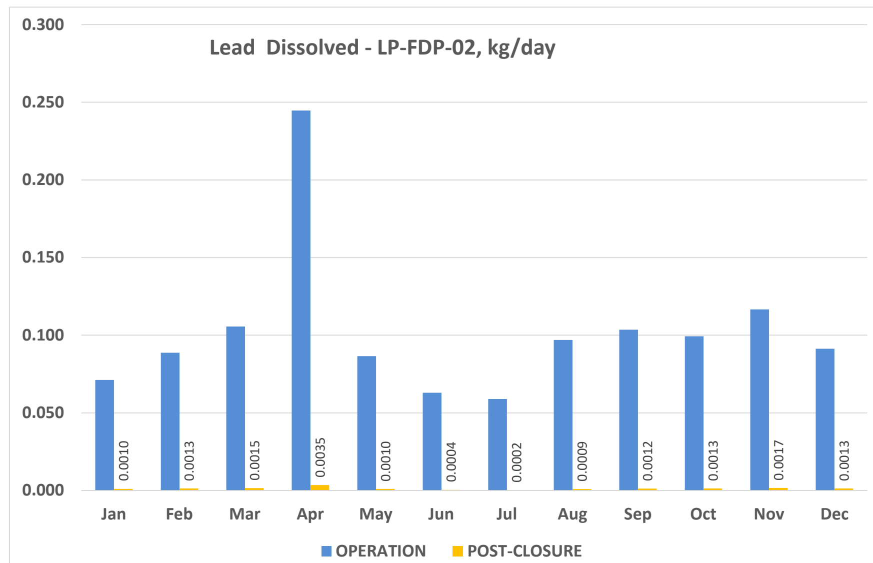
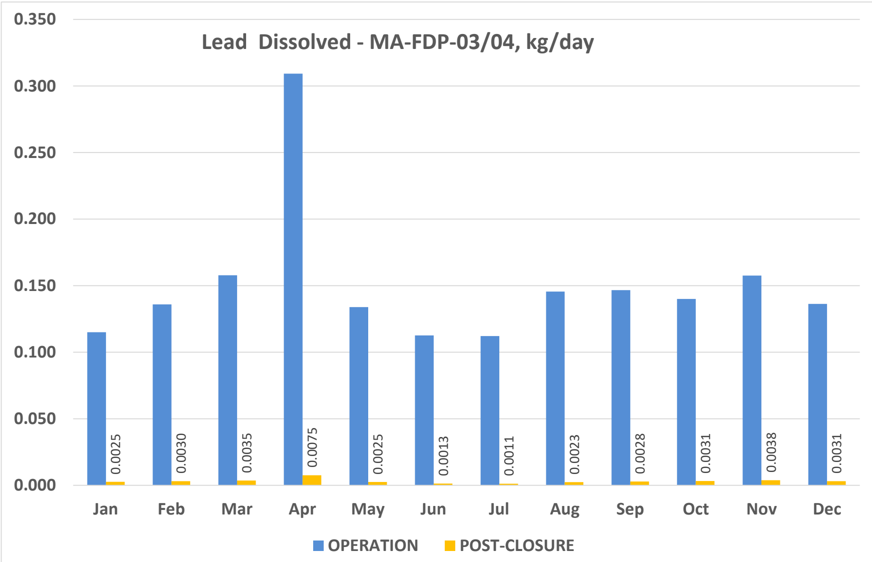
Sep
Oct
Nov
Dec
OPERATION
POST-CLOSURE

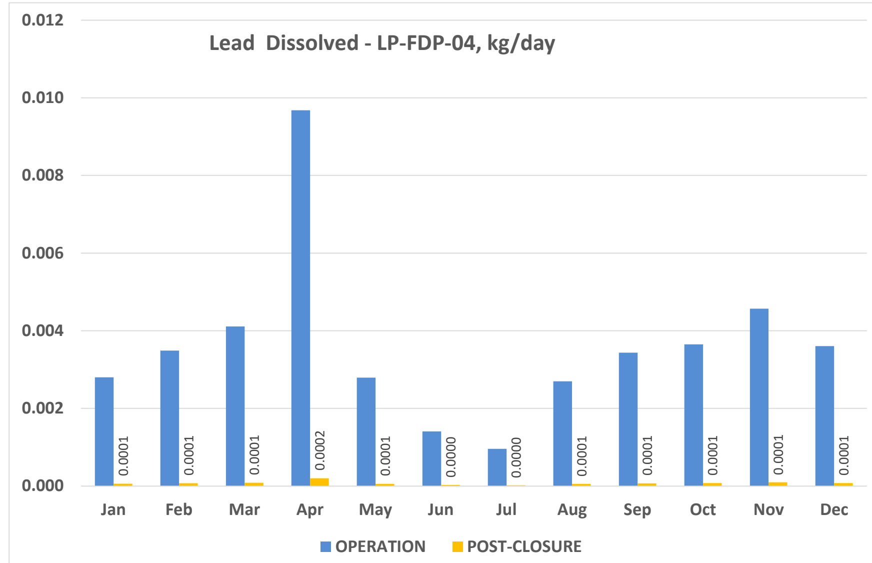

Lead Dissolved - MA-FDP-01, kg/day
0.050
0.045
0.040
0.035
0.030
0.025
0.020
0.015
0.010
0.005
0.000
0.0003
0.0003
0.0004
0.0009
0.0003
0.0001
0.0001
0.0002
0.0003
0.0003
0.0004
0.0003
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
OPERATION
POST-CLOSURE

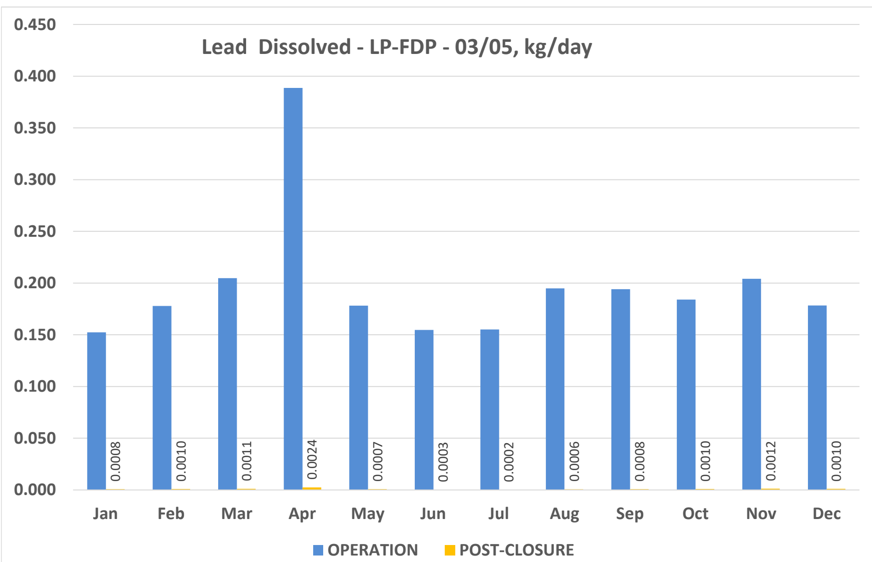

Lead Dissolved - MA-FDP-02, kg/day
0.200
0.180
0.160
0.140
0.120
0.100
0.080
0.060
0.040
0.020
0.000
0.0007
0.0008
0.0010
0.0023
0.0006
0.0003
0.0002
0.0006
0.0008
0.0009
0.0011
0.0009
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
OPERATION
POST-CLOSURE

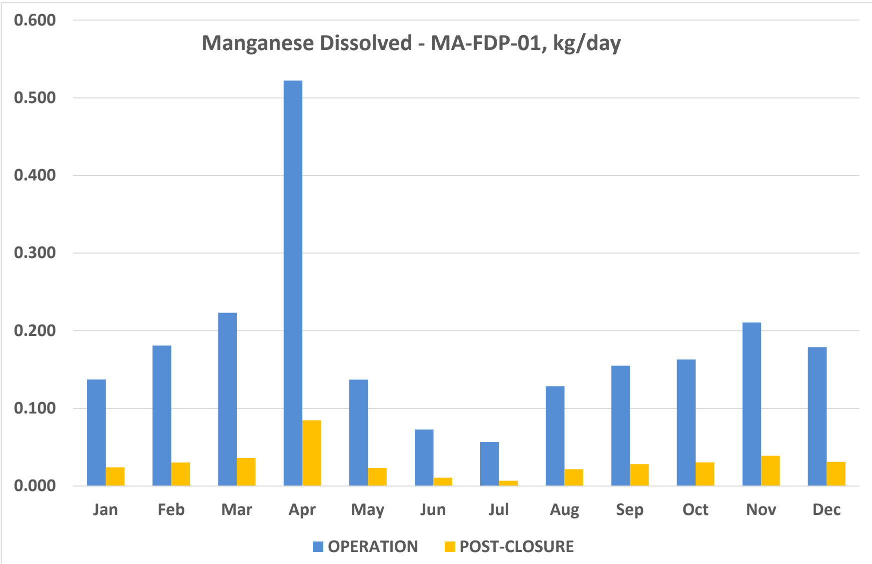

Lead Dissolved - LP-FDP-01, kg/day
0.050
0.045
0.040
0.035
0.030
0.025
0.020
0.015
0.010
0.005
0.000
0.0002
0.0003
0.0004
0.0009
0.0002
0.0001
0.0001
0.0002
0.0003
0.0003
0.0004
0.0003
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
OPERATION
POST-CLOSURE


Lead Dissolved - LP-FDP-02, kg/day
0.300
0.250
0.200
0.150
0.100
0.050
0.000
0.0010
0.0013
0.0015
0.0035
0.0010
0.0004
0.0002
0.0009
0.0012
0.0013
0.0017
0.0013
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
OPERATION
POST-CLOSURE

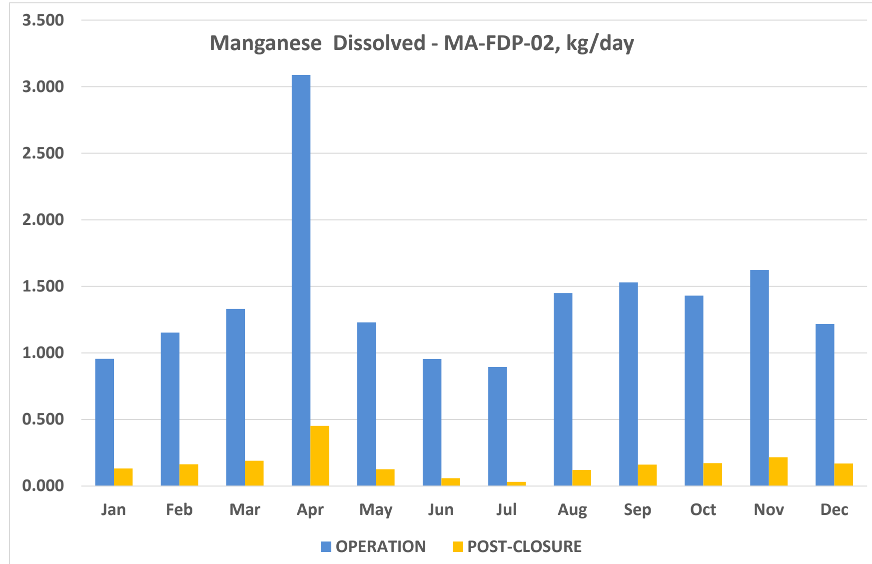

Lead Dissolved - MA-FDP-03/04, kg/day
0.350
0.300
0.250
0.200
0.150
0.100
0.050
0.000
0.0025
0.0030
0.0035
0.0075
0.0025
0.0013
0.0011
0.0023
0.0028
0.0031
0.0038
0.0031
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
OPERATION
POST-CLOSURE


Lead Dissolved - LP-FDP-04, kg/day
0.012
0.010
0.008
0.006
0.004
0.002
0.000
0.0001
0.0001
0.0001
0.0002
0.0001
0.0000
0.0000
0.0001
0.0001
0.0001
0.0001
0.0001
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
OPERATION
POST-CLOSURE

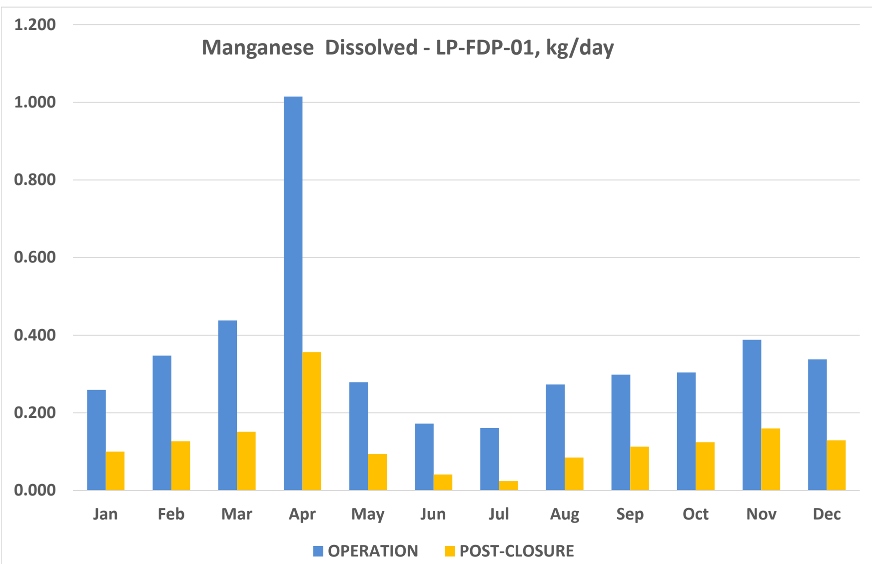

Lead Dissolved - LP-FDP - 03/05, kg/day
0.450
0.400
0.350
0.300
0.250
0.200
0.150
0.100
0.050
0.000
0.0008
0.0010
0.0011
0.0024
0.0007
0.0003
0.0002
0.0006
0.0008
0.0010
0.0012
0.0010
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
OPERATION
POST-CLOSURE



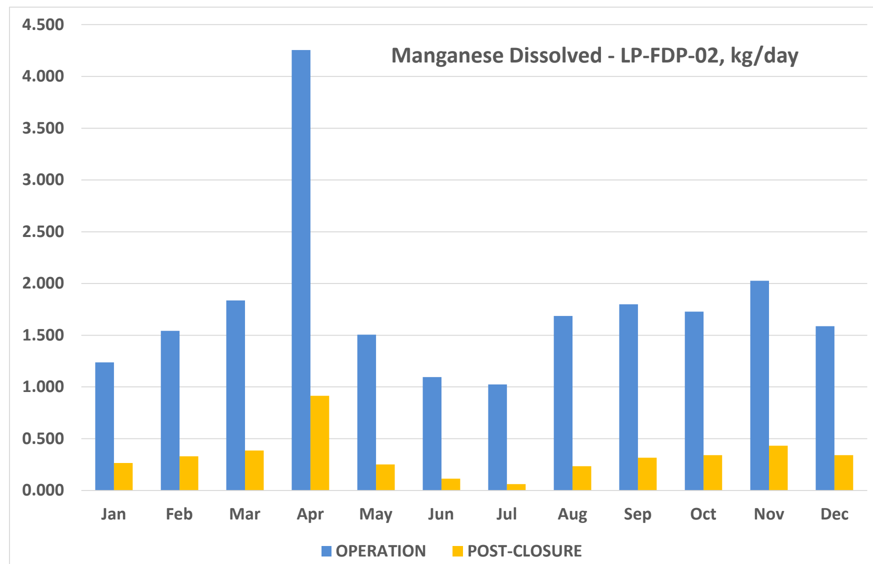
Manganese Dissolved - MA-FDP-01, kg/day
0.600
0.500
0.400
0.300
0.200
0.100
0.000
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
OPERATION
POST-CLOSURE



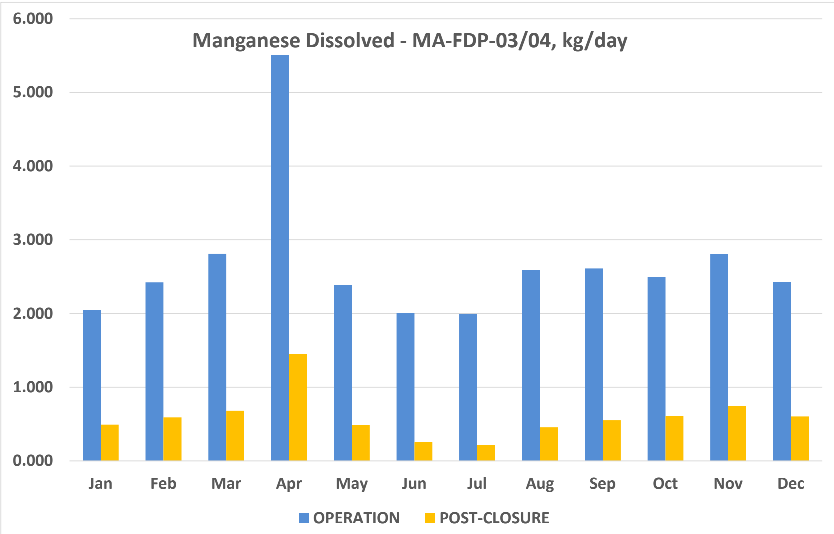
Manganese Dissolved - MA-FDP-02, kg/day
3.500
3.000
2.500
2.000
1.500
1.000
0.500
0.000
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
OPERATION
POST-CLOSURE

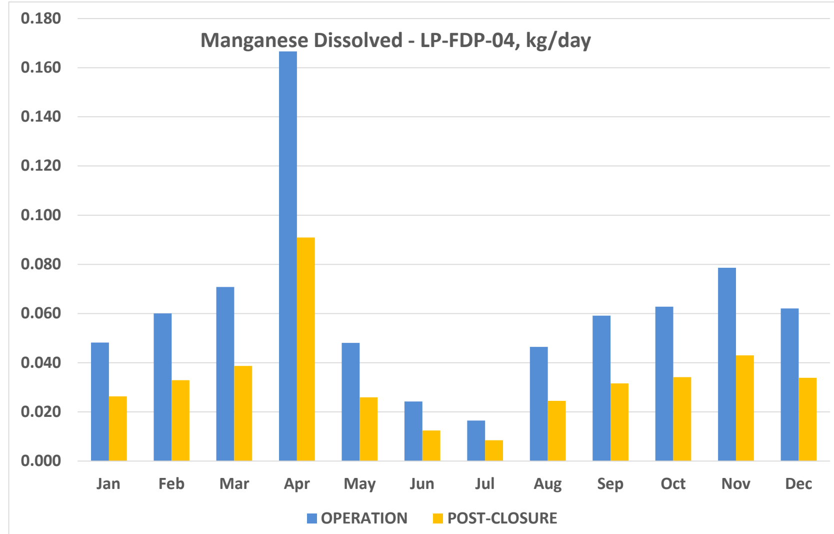


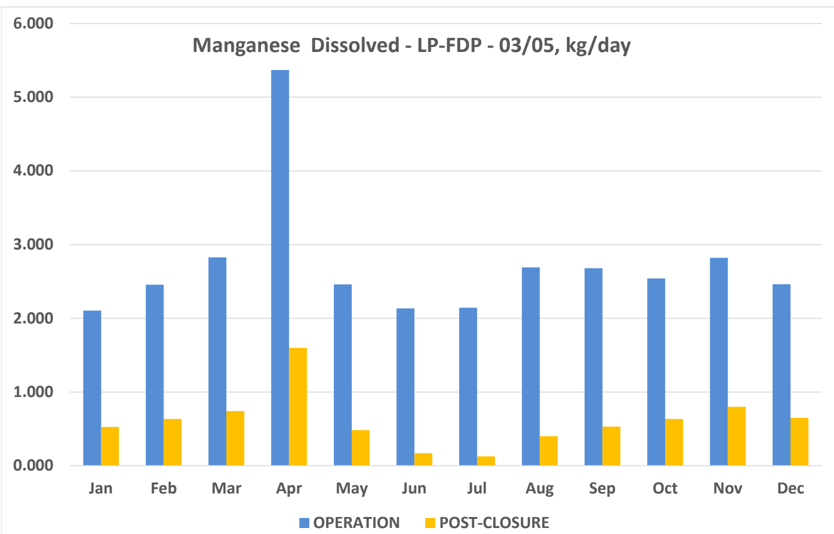
Manganese Dissolved - LP-FDP-01, kg/day
1.200
1.000
0.800
0.600
0.400
0.200
0.000
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
OPERATION
POST-CLOSURE

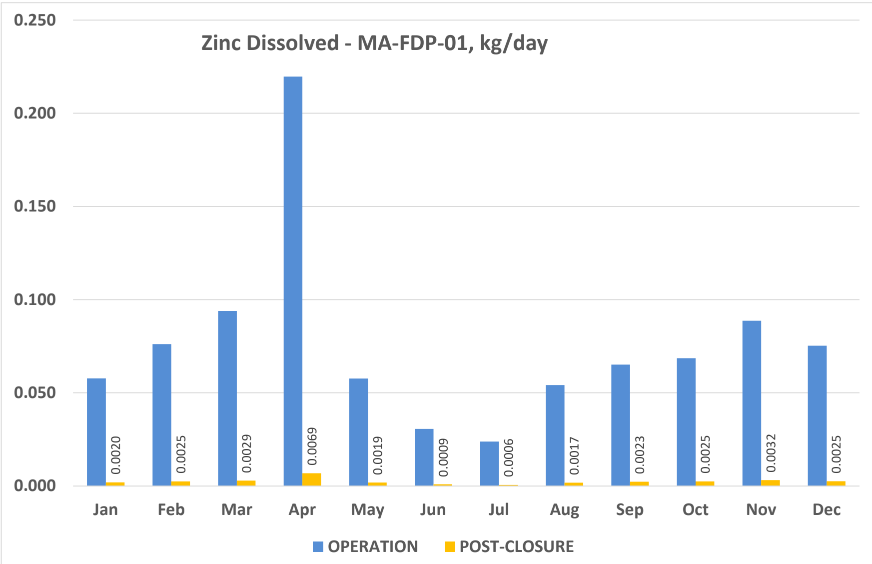


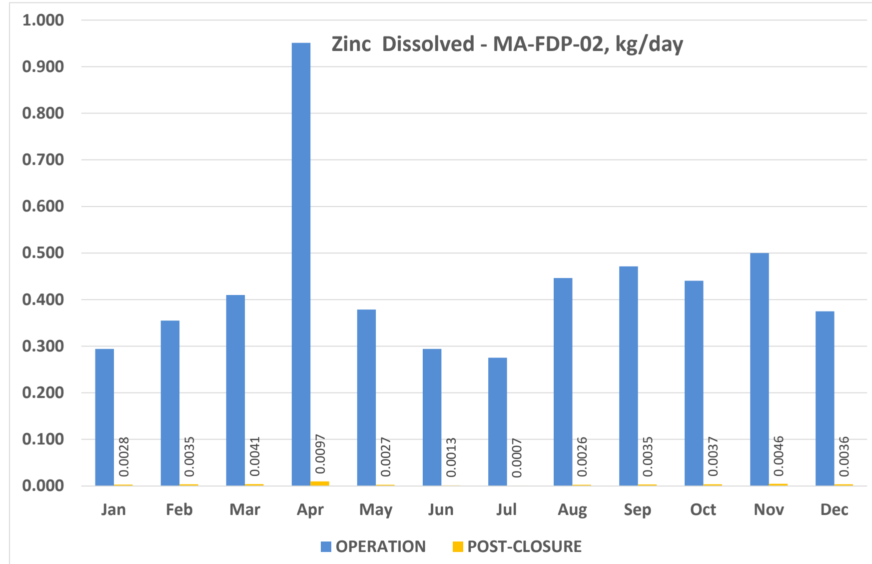
Manganese Dissolved - LP-FDP-02, kg/day
4.500
4.000
3.500
3.000
2.500
2.000
1.500
1.000
0.500
0.000
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
OPERATION
POST-CLOSURE

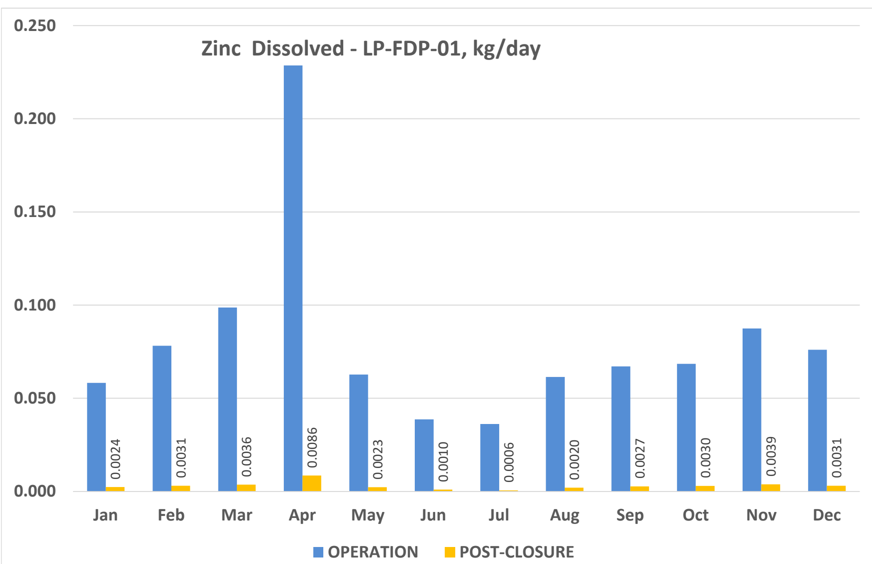

Manganese Dissolved - MA-FDP-03/04, kg/day
6.000
5.000
4.000
3.000
2.000
1.000
0.000
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
OPERATION
POST-CLOSURE

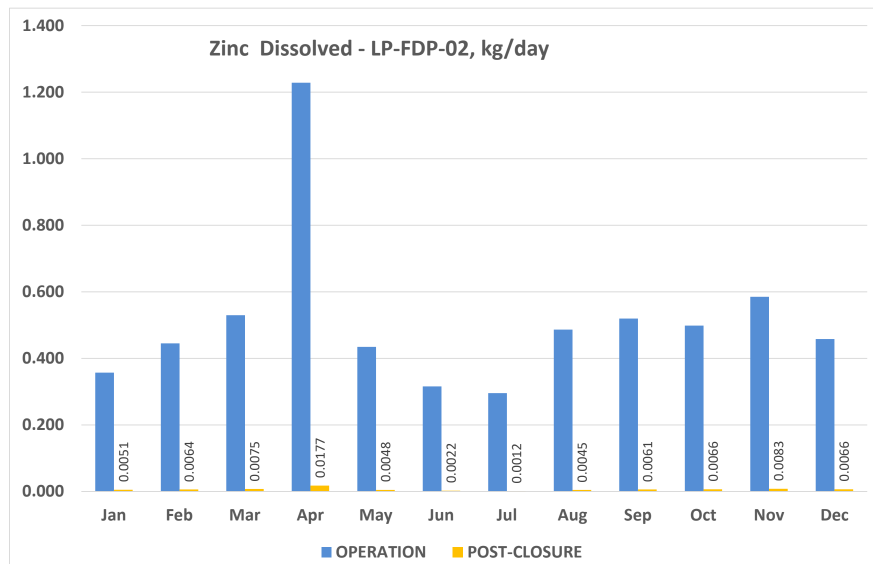

Manganese Dissolved - LP-FDP-04, kg/day
0.180
0.160
0.140
0.120
0.100
0.080
0.060
0.040
0.020
0.000
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
OPERATION
POST-CLOSURE

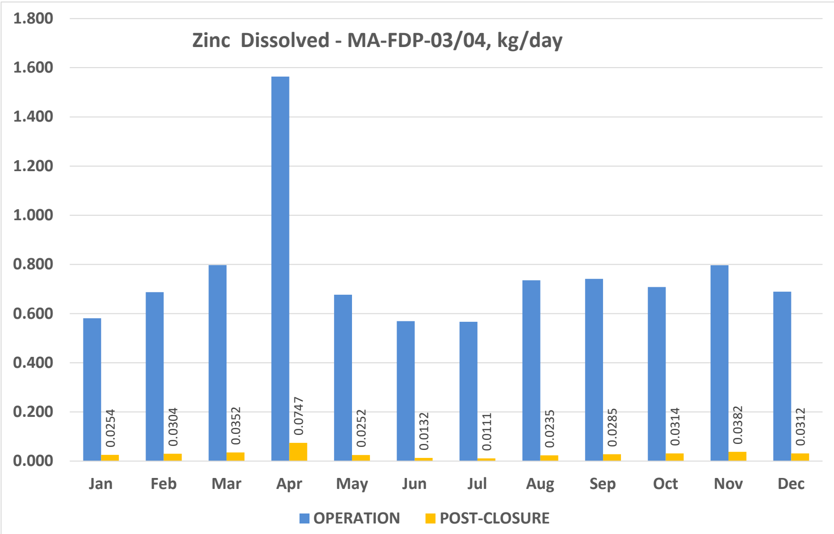

Manganese Dissolved - LP-FDP - 03/05, kg/day
6.000
5.000
4.000
3.000
2.000
1.000
0.000
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
OPERATION
POST-CLOSURE

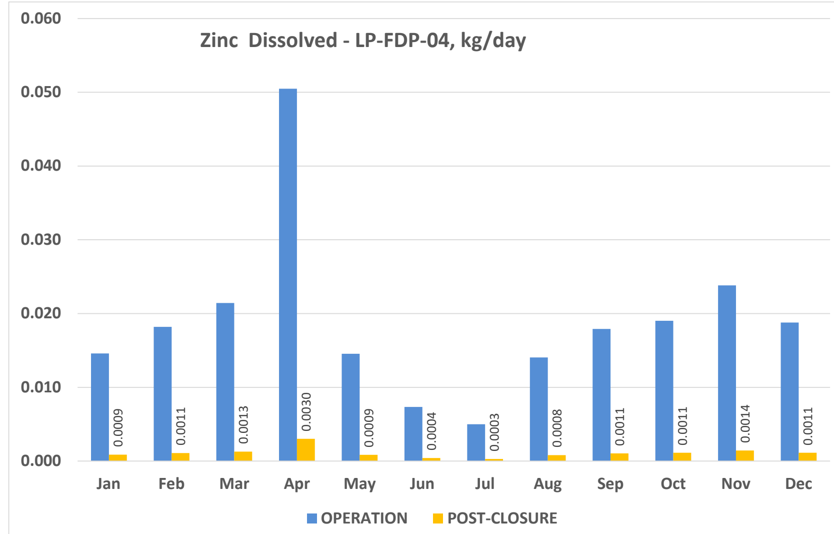

Zinc Dissolved - MA-FDP-01, kg/day
0.250
0.200
0.150
0.100
0.050
0.000
0.0020
0.0025
0.0029
0.0069
0.0019
0.0009
0.0006
0.0017
0.0023
0.0025
0.0032
0.0025
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
OPERATION
POST-CLOSURE

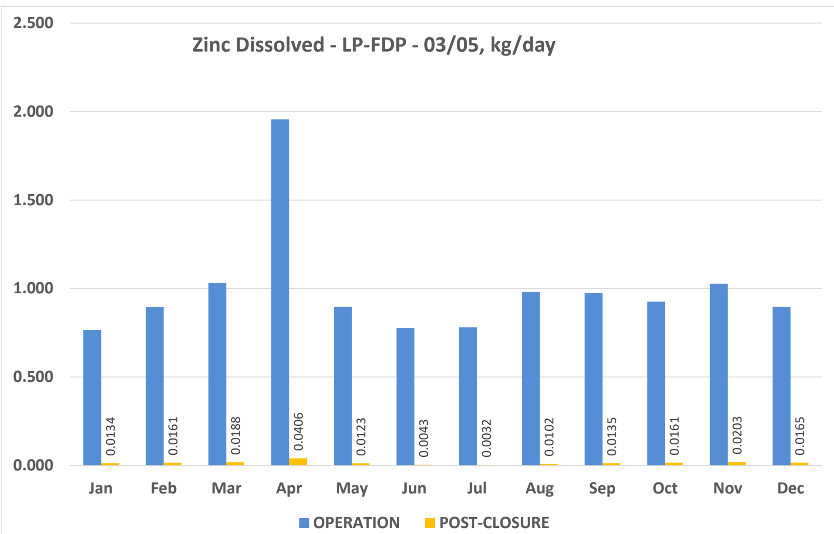

Zinc Dissolved - MA-FDP-02, kg/day
1.000
0.900
0.800
0.700
0.600
0.500
0.400
0.300
0.200
0.100
0.000
0.0028
0.0035
0.0041
0.0097
0.0027
0.0013
0.0007
0.0026
0.0035
0.0037
0.0046
0.0036
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
OPERATION
POST-CLOSURE


Zinc Dissolved - LP-FDP-01, kg/day
0.250
0.200
0.150
0.100
0.050
0.000
0.0024
0.0031
0.0036
0.0086
0.0023
0.0010
0.0006
0.0020
0.0027
0.0030
0.0039
0.0031
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
OPERATION
POST-CLOSURE

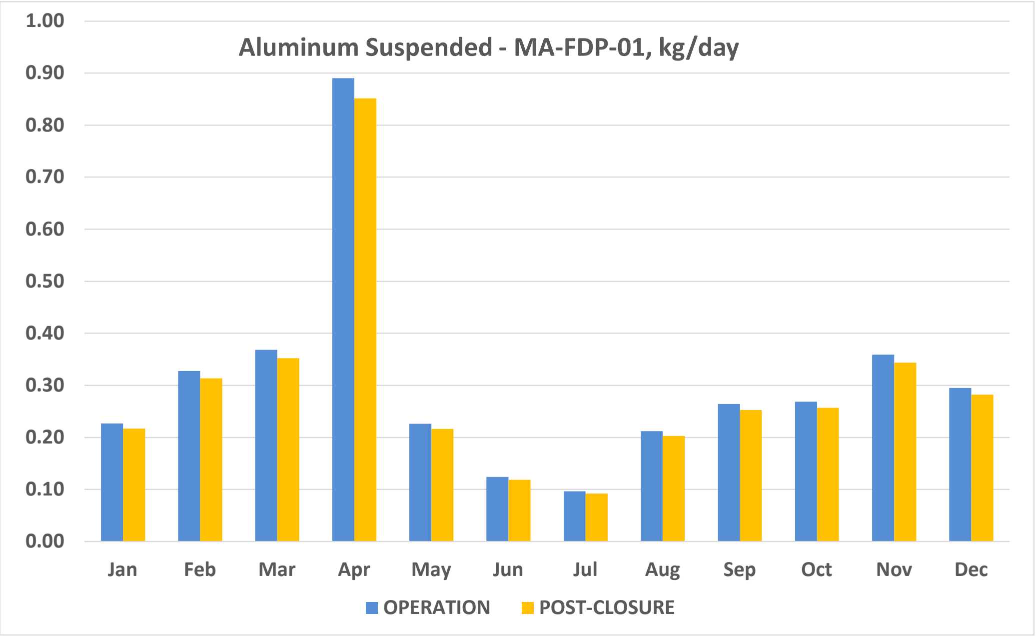

Zinc Dissolved - LP-FDP-02, kg/day
1.400
1.200
1.000
0.800
0.600
0.400
0.200
0.000
0.0051
0.0064
0.0075
0.0177
0.0048
0.0022
0.0012
0.0045
0.0061
0.0066
0.0083
0.0066
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
OPERATION
POST-CLOSURE

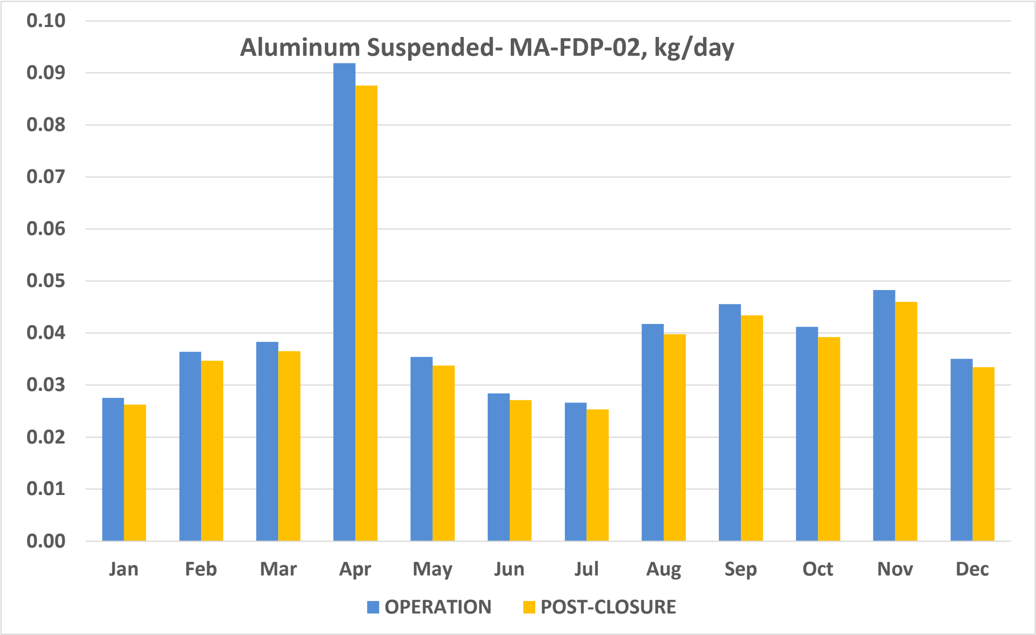

Zinc Dissolved - MA-FDP-03/04, kg/day
1.800
1.600
1.400
1.200
1.000
0.800
0.600
0.400
0.200
0.000
0.0254
0.0304
0.0352
0.0747
0.0252
0.0132
0.0111
0.0235
0.0285
0.0314
0.0382
0.0312
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
OPERATION
POST-CLOSURE

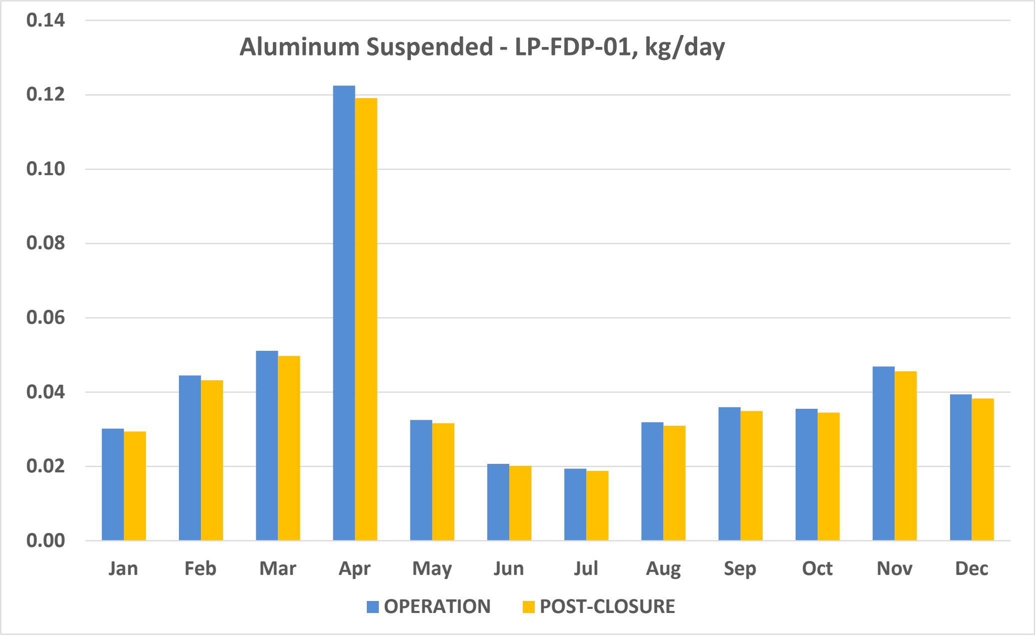

Zinc Dissolved - LP-FDP-04, kg/day
0.060
0.050
0.040
0.030
0.020
0.010
0.000
0.0009
0.0011
0.0013
0.0030
0.0009
0.0004
0.0003
0.0008
0.0011
0.0011
0.0014
0.0011
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
OPERATION
POST-CLOSURE

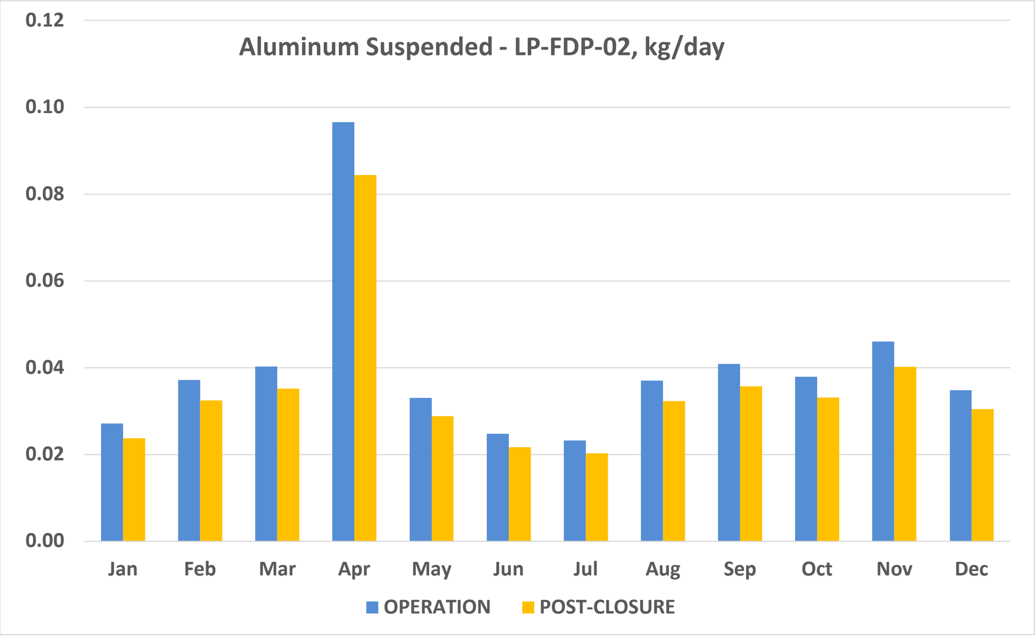

Zinc Dissolved - LP-FDP - 03/05, kg/day
2.500
2.000
1.500
1.000
0.500
0.000
0.0134
0.0161
0.0188
0.0406
0.0123
0.0043
0.0032
0.0102
0.0135
0.0161
0.0203
0.0165
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
OPERATION
POST-CLOSURE

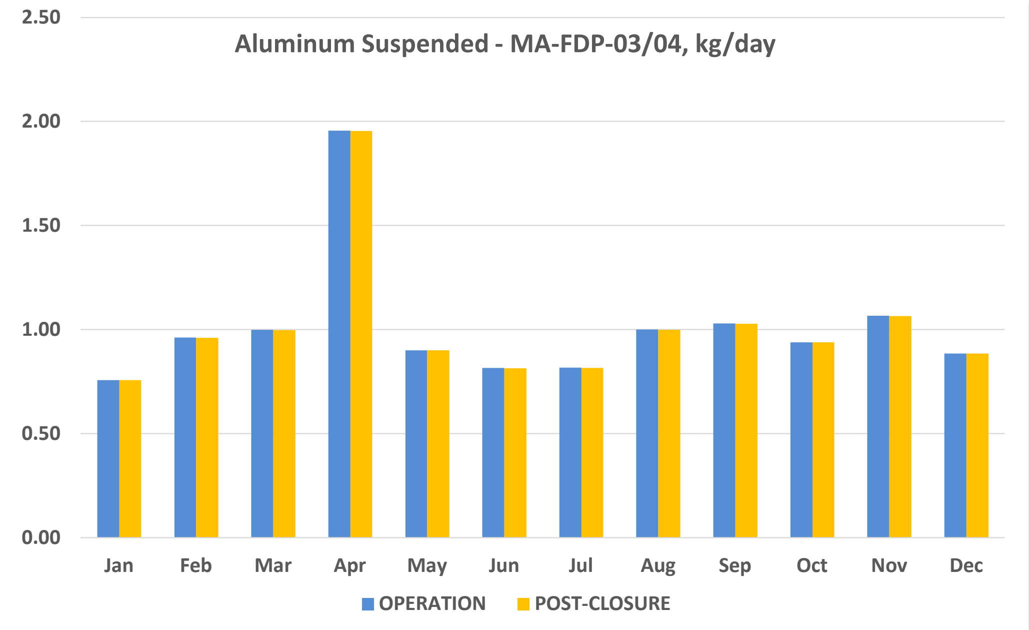
APPENDIX IR-41.B
SUSPENDED LOADING

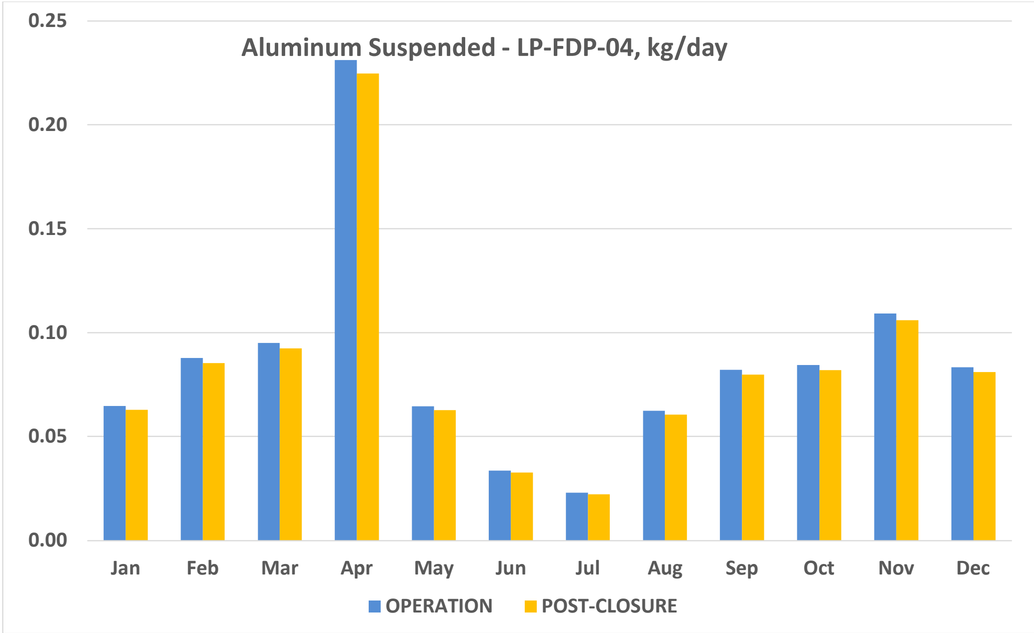

Aluminum Suspended - MA-FDP-01, kg/day
1.00
0.90
0.80
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
OPERATION
POST-CLOSURE

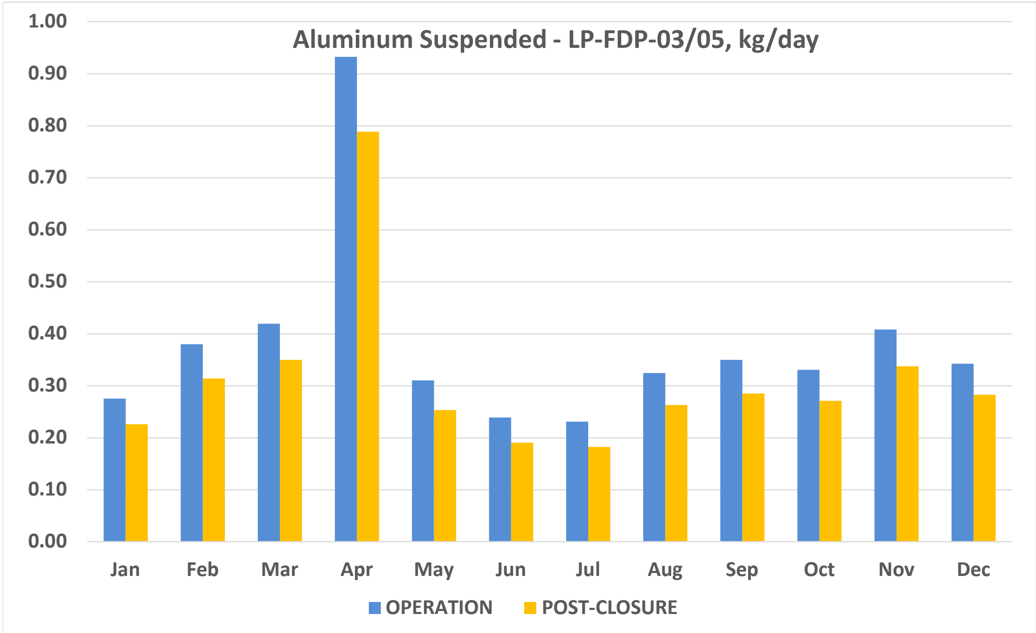

Aluminum Suspended- MA-FDP-02, kg/day
0.10
0.09
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0.00
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
OPERATION
POST-CLOSURE

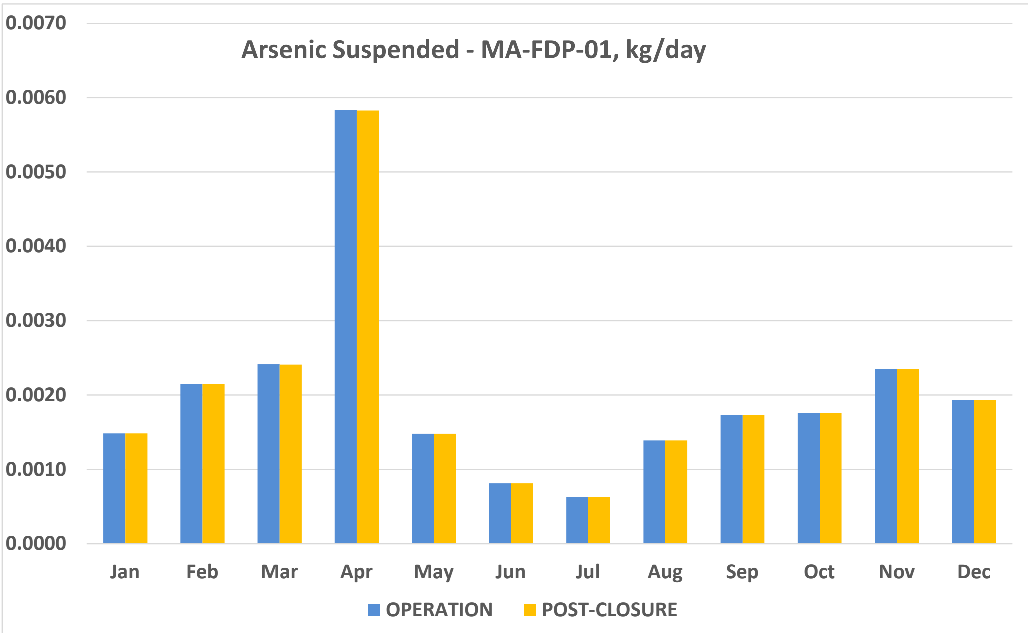

Aluminum Suspended - LP-FDP-01, kg/day
0.14
0.12
0.10
0.08
0.06
0.04
0.02
0.00
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
OPERATION
POST-CLOSURE

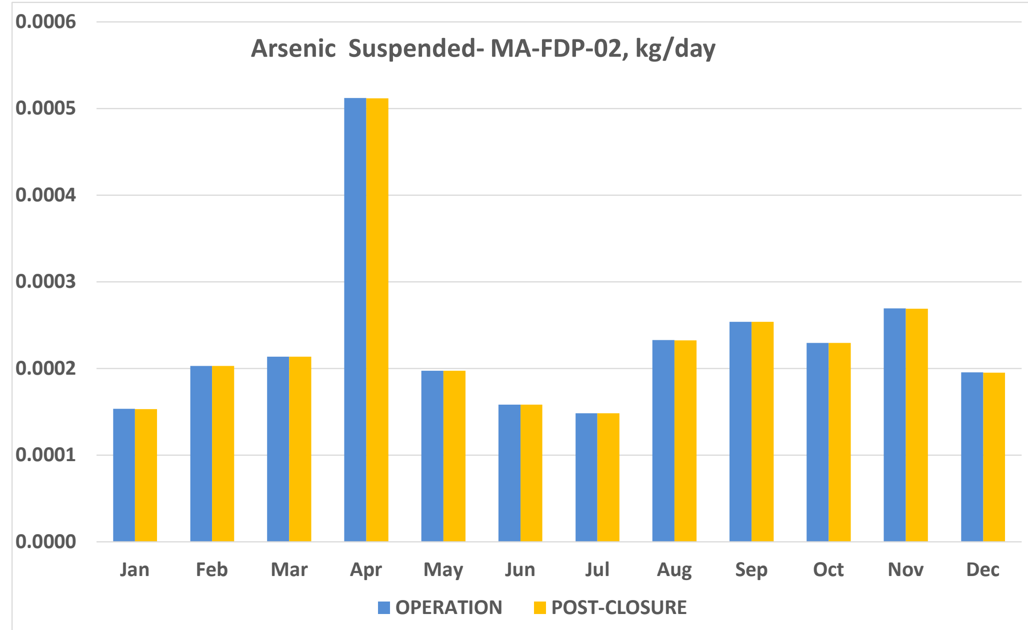

Aluminum Suspended - LP-FDP-02, kg/day
0.12
0.10
0.08
0.06
0.04
0.02
0.00
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
OPERATION
POST-CLOSURE

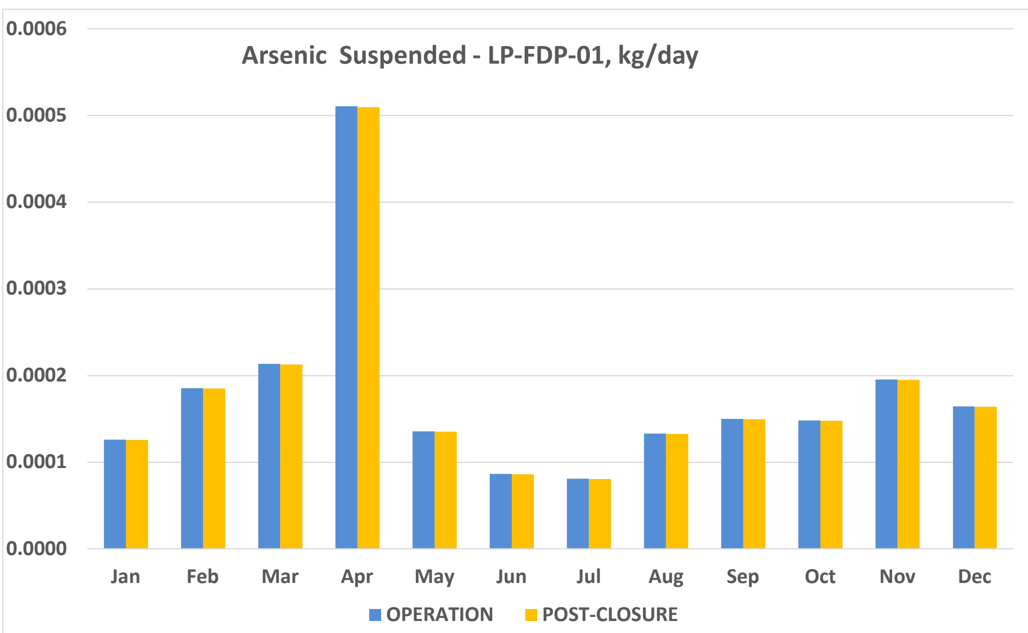

Aluminum Suspended - MA-FDP-03/04, kg/day
2.50
2.00
1.50
1.00
0.50
0.00
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
OPERATION
POST-CLOSURE

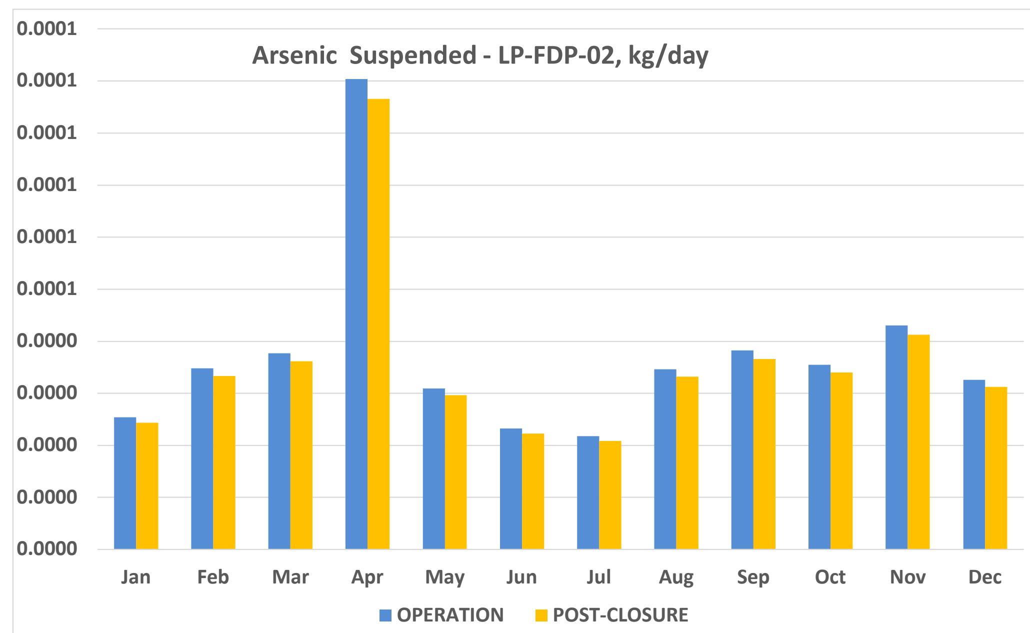

Aluminum Suspended - LP-FDP-04, kg/day
0.25
0.20
0.15
0.10
0.05
0.00
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
OPERATION
POST-CLOSURE

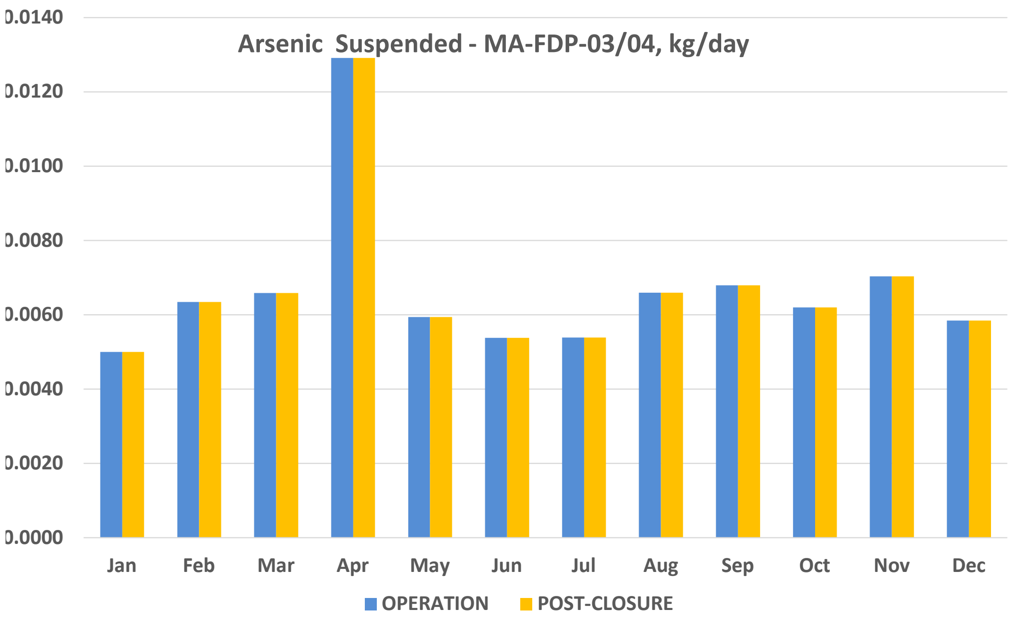

Aluminum Suspended - LP-FDP-03/05, kg/day
1.00
0.90
0.80
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
OPERATION
POST-CLOSURE

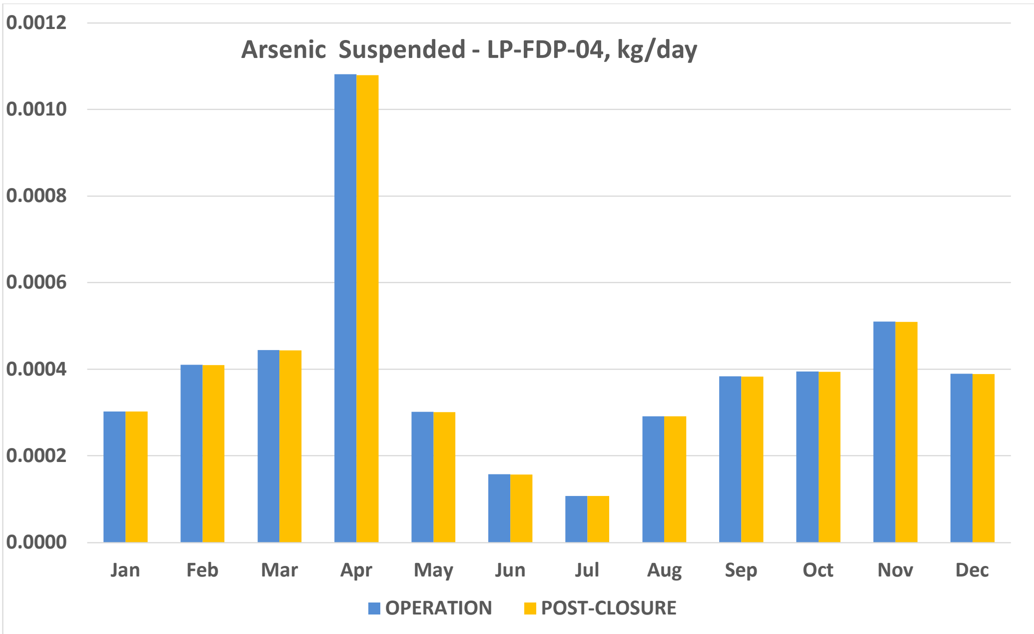

Arsenic Suspended - MA-FDP-01, kg/day
0.0070
0.0060
0.0050
0.0040
0.0030
0.0020
0.0010
0.0000
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
OPERATION
POST-CLOSURE

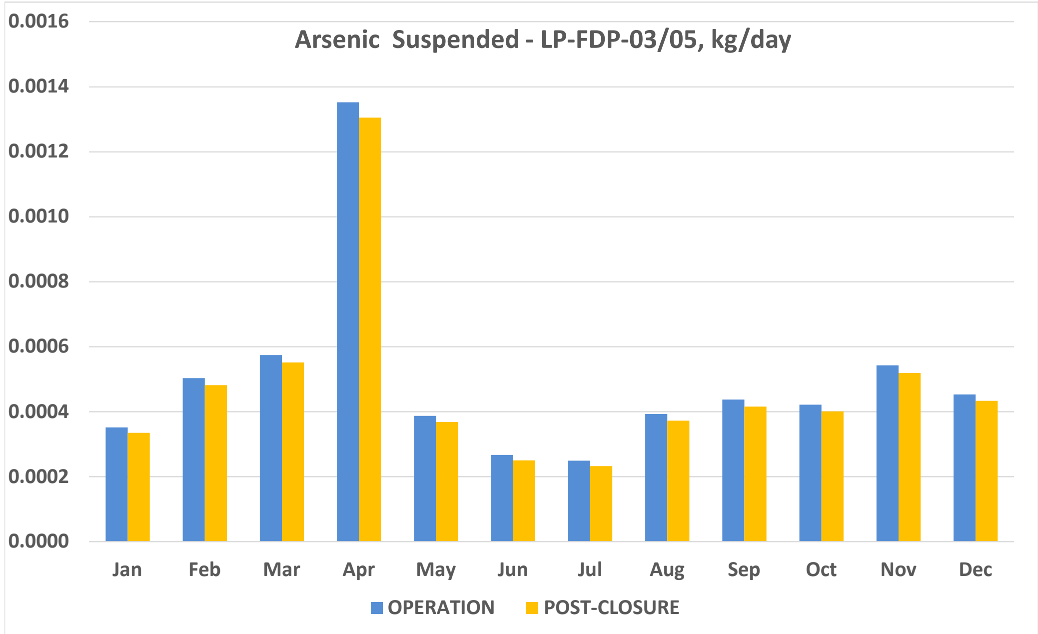

Arsenic Suspended- MA-FDP-02, kg/day
0.0006
0.0005
0.0004
0.0003
0.0002
0.0001
0.0000
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
OPERATION
POST-CLOSURE

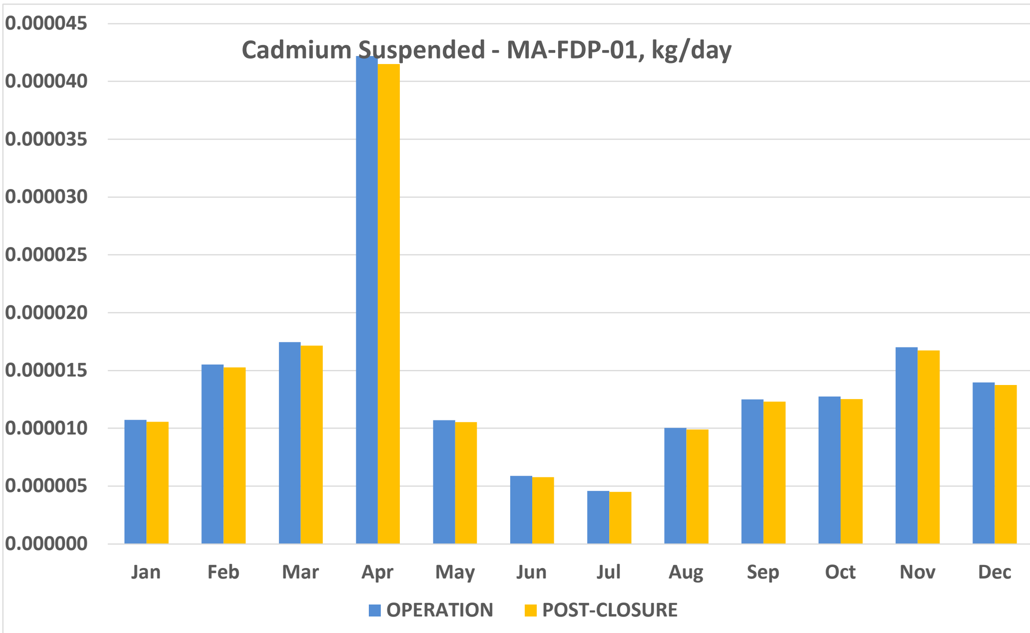

Arsenic Suspended - LP-FDP-01, kg/day
0.0006
0.0005
0.0004
0.0003
0.0002
0.0001
0.0000
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
OPERATION
POST-CLOSURE


Arsenic Suspended - LP-FDP-02, kg/day
0.0001
0.0001
0.0001
0.0001
0.0001
0.0001
0.0000
0.0000
0.0000
0.0000
0.0000
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
OPERATION
POST-CLOSURE

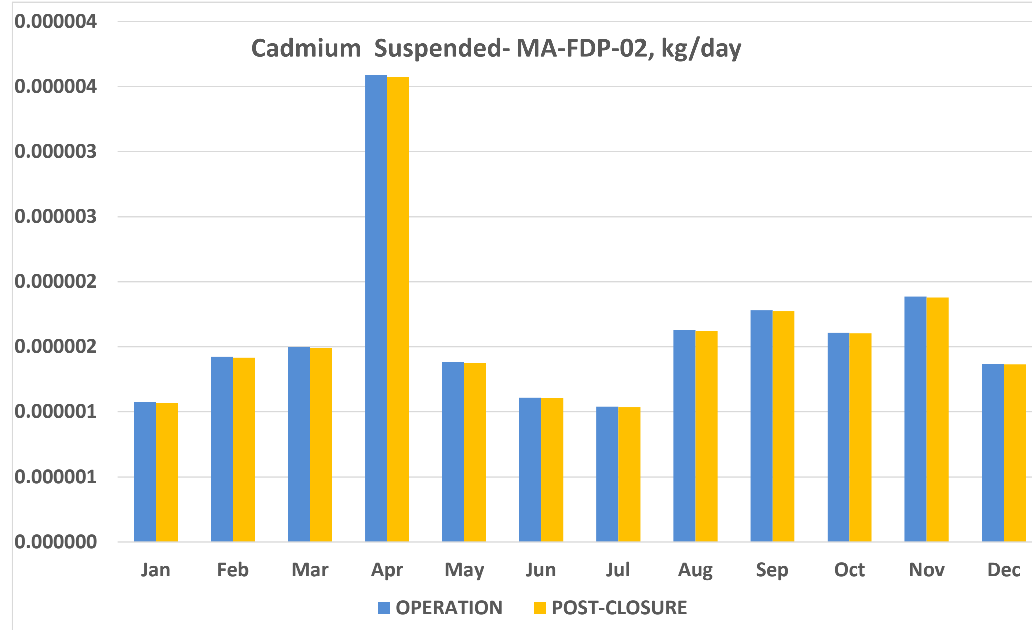

Arsenic Suspended - MA-FDP-03/04, kg/day
0.0140
0.0120
0.0100
0.0080
0.0060
0.0040
0.0020
0.0000
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
OPERATION POST-CLOSURE


Arsenic Suspended - LP-FDP-04, kg/day
0.0012
0.0010
0.0008
0.0006
0.0004
0.0002
0.0000
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
OPERATION POST-CLOSURE

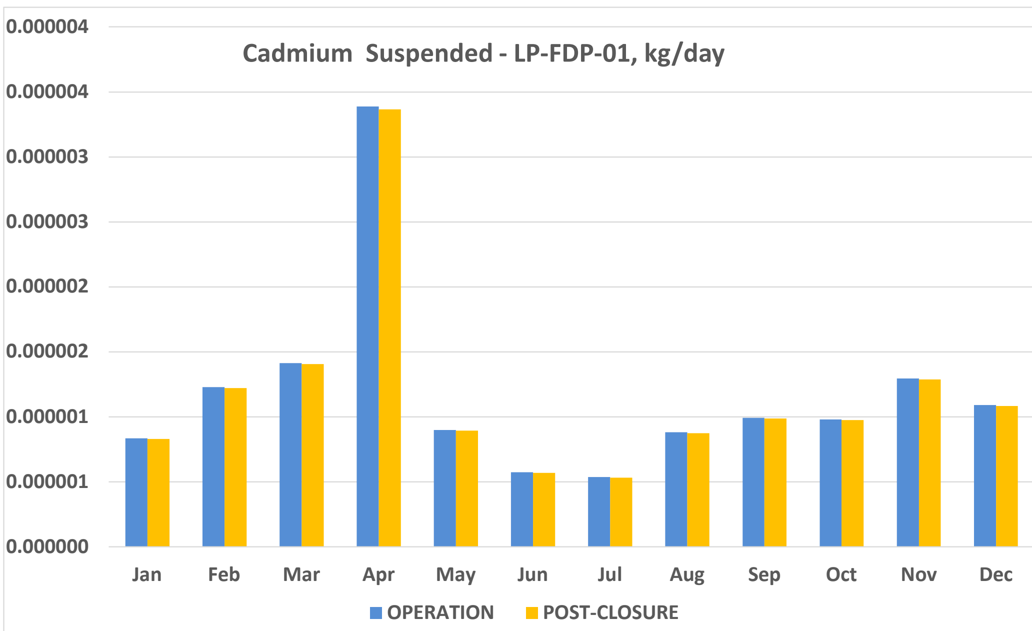

Arsenic Suspended - LP-FDP-03/05, kg/day
0.0016
0.0014
0.0012
0.0010
0.0008
0.0006
0.0004
0.0002
0.0000
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
OPERATION POST-CLOSURE



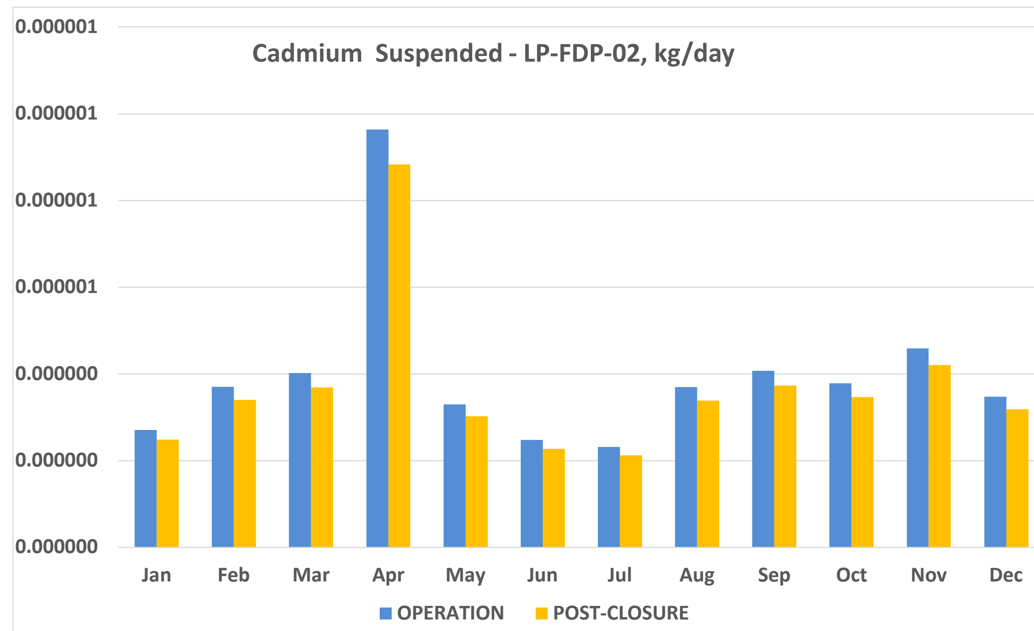
Cadmium Suspended - MA-FDP-01, kg/day
0.000045
0.000040
0.000035
0.000030
0.000025
0.000020
0.000015
0.000010
0.000005
0.000000
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
OPERATION POST-CLOSURE



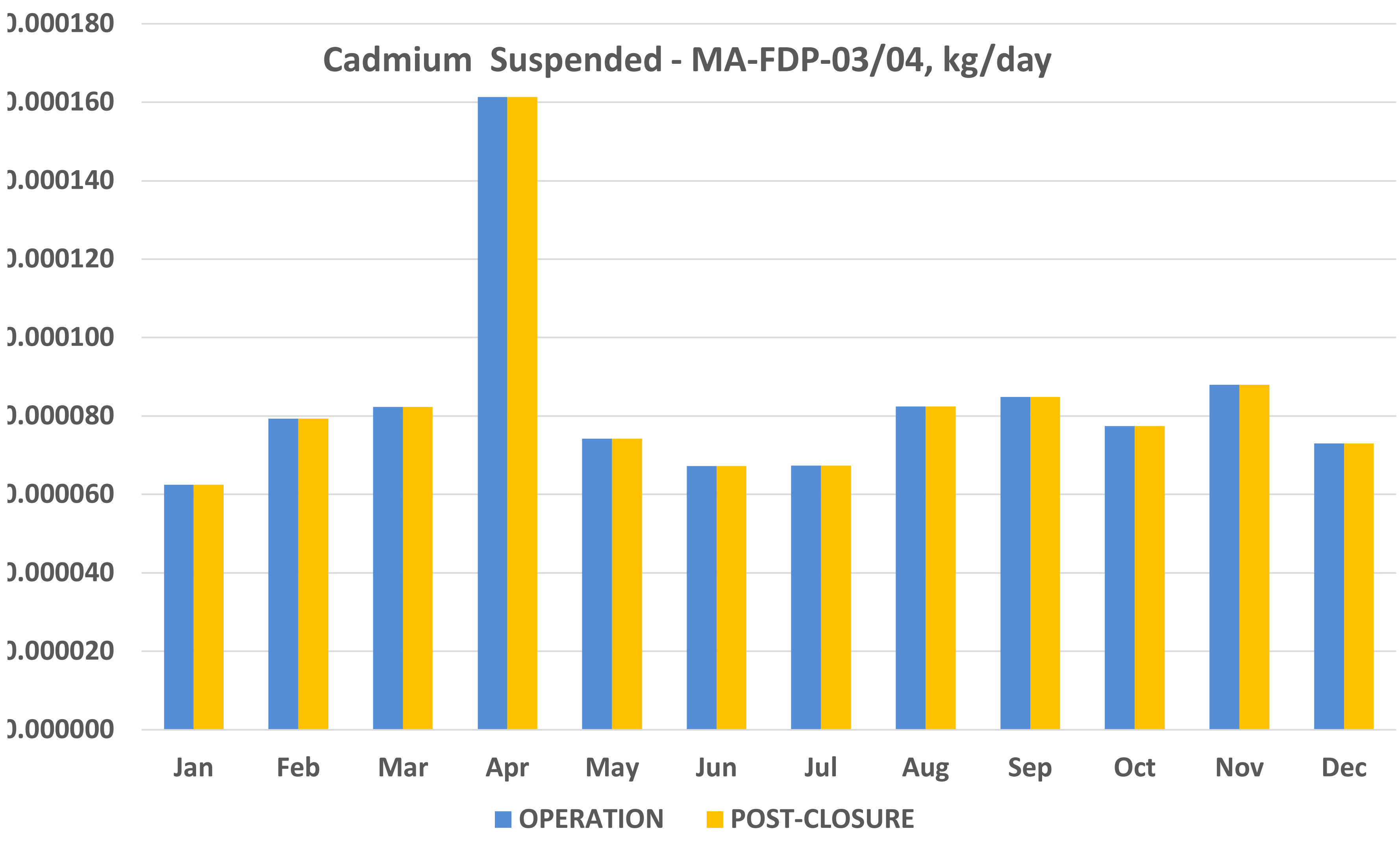
Cadmium Suspended- MA-FDP-02, kg/day
0.000004
0.000004
0.000003
0.000003
0.000002
0.000002
0.000001
0.000001
0.000000
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
OPERATION POST-CLOSURE

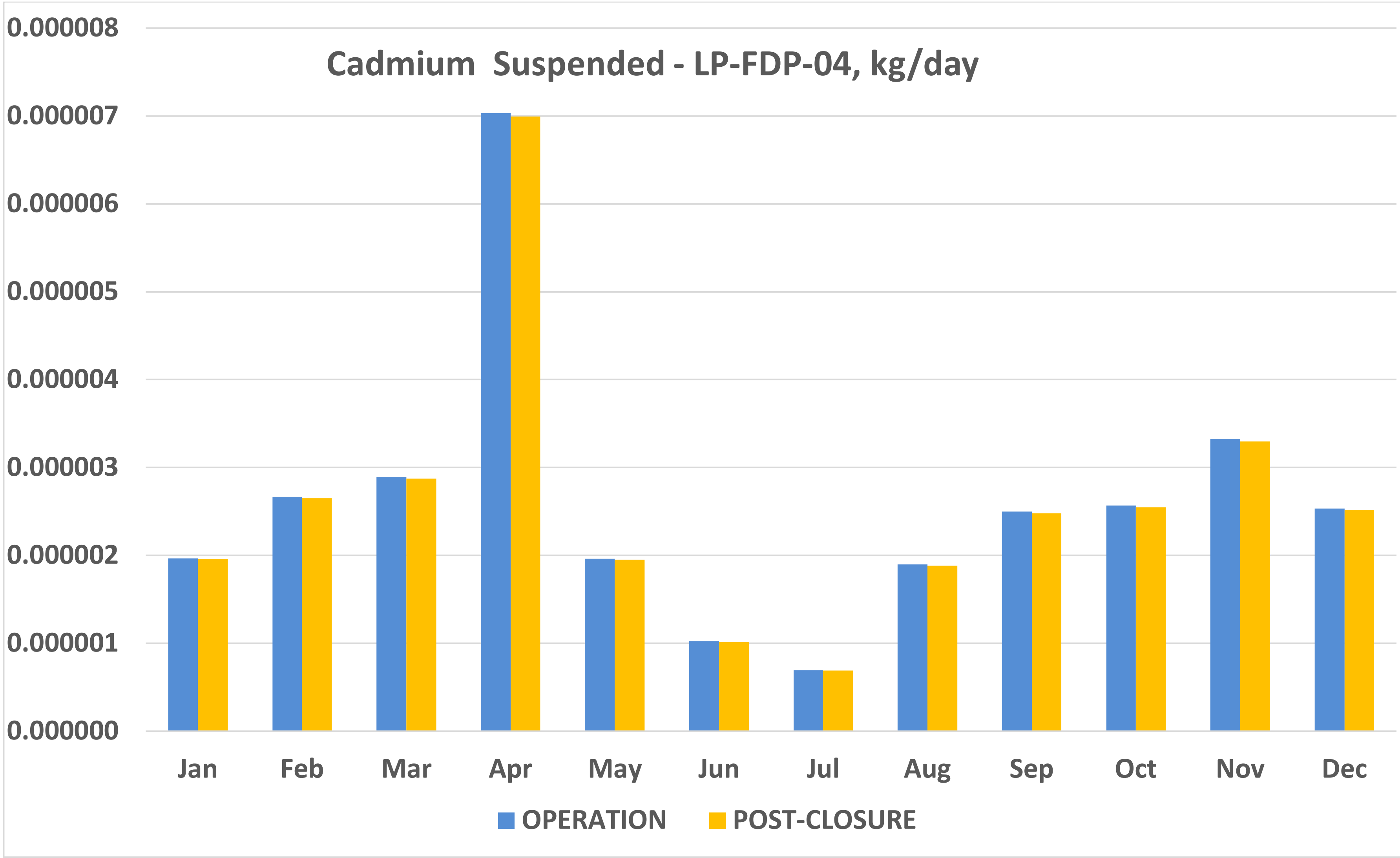


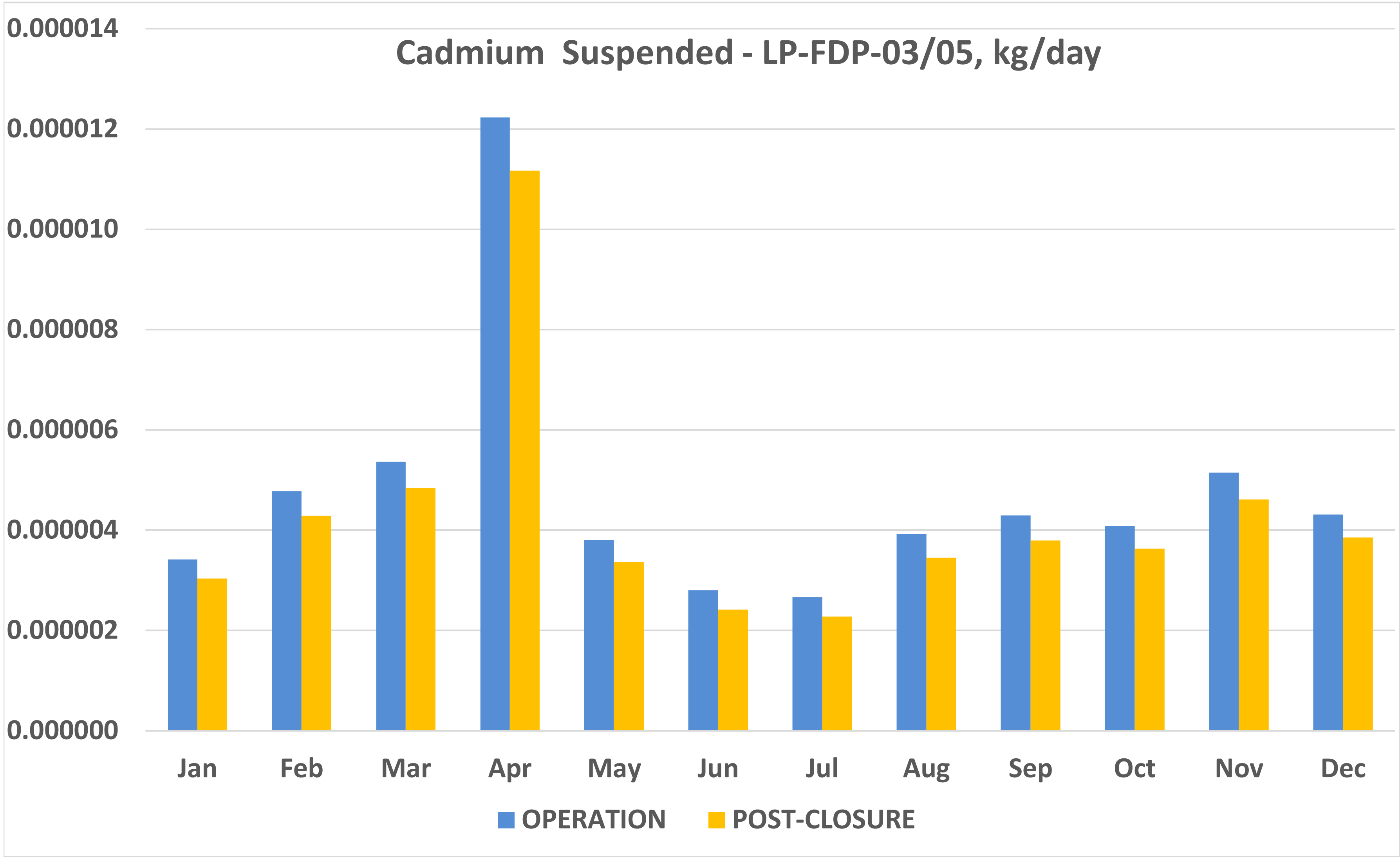
Cadmium Suspended - LP-FDP-01, kg/day
0.000004
0.000004
0.000003
0.000003
0.000002
0.000002
0.000001
0.000001
0.000000
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
OPERATION POST-CLOSURE

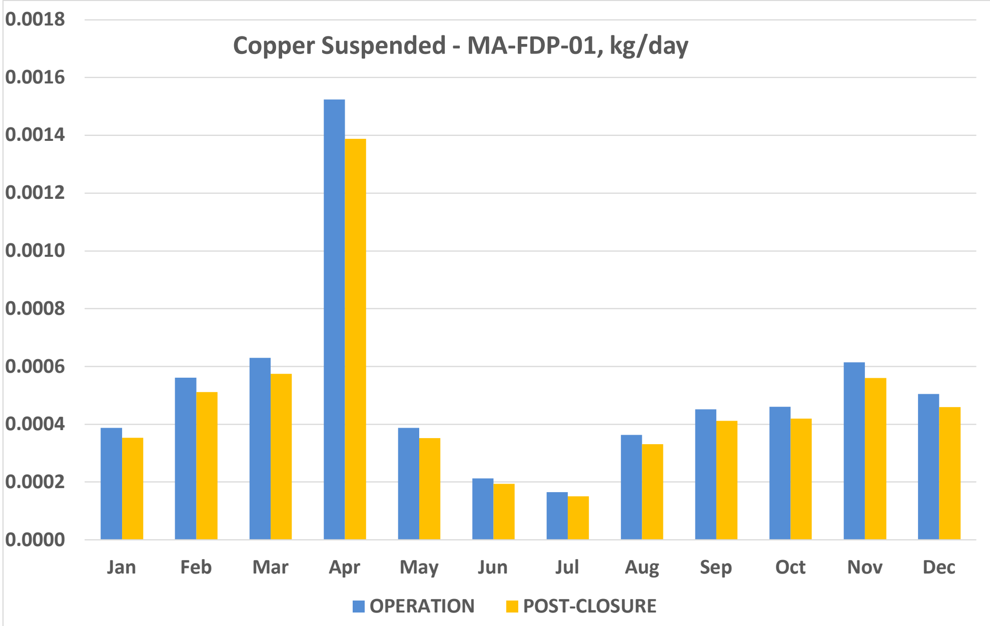


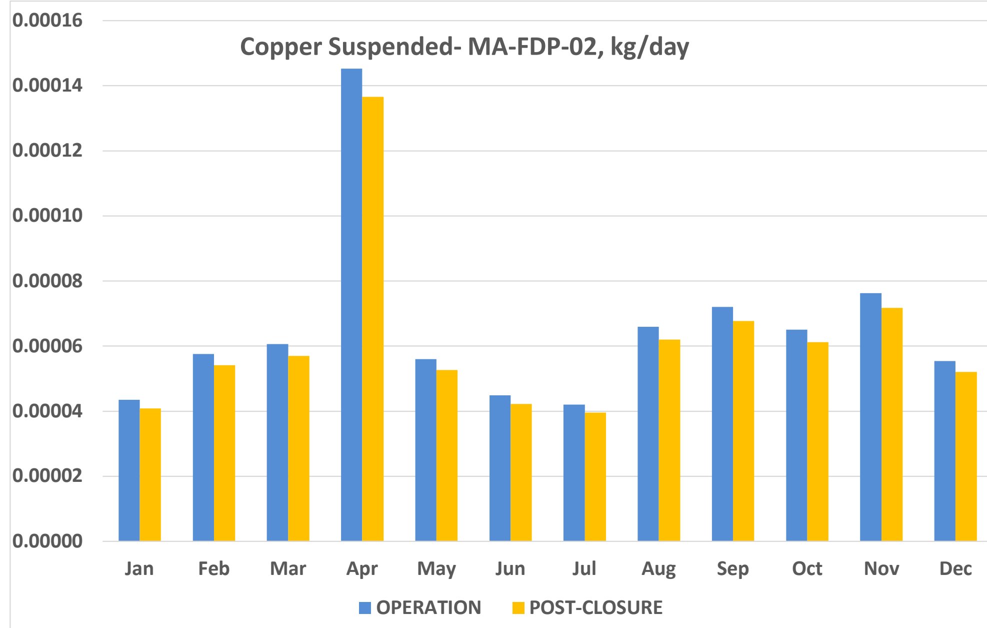
Cadmium Suspended - LP-FDP-02, kg/day
0.000001
0.000001
0.000001
0.000001
0.000000
0.000000
0.000000
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
OPERATION POST-CLOSURE

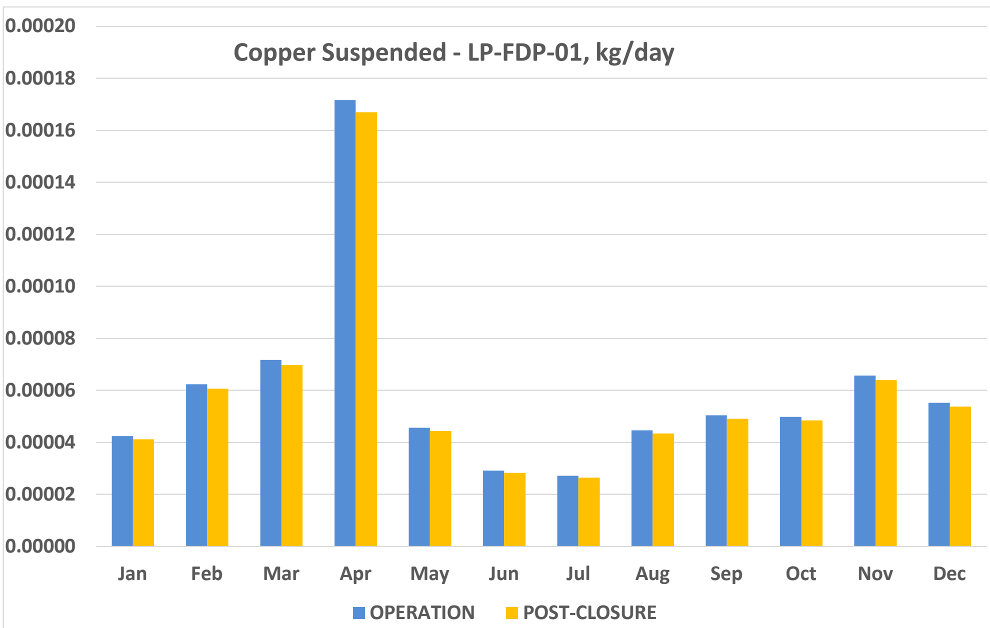

Cadmium Suspended - MA-FDP-03/04, kg/day
0.000180
0.000160
0.000140
0.000120
0.000100
0.000080
0.000060
0.000040
0.000020
0.000000
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
OPERATION
POST-CLOSURE

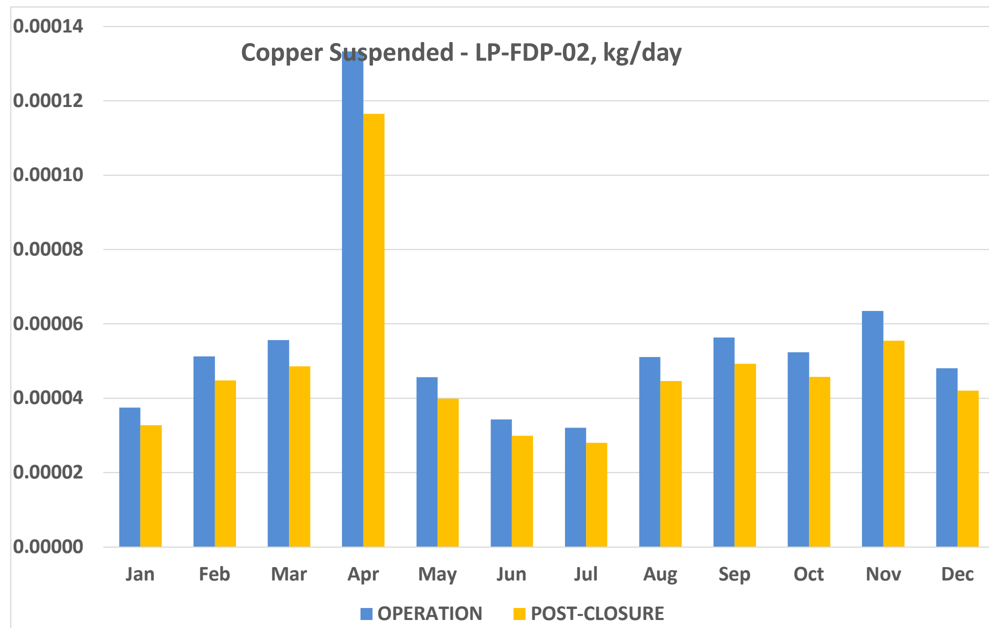

Cadmium Suspended - LP-FDP-04, kg/day
0.000008
0.000007
0.000006
0.000005
0.000004
0.000003
0.000002
0.000001
0.000000
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
OPERATION
POST-CLOSURE

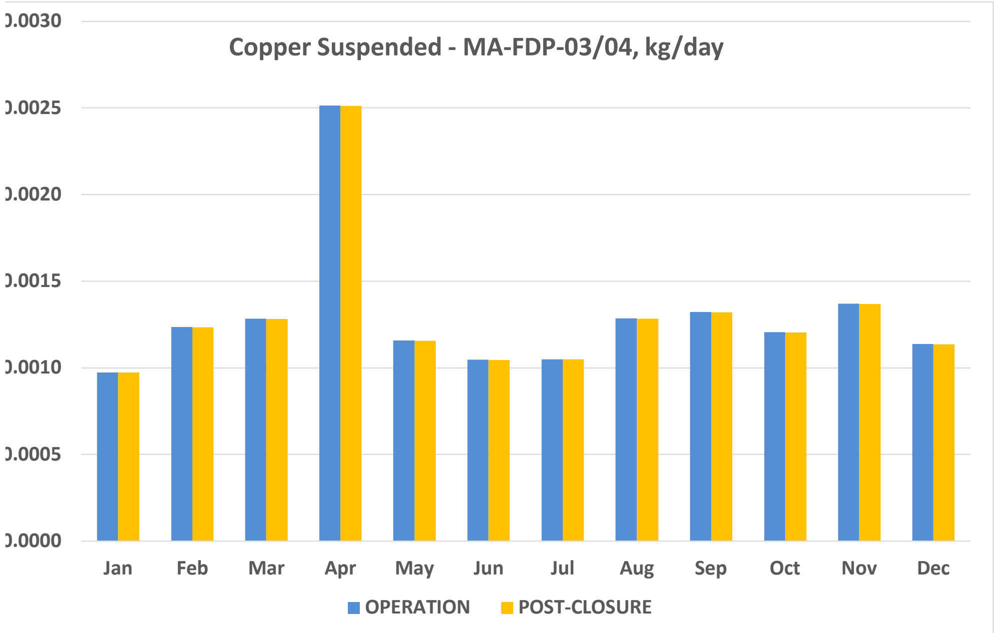

Cadmium Suspended - LP-FDP-03/05, kg/day
0.000014
0.000012
0.000010
0.000008
0.000006
0.000004
0.000002
0.000000
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
OPERATION
POST-CLOSURE


Copper Suspended - MA-FDP-01, kg/day
0.0018
0.0016
0.0014
0.0012
0.0010
0.0008
0.0006
0.0004
0.0002
0.0000
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
OPERATION POST-CLOSURE


Copper Suspended- MA-FDP-02, kg/day
0.00016
0.00014
0.00012
0.00010
0.00008
0.00006
0.00004
0.00002
0.00000
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
OPERATION POST-CLOSURE


Copper Suspended - LP-FDP-01, kg/day
0.00020
0.00018
0.00016
0.00014
0.00012
0.00010
0.00008
0.00006
0.00004
0.00002
0.00000
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
OPERATION POST-CLOSURE


Copper Suspended - LP-FDP-02, kg/day
0.00014
0.00012
0.00010
0.00008
0.00006
0.00004
0.00002
0.00000
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
OPERATION POST-CLOSURE


Copper Suspended - MA-FDP-03/04, kg/day
0.0030
0.0025
0.0020
0.0015
0.0010
0.0005
0.0000
Jan
Feb
Mar
Apr
May
Jun
Jul
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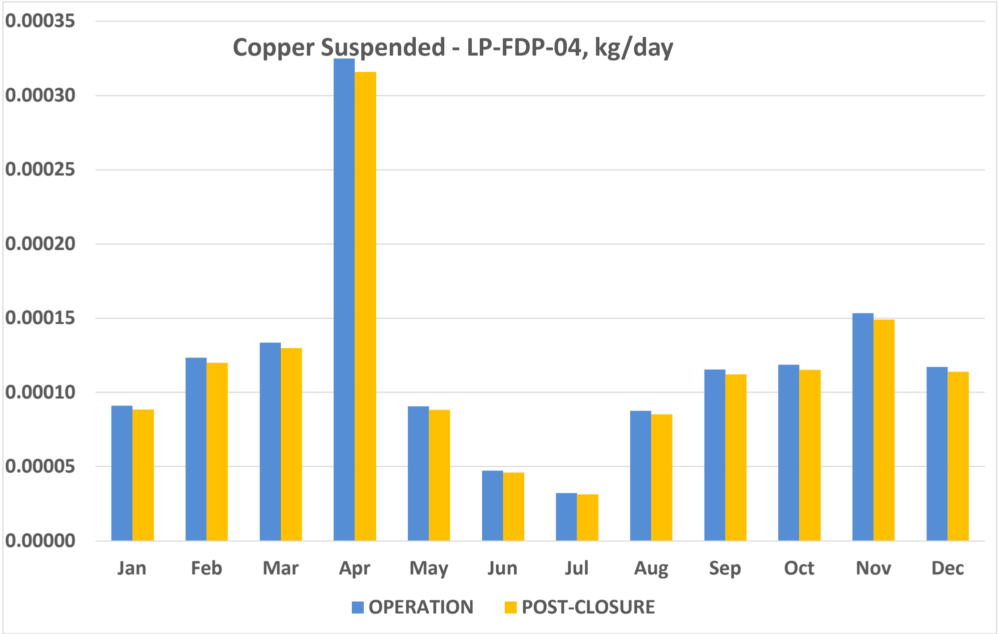
Sep
Oct
Nov
Dec
OPERATION
POST-CLOSURE


Copper Suspended - LP-FDP-04, kg/day
0.00035
0.00030
0.00025
0.00020
0.00015
0.00010
0.00005
0.00000
Jan
Feb
Mar
Apr
May
Jun
Jul
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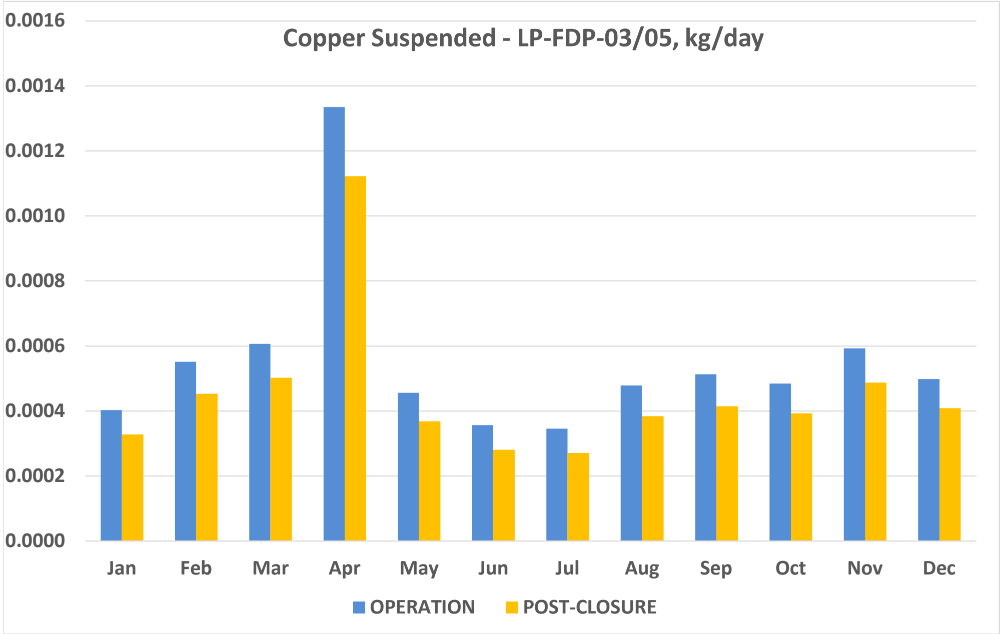
Sep
Oct
Nov
Dec
OPERATION
POST-CLOSURE


Copper Suspended - LP-FDP-03/05, kg/day
0.0016
0.0014
0.0012
0.0010
0.0008
0.0006
0.0004
0.0002
0.0000
Jan
Feb
Mar
Apr
May
Jun
Jul
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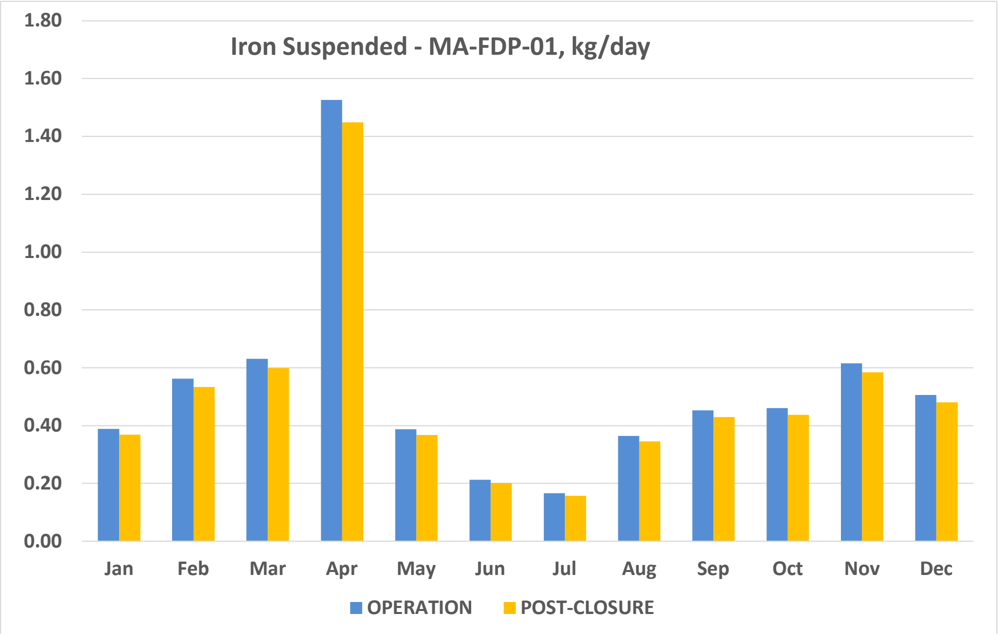
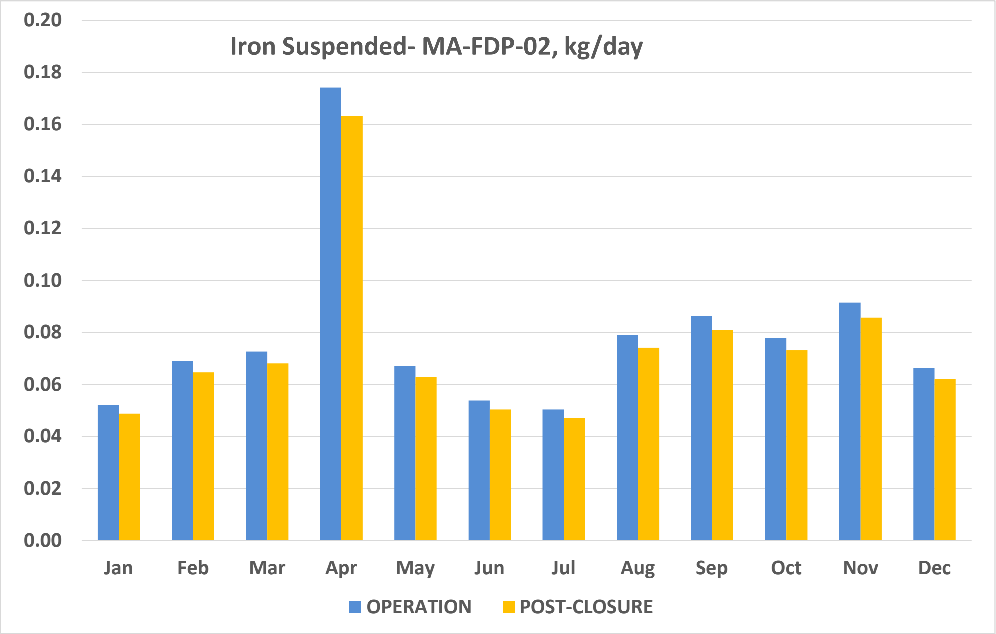
Oct
Nov
Dec
OPERATION
POST-CLOSURE


Iron Suspended - MA-FDP-01, kg/day
1.80
1.60
1.40
1.20
1.00
0.80
0.60
0.40
0.20
0.00
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
OPERATION
POST-CLOSURE


Iron Suspended- MA-FDP-02, kg/day
0.20
0.18
0.16
0.14
0.12
0.10
0.08
0.06
0.04
0.02
0.00
Jan
Feb
Mar
Apr
May
Jun
Jul
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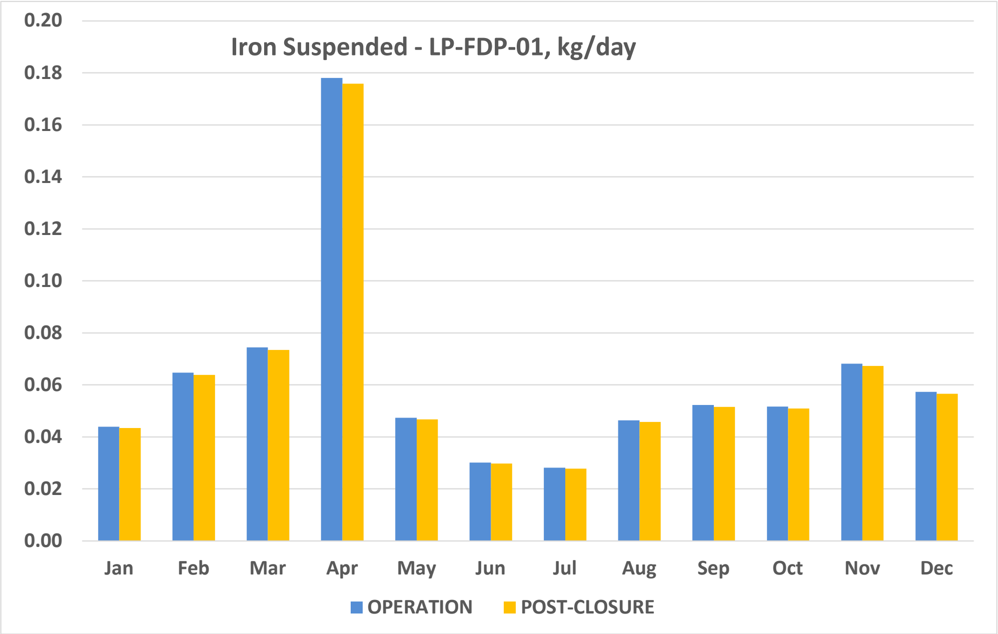
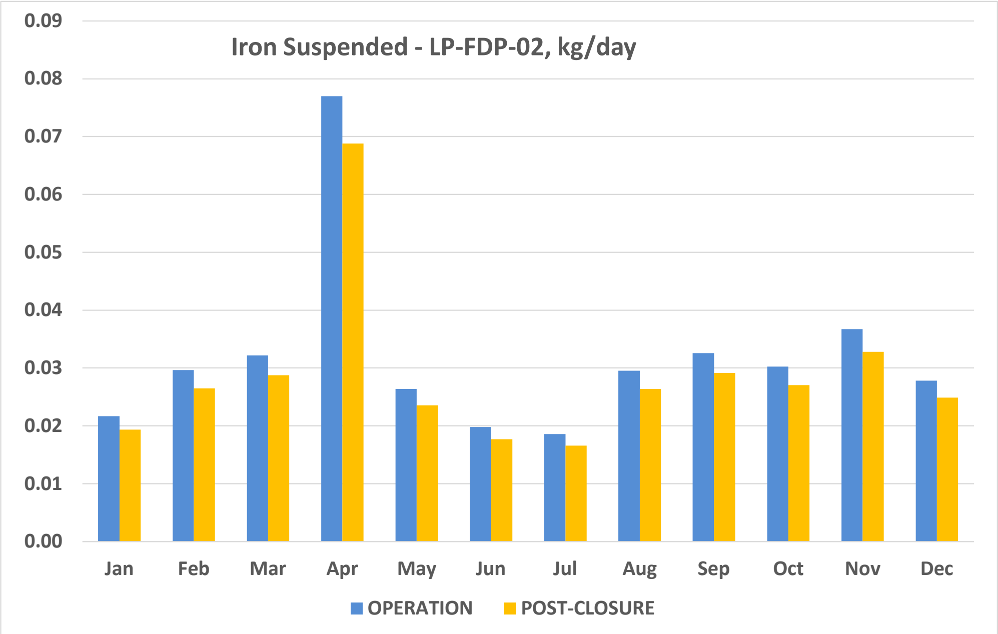
Sep
Oct
Nov
Dec
OPERATION
POST-CLOSURE


Iron Suspended - LP-FDP-01, kg/day
0.20
0.18
0.16
0.14
0.12
0.10
0.08
0.06
0.04
0.02
0.00
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
OPERATION
POST-CLOSURE


Iron Suspended - LP-FDP-02, kg/day
0.09
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0.00
Jan
Feb
Mar
Apr
May
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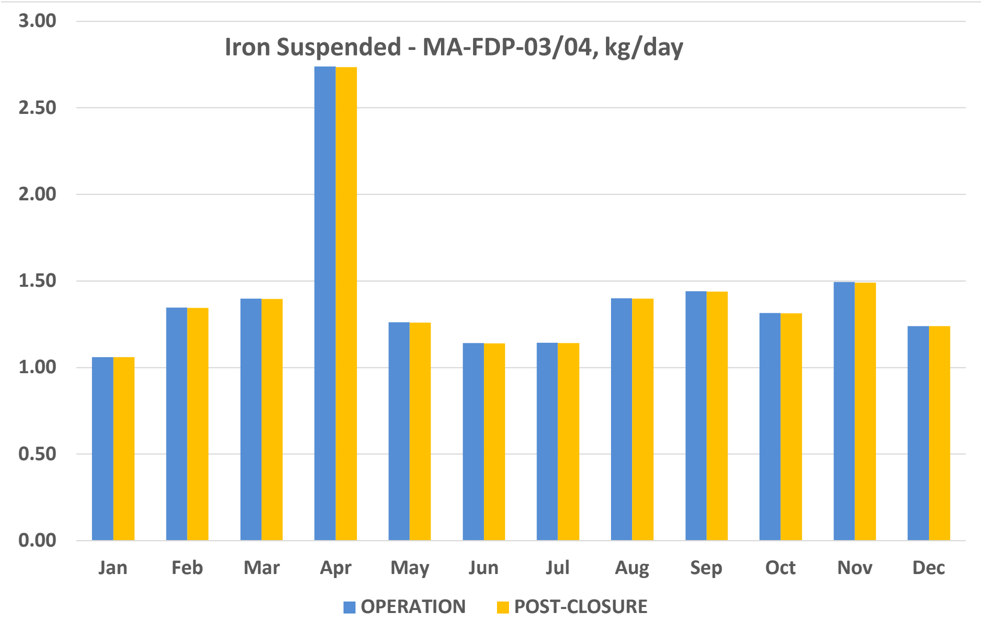
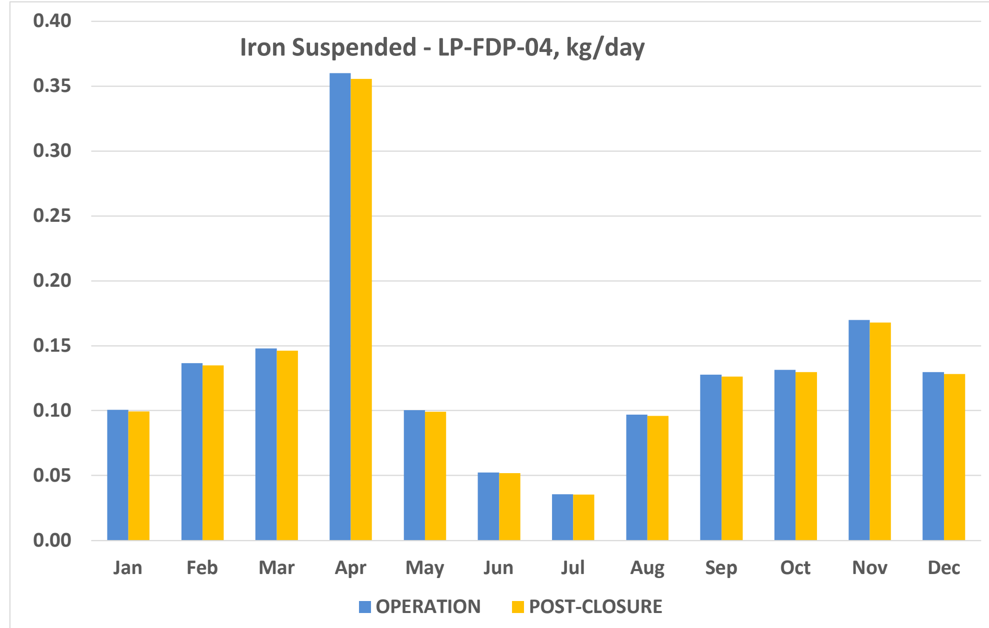
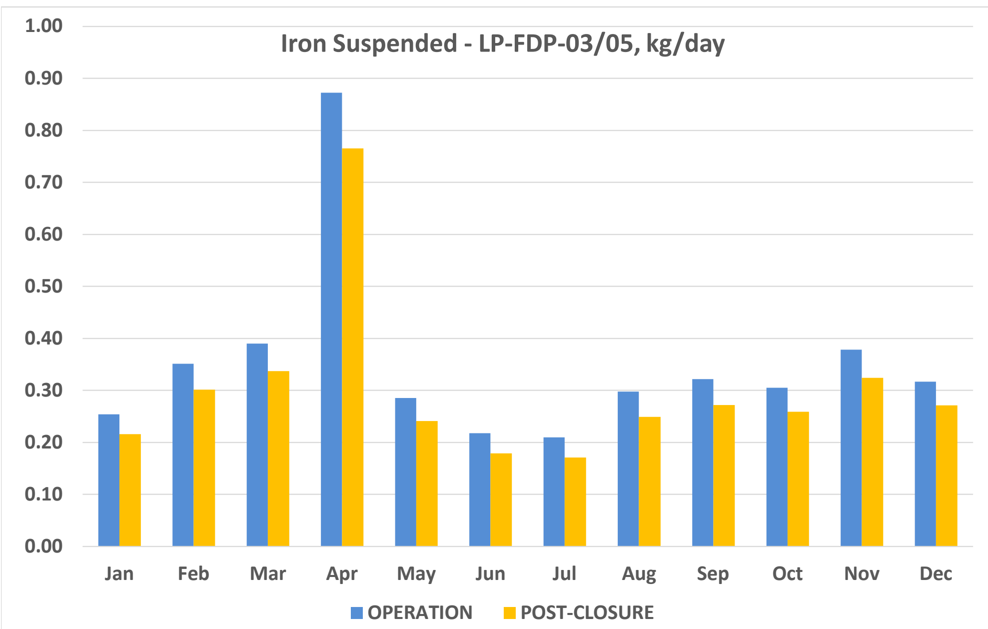
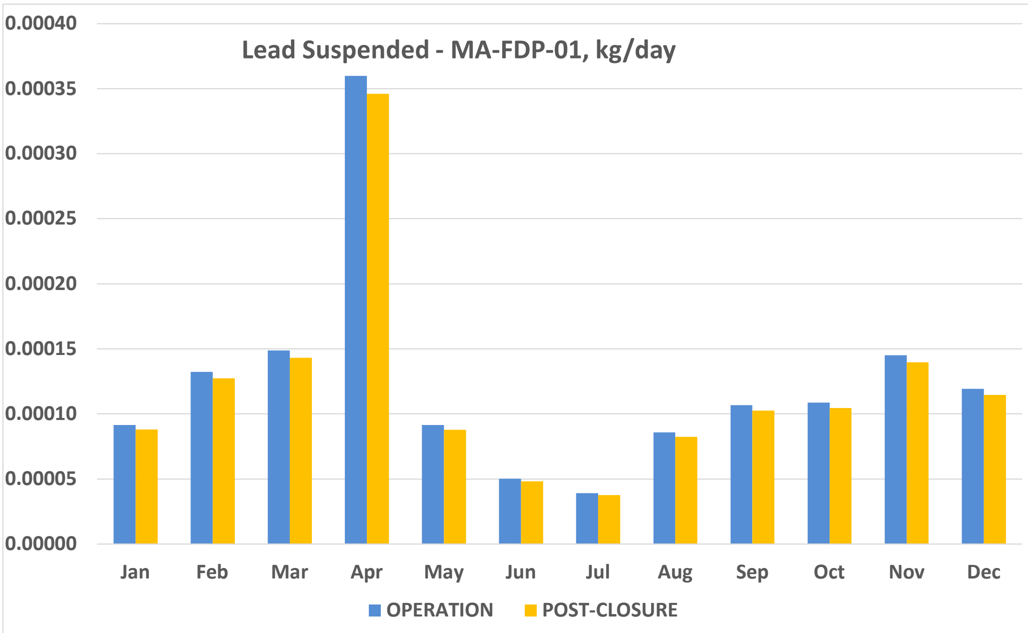
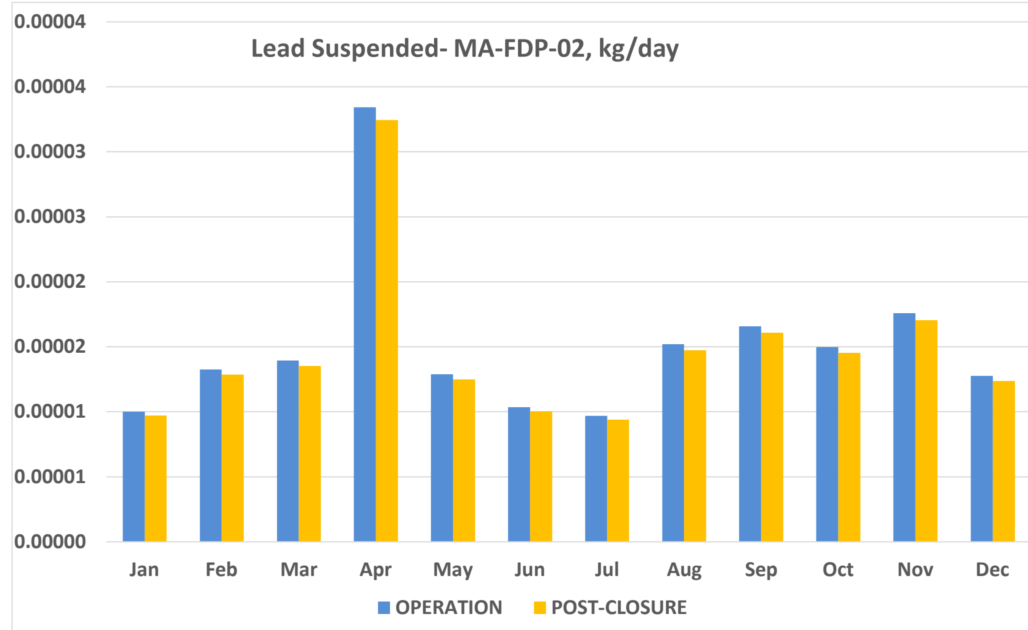
Nov
Dec
OPERATION
POST-CLOSURE

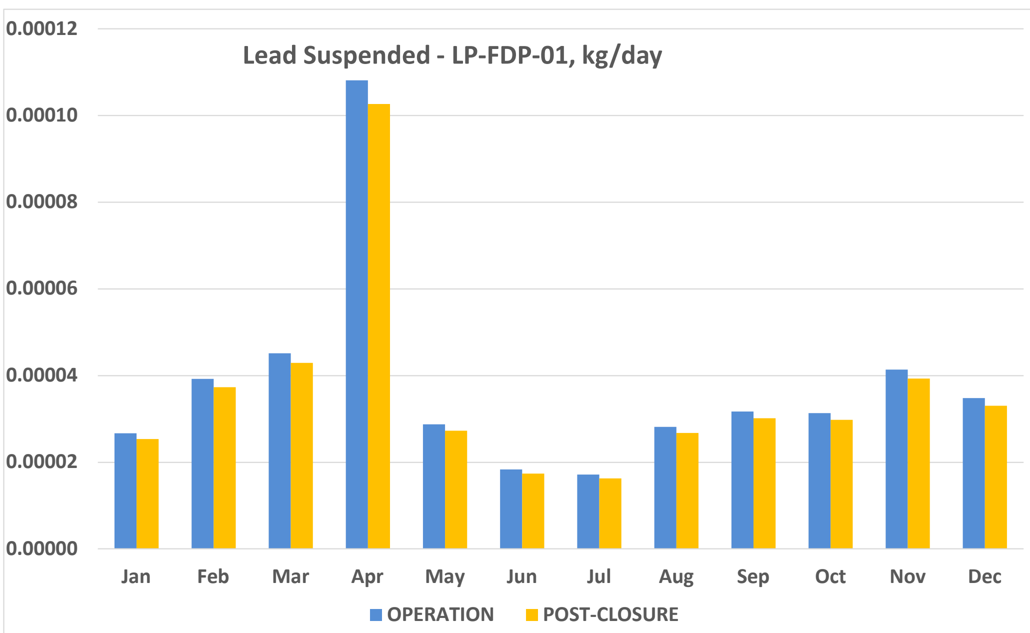

Iron Suspended - MA-FDP-03/04, kg/day
3.00
2.50
2.00
1.50
1.00
0.50
0.00
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
OPERATION
POST-CLOSURE

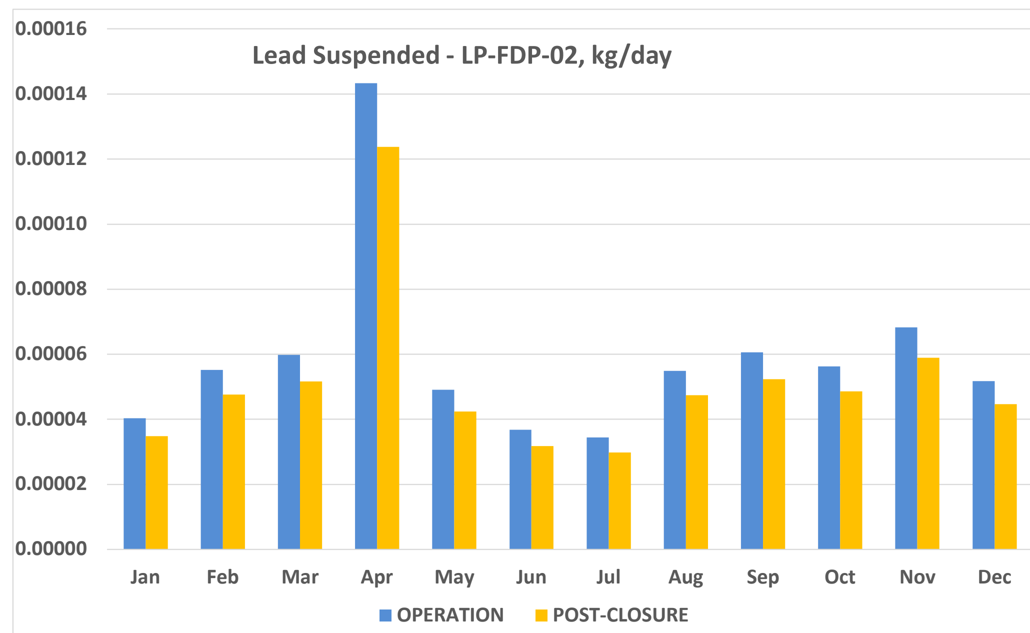

Iron Suspended - LP-FDP-04, kg/day
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
OPERATION
POST-CLOSURE

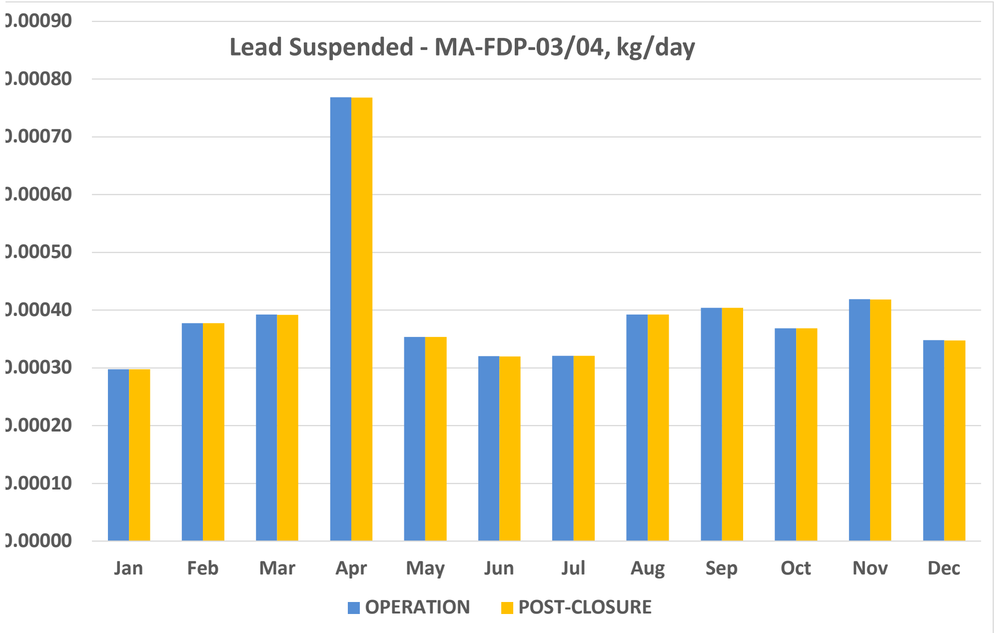

Iron Suspended - LP-FDP-03/05, kg/day
1.00
0.90
0.80
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
OPERATION
POST-CLOSURE

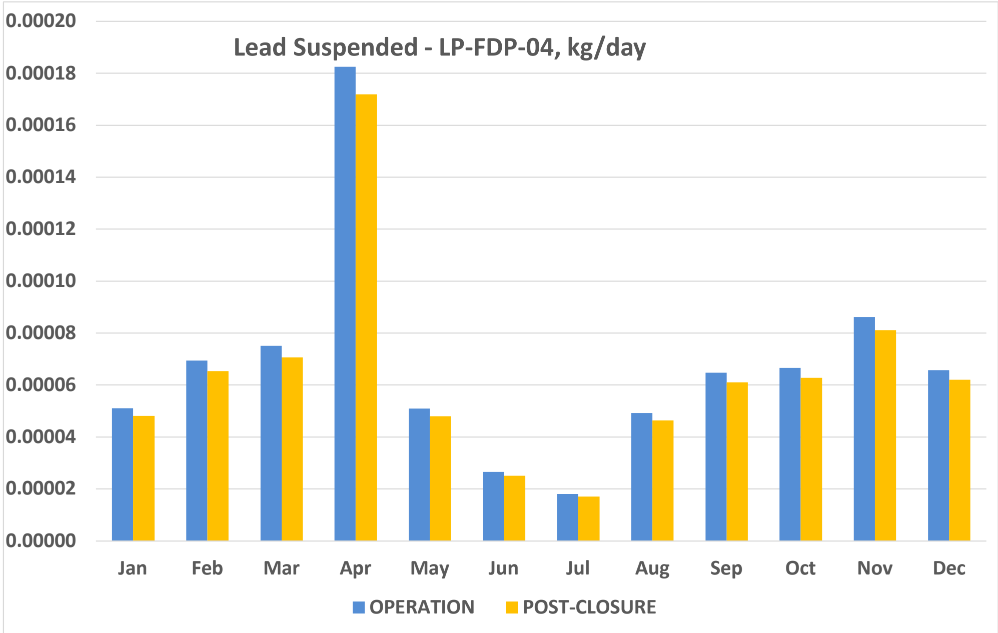

Lead Suspended - MA-FDP-01, kg/day
0.00040
0.00035
0.00030
0.00025
0.00020
0.00015
0.00010
0.00005
0.00000
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
OPERATION
POST-CLOSURE

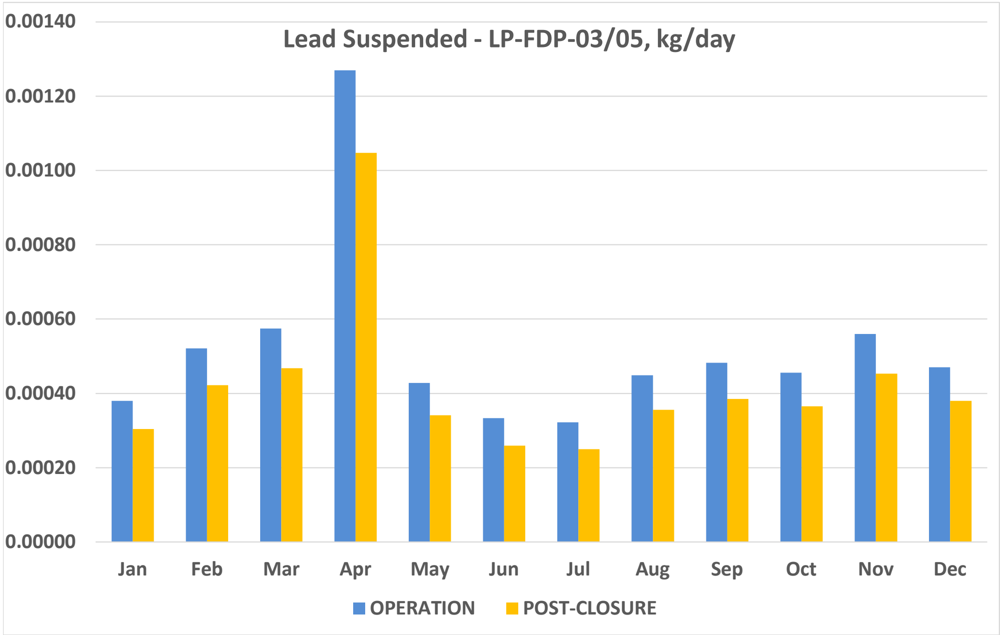

Lead Suspended- MA-FDP-02, kg/day
0.00004
0.00004
0.00003
0.00003
0.00002
0.00002
0.00001
0.00001
0.00000
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
OPERATION
POST-CLOSURE

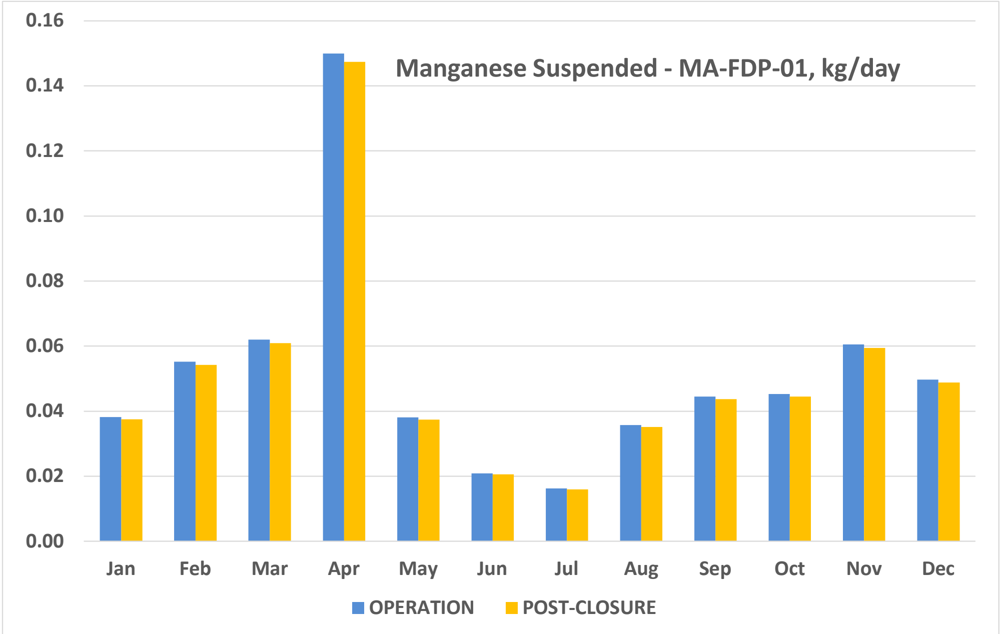

Lead Suspended - LP-FDP-01, kg/day
0.00012
0.00010
0.00008
0.00006
0.00004
0.00002
0.00000
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
OPERATION
POST-CLOSURE


Lead Suspended - LP-FDP-02, kg/day
0.00016
0.00014
0.00012
0.00010
0.00008
0.00006
0.00004
0.00002
0.00000
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
OPERATION
POST-CLOSURE


Lead Suspended - MA-FDP-03/04, kg/day
0.00090
0.00080
0.00070
0.00060
0.00050
0.00040
0.00030
0.00020
0.00010
0.00000
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
OPERATION POST-CLOSURE


Lead Suspended - LP-FDP-04, kg/day
0.00020
0.00018
0.00016
0.00014
0.00012
0.00010
0.00008
0.00006
0.00004
0.00002
0.00000
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
OPERATION POST-CLOSURE


Lead Suspended - LP-FDP-03/05, kg/day
0.00140
0.00120
0.00100
0.00080
0.00060
0.00040
0.00020
0.00000
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
OPERATION POST-CLOSURE


Manganese Suspended - MA-FDP-01, kg/day
0.16
0.14
0.12
0.10
0.08
0.06
0.04
0.02
0.00
Jan
Feb
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Jun
Jul
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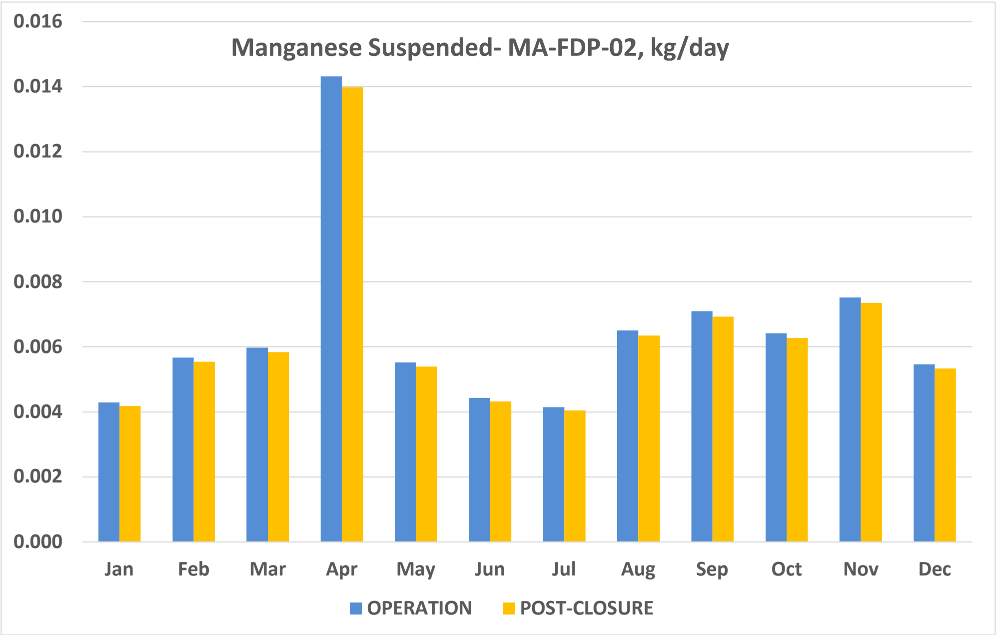
Sep
Oct
Nov
Dec
OPERATION
POST-CLOSURE


Manganese Suspended- MA-FDP-02, kg/day
0.016
0.014
0.012
0.010
0.008
0.006
0.004
0.002
0.000
Jan
Feb
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Jun
Jul
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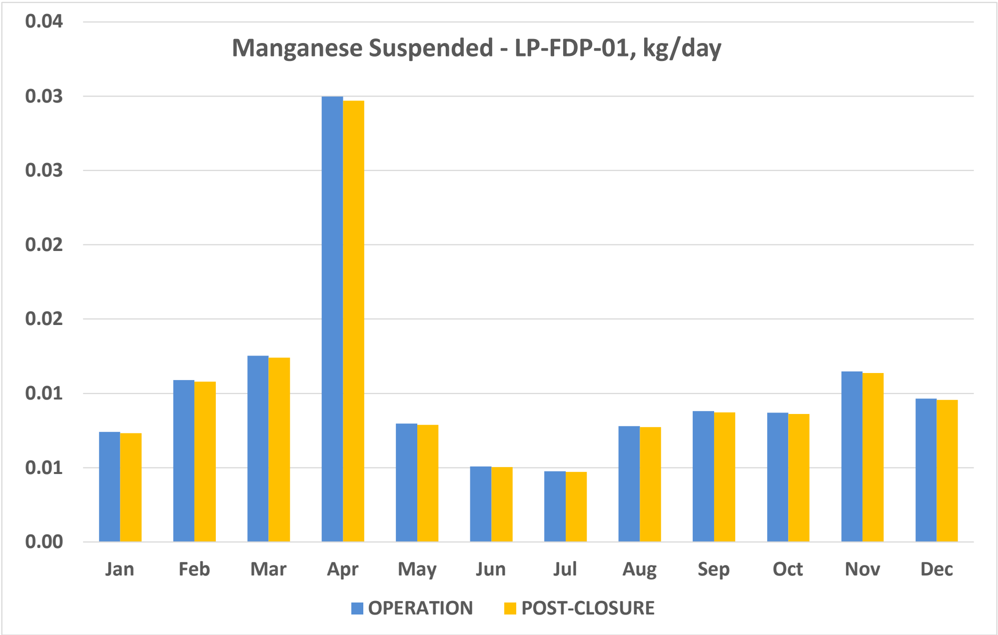
Sep
Oct
Nov
Dec
OPERATION
POST-CLOSURE


Manganese Suspended - LP-FDP-01, kg/day
0.04
0.03
0.03
0.02
0.02
0.01
0.01
0.00
Jan
Feb
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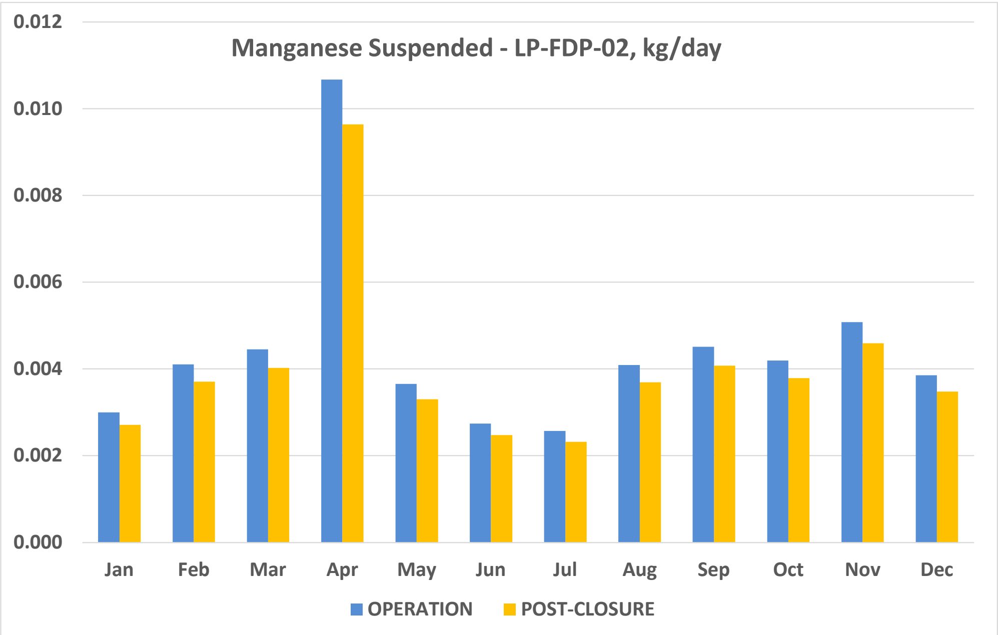
Nov
Dec
OPERATION
POST-CLOSURE


Manganese Suspended - LP-FDP-02, kg/day
0.012
0.010
0.008
0.006
0.004
0.002
0.000
Jan
Feb
Mar
Apr
May
Jun
Jul
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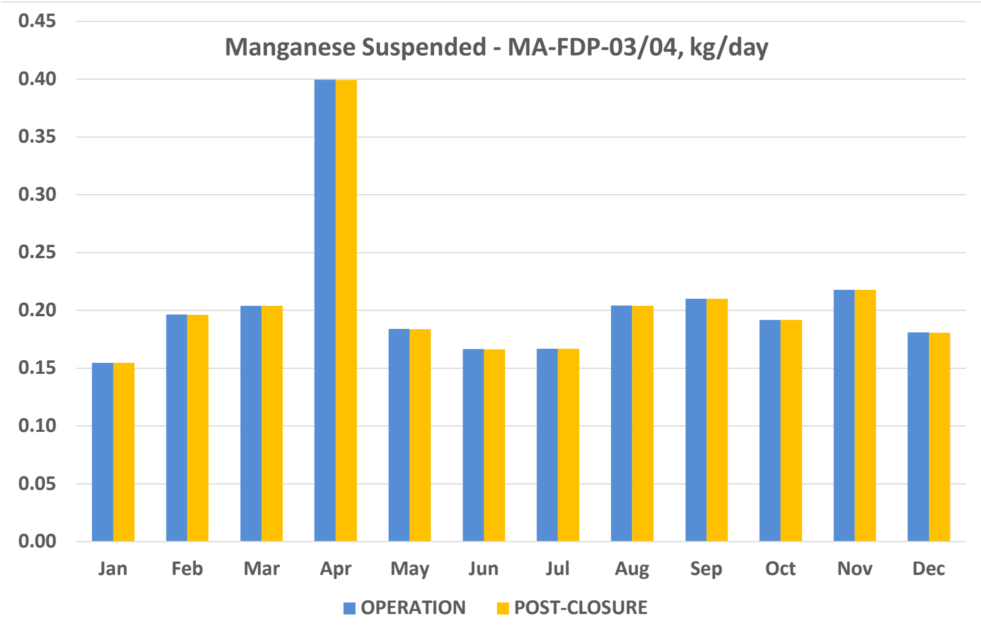
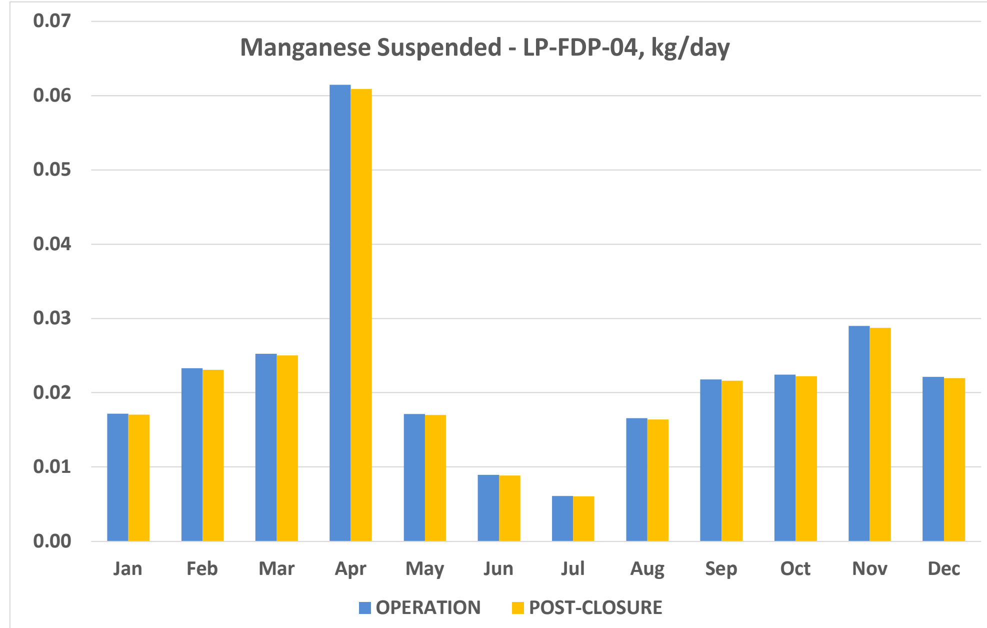
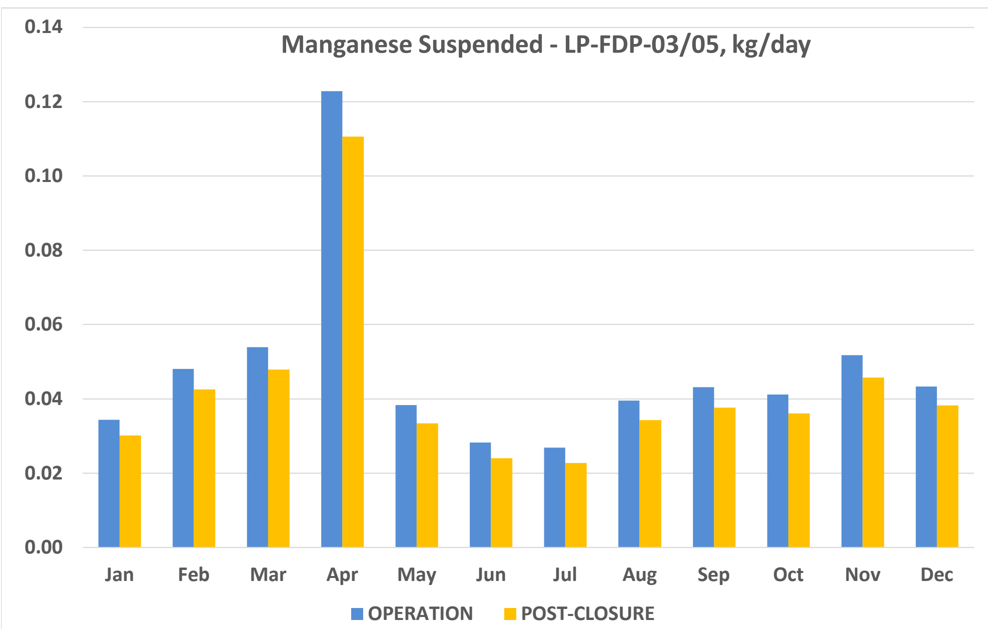
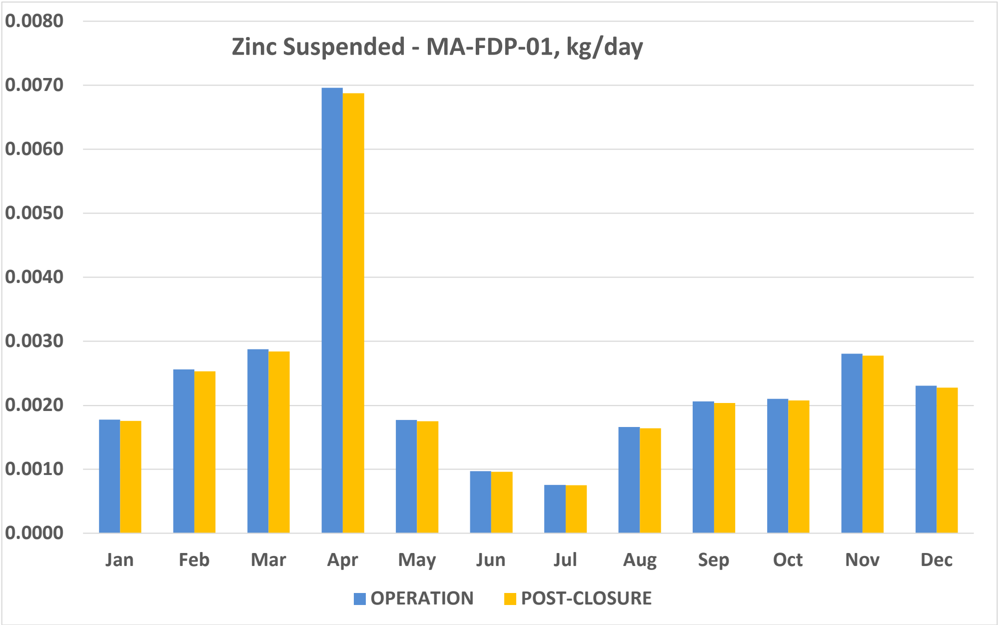
Sep
Oct
Nov
Dec
OPERATION
POST-CLOSURE


Manganese Suspended - MA-FDP-03/04, kg/day
0.45
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
OPERATION POST-CLOSURE


Manganese Suspended - LP-FDP-04, kg/day
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0.00
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
OPERATION POST-CLOSURE


Manganese Suspended - LP-FDP-03/05, kg/day
0.14
0.12
0.10
0.08
0.06
0.04
0.02
0.00
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
OPERATION POST-CLOSURE


Zinc Suspended - MA-FDP-01, kg/day
0.0080
0.0070
0.0060
0.0050
0.0040
0.0030
0.0020
0.0010
0.0000
Jan
Feb
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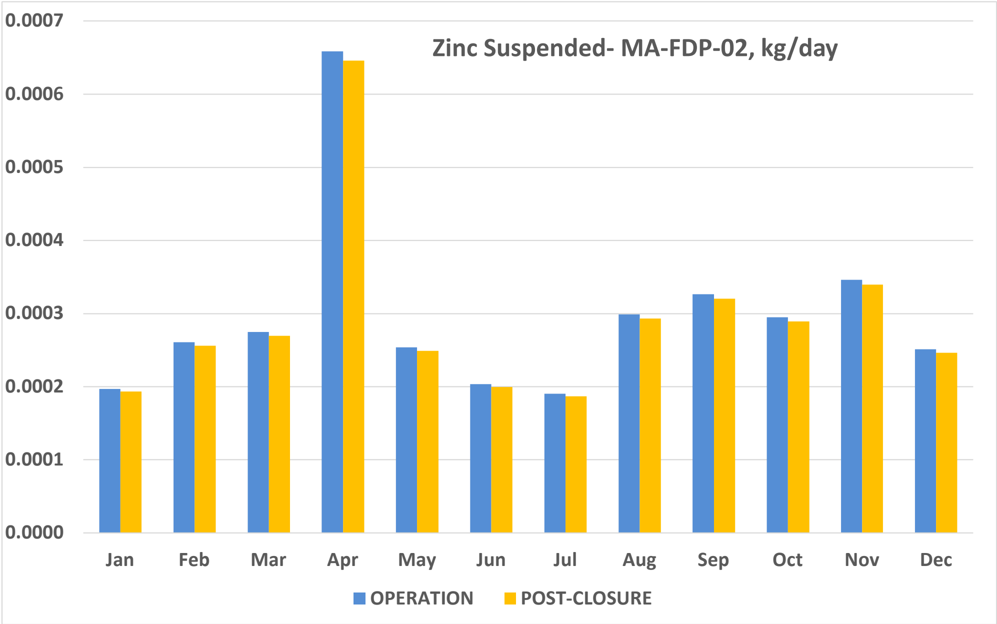
Nov
Dec
OPERATION
POST-CLOSURE


Zinc Suspended- MA-FDP-02, kg/day
0.0007
0.0006
0.0005
0.0004
0.0003
0.0002
0.0001
0.0000
Jan
Feb
Mar
Apr
May
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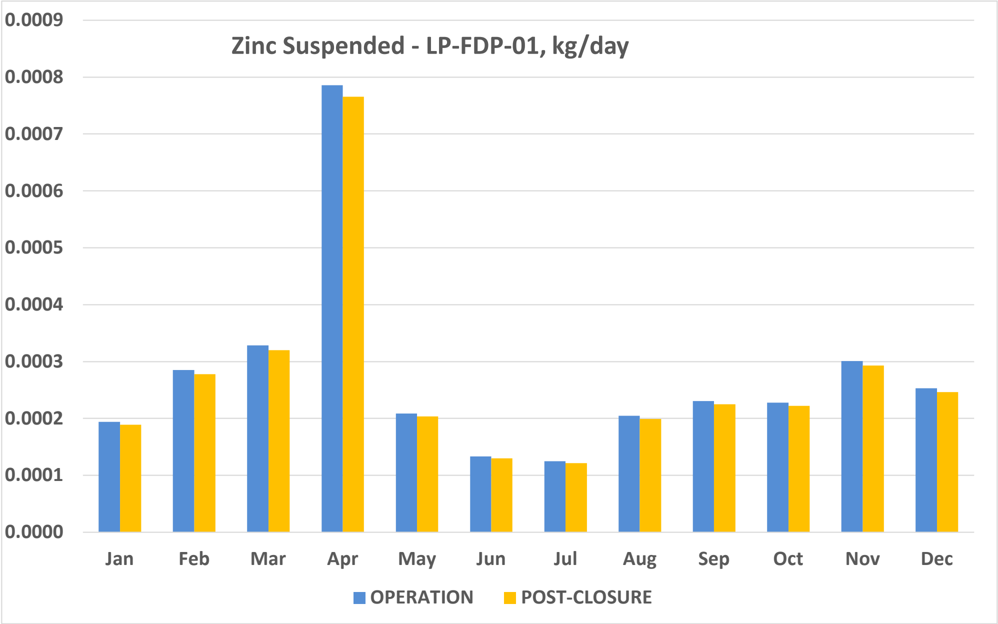
Jul
Aug
Sep
Oct
Nov
Dec
OPERATION
POST-CLOSURE


Zinc Suspended - LP-FDP-01, kg/day
0.0009
0.0008
0.0007
0.0006
0.0005
0.0004
0.0003
0.0002
0.0001
0.0000
Jan
Feb
Mar
Apr
May
Jun
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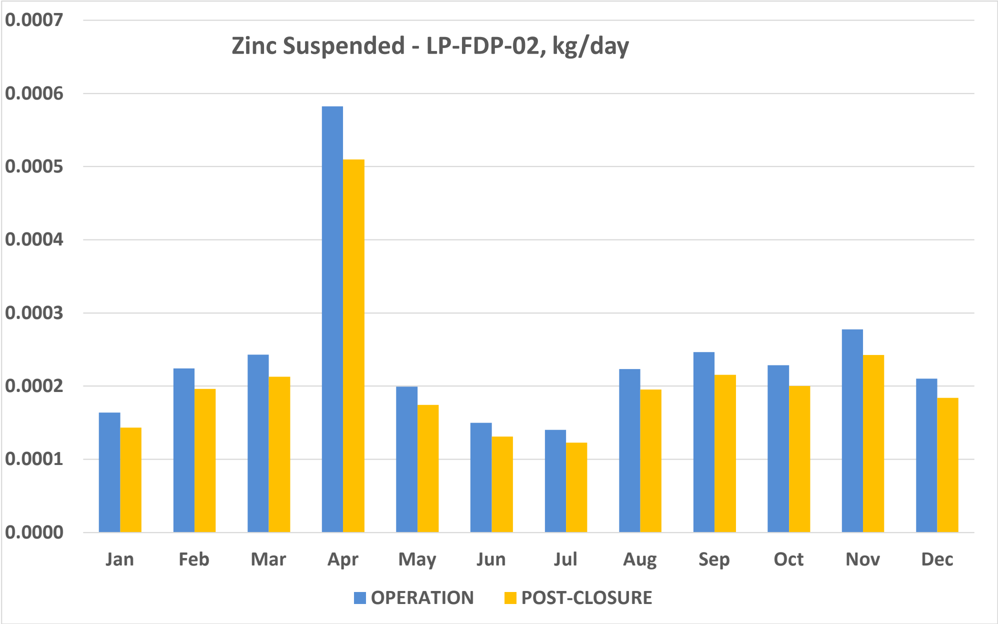
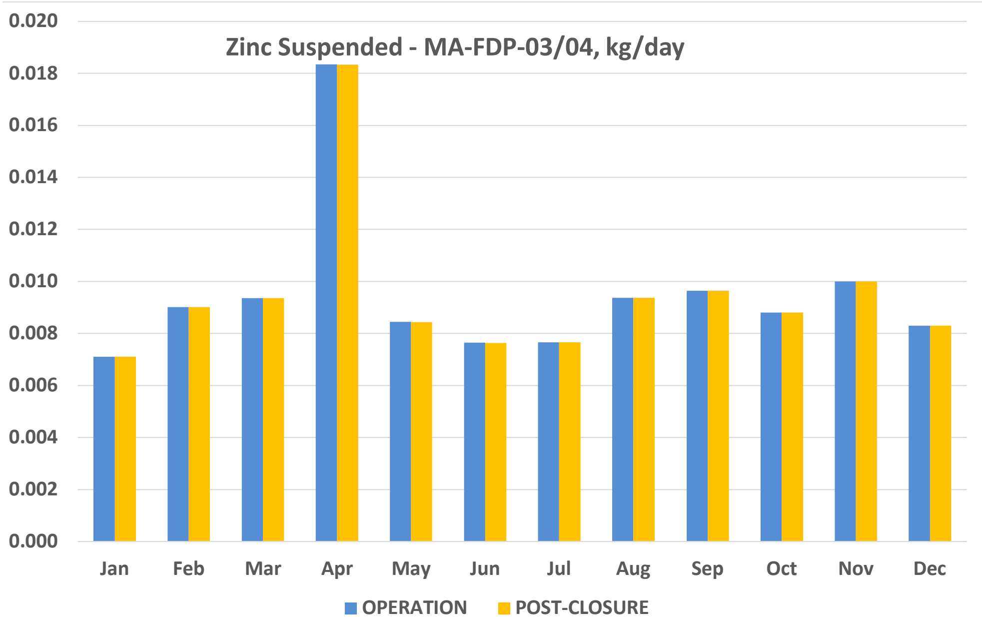
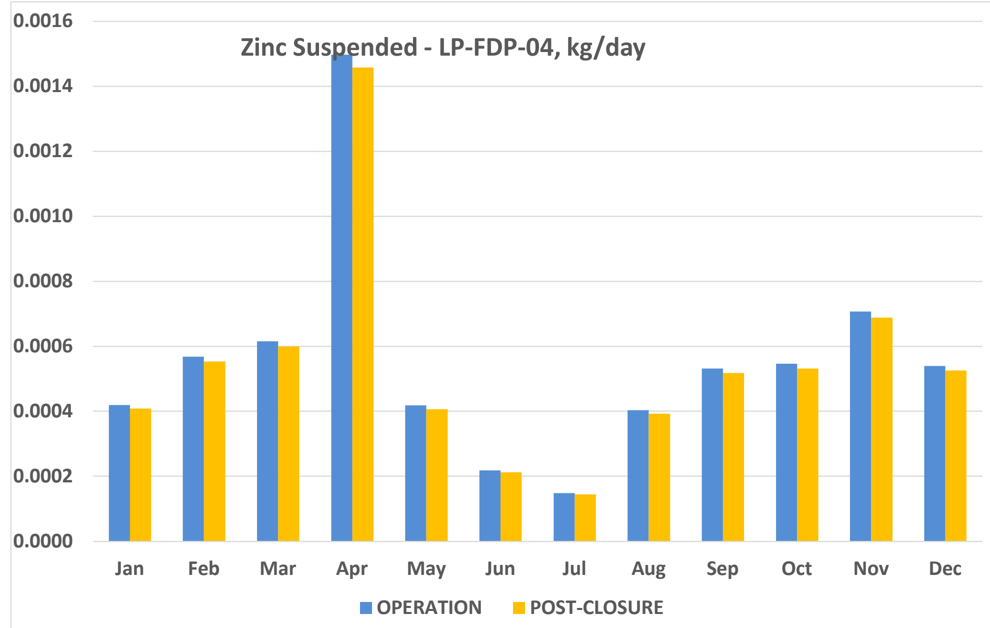
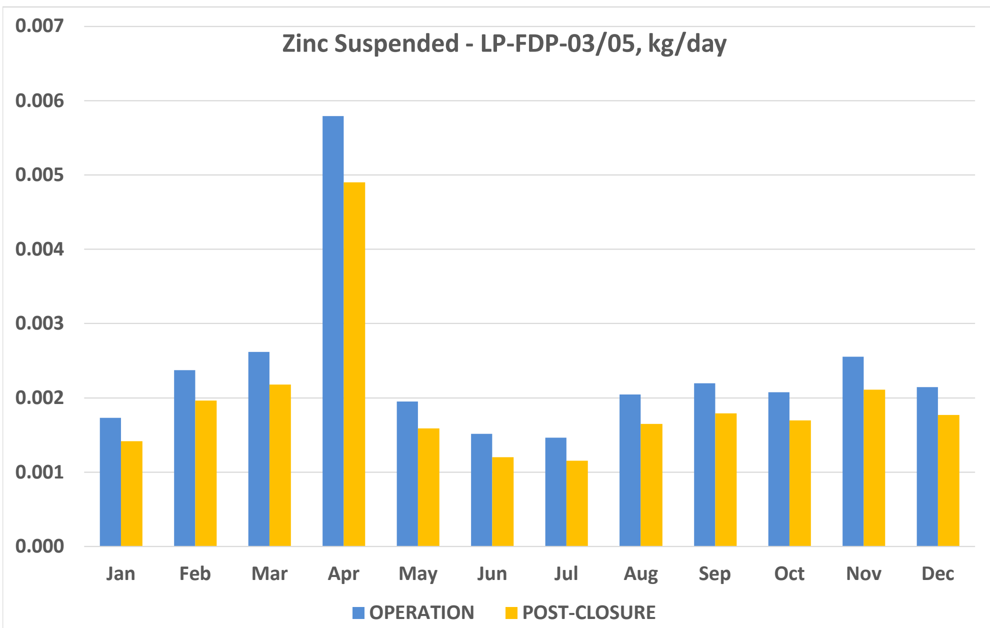
Nov
Dec
OPERATION
POST-CLOSURE


Zinc Suspended - LP-FDP-02, kg/day
0.0007
0.0006
0.0005
0.0004
0.0003
0.0002
0.0001
0.0000
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
OPERATION
POST-CLOSURE


Zinc Suspended - MA-FDP-03/04, kg/day
0.020
0.018
0.016
0.014
0.012
0.010
0.008
0.006
0.004
0.002
0.000
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
OPERATION POST-CLOSURE


Zinc Suspended - LP-FDP-04, kg/day
0.0016
0.0014
0.0012
0.0010
0.0008
0.0006
0.0004
0.0002
0.0000
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
OPERATION POST-CLOSURE


Zinc Suspended - LP-FDP-03/05, kg/day
0.007
0.006
0.005
0.004
0.003
0.002
0.001
0.000
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
OPERATION POST-CLOSURE