Environmental and Social Impact Assessment for the Troilus Mine Project

HYDROGEOLOGY

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Acronyms and Abbreviations

CU	Coefficient of uniformity
CV	Conservation value
ESIA	Environmental and Social Impact Assessment
GCC	Grand Council of the Crees
GWL	Groundwater Level
HIS	Hydrogeological Information System
IAA	Impact Assessment Act
JBNQA	James Bay and Northern Quebec Agreement
LEET	In-trench landfill
LQE	Environment Quality Act
LSA	Local Study Area
mamsl	Meters above mean sea level
MDMER	Metal and Diamond Mining Effluent Regulations
MELCCFP	Ministry of the Environment, the Fight against Climate Change, Wildlife and Parks
MW	Monitoring Well
NE	Northeast
NQIA	Northern Quebec Inuit Association
PDA	Project Development Area
PT	Pumping Test
PZ	Piezometer
REAFIE	Regulation respecting the supervision of activities in relation to their impact on the environment
RSA	Regional Study Area
SO	Southwest
SWL	Surface Water Level
SWL	Surface Water Level

13. Hydrogeology

13.1 Scope of Assessment

13.1.1 Regulatory and Policy Setting

The Troilus Gold Corp (Troilus) mining project is located in the Eeyou Istchee James Bay territory, in the Nord-du-Québec region. As such, it is governed by the James Bay and Northern Quebec Agreement (JBNQA) signed in 1975 between the governments of Canada and Quebec, the Grand Council of the Crees(GCC) and the Northern Quebec Inuit Association (NQIA).

Among other things, the JBNQA divides the territory into Category I, II and III lands. Category I lands are reserved for the exclusive use of the Crees, while Category II lands, contiguous to Category I lands, are part of the Québec public domain, where the Crees have exclusive hunting, fishing and trapping rights.

The Troilus project is located on Category III lands, which represent all lands in the territory covered by the Agreement that are not included in Category I or II lands. On these lands, hunting and fishing are permitted for both First Nations and non-natives, although the Crees have exclusive trapping rights for furbearers, and hunting and fishing rights for certain wildlife species.

Mining rights on these Category III lands belong to the provincial government. However, given the interactions of the site's groundwater with surface water, which in many cases corresponds to fish habitat and falls under federal jurisdiction, the design and construction of the project will also have to comply with applicable federal regulations.

Legislation applicable to groundwater includes the following acts, regulations, policies and guidelines.

13.1.1.1 Provincial Regulatory Context

Environment Quality Act (LQE)

The Environmental Quality Act (LQE) requires mining projects to obtain authorizations in compliance with regulations. The main regulations and policies applicable to the groundwater component of the Troilus project are as follows:

- Water withdrawal and protection regulation;
- Regulation respecting the quality of drinking water;
- Land protection and rehabilitation regulation;
- Soil protection and contaminated land rehabilitation policy;
- Groundwater catchment regulation;
- Regulation respecting industrial depollution attestations.

Directive 019 on the mining industry

Under this directive (MDDEP, 2012), the Regulation respecting the supervision of activities in relation to their impact on the environment (REAFIE) specifies, among other things, the activities subject to ministerial authorization, as well as the information and documents required for such an application. Directive 019 (MDDEP, 2012) requires mining projects to submit background groundwater levels and a groundwater monitoring program. Depending on the level of risk associated with mine tailings, protective measures must also be put in place to protect groundwater from contamination. Note that a new version of Directive 019 (MDDEP, 2012) was published on February 13, 2025, but it does not apply to this project due to the assessment process already underway.

13.1.1.2 Federal Regulatory Context

At the federal level, the Troilus project is subject to the Impact Assessment Act (IAA), given that expected ore production exceeds 5,000 t/d (Regulations Designating Physical Activities, SOR/2019-285).

The Metal and Diamond Mining Effluent Regulations (MDMER) impose strict groundwater protection requirements to prevent contamination by toxic substances and heavy metals from mining activities. It requires operators to implement effluent control and treatment measures, including proper tailings management, regular monitoring of groundwater quality, and compliance with pollutant concentration limits. By imposing these obligations, the regulation aims to reduce the risk of spills or leaks of deleterious substances into aquifers, thereby ensuring the protection of groundwater resources essential to human health, the environment and local ecosystems.

13.1.1.3 Regional Regulatory Context

A certificate of non-contravention is required by the regional government of Eeyou Istchee Baie-James for the installation of a groundwater well. This permit authorizes the withdrawal of groundwater or surface water and is required for any project that plans to draw water above certain thresholds. It is essential for a mine project, since water is required for various activities such as drainage, ore processing and domestic uses related to temporary installations. No water catchment facility can be legally built or operated without this permit, which must be obtained before work begins. The form requires a precise description of the abstraction structure, anticipated water volumes, pumping methods and potential environmental impacts. This permit is often part of a broader environmental assessment for a mining project and may include strict conditions for the protection of water and wildlife.

13.1.2 Regulatory Requirements

Under the provincial and federal laws and regulations mentioned above, in an order corresponding to the stages of a generic groundwater characterization study, the groundwater component of the environmental and social impact assessment (ESIA) must provide a complete picture of the hydrogeological environment around a project site. This includes, where applicable, the identification of water wells (domestic, municipal or community), their use, and the aquifer strata they are screened in. It also involves characterizing groundwater-producing geological units, their hydraulic properties, and describing the interactions between groundwater and surface water, including dependent ecosystems. Conceptual and digital 3D maps and models should illustrate flow direction, recharge/discharge zones, and contamination risks for different phases of the project. Water level monitoring must be planned, with rigorous calibration of the numerical model, assessment of uncertainties, and analysis of the possible impact on natural and human environments, especially those of cultural importance.

13.1.3 Influence of Consultation and Engagement

Table 13.1 presents a summary of key information, traditional knowledge and concerns for the hydrogeology project, based on the various consultations carried out.

Table 13.1 Summary of Key Information, Indigenous Knowledge and Concerns for the Project Related to Hydrogeology

Theme	Key Information, Indigenous Knowledge and Concerns	Influence on the Assessment	Where information is addressed in the ESIA
Groundwater sources	Concerns shared by Cree First Nations and land users to ensure drinking water supply and monitor drinking water quality for local users.	The relocation of the Awashish family will ensure that there is no impact on groundwater quality or quantity.	Chapter 14 Section 4.1.3
Preserving the water network	Concerns shared by Cree First Nations and land users to maintain connectivity between Lac Amont (PE2) and Lac A (PE43) to allow fish circulation between these two lakes in Bibou Creek.	The Bibou Creek diversion was designed to maintain water connectivity between Lake A (PE43) and Lac Amont (PE2). This connectivity will be maintained during final restoration.	Chapter 14 Section 4.1.3

13.1.4 Potential Impacts, Pathways and Measurable Parameters

The assessment of the project's potential impacts on groundwater quantity was carried out considering concerns raised by stakeholders, including local communities, Cree communities and regulatory agencies. These concerns relate primarily to the availability of water resources for domestic, tourism and traditional uses. Mining, through its pumping, drainage and alteration of the groundwater flow regime, is a major factor that can influence these water resources.

The impact pathways identified result mainly from intensive groundwater pumping to keep pits dry, drainage of underground excavations and modification of hydrogeological flows. These mechanisms can lead to a lowering of aquifer levels, a reduction in the flow of drinking water springs and wells, and a drying up of wetlands and watercourses connected to aquifers. These impacts are likely to disproportionately affect certain populations, particularly land users who depend directly on groundwater for their water supply.

To quantify these impacts, several measurable parameters have been selected, such as the piezometric level of aquifers, the flow rate of springs and rivers connected to aquifers, and the rate of aquifer recharge. These indicators make it possible to objectively assess the extent of hydrogeological modifications and verify their compliance with established regulatory thresholds.

Table 13.2 summarizes the potential impacts identified, linking them to the project phases concerned (construction, operation, closure) and the appropriate monitoring parameters. These analyses will help establish appropriate mitigation measures to minimize adverse impacts on groundwater availability and ensure sustainable management of the resource.

Table 13.2 Potential impacts, Impacts pathways and measurable parameters for hydrogeology

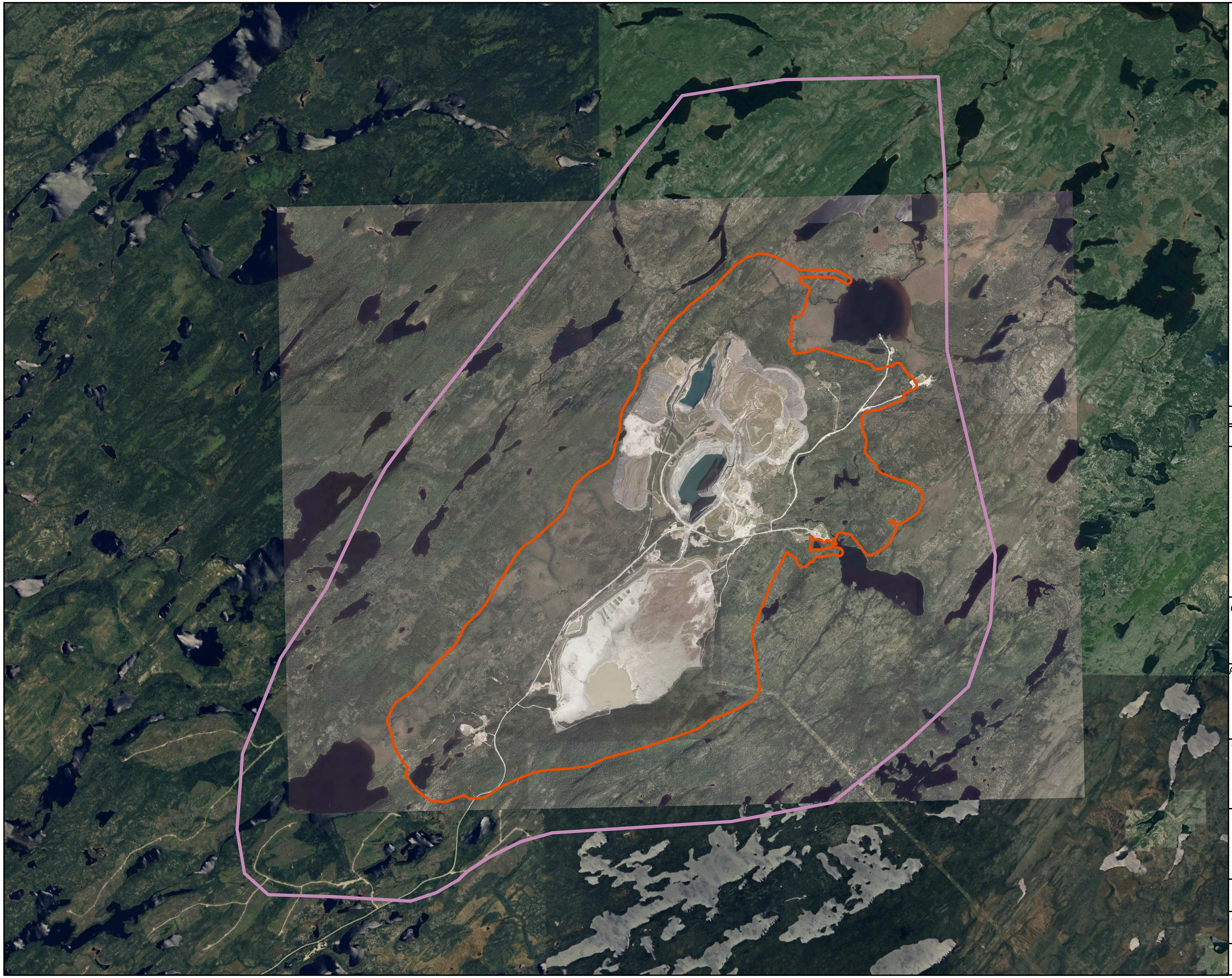
Potential impact	Impact Pathway	Measurable Parameters and Units of Measurement	Project Phase Concerned
Lowering or raising of aquifer levels	Intensive pumping for mining. Drainage of pits disturbing the water balance. Construction of permanent infrastructure. Changes in groundwater flow direction due to excavations. Accidental connection between deep and shallow aquifers.	Water table piezometric level (m) Pit seepage rate (m^3/s) Modeling of underground flows (m3/d) Hydraulic conductivity of geological formations (m/s)	Construction, operations and closure
Reduced flow from community springs and wells	Decrease in natural aquifer recharge due to prolonged mining operations.	Spring and well discharge (m^3/s) Water table piezometric level (m)	Exploitation and closure
Reduced recharge of local aquifers	Destruction of soils and vegetation limiting rainwater infiltration. Sealing of surfaces due to mining infrastructures.	Aquifer recharge rate (mm/year) Soil sealing rate (%)	Construction, operations and closure
Drainage of wetlands and watercourses dependent on aquifers	Lowering of groundwater levels, interrupting water supply to aquatic ecosystems near the mine site.	Area of wetlands affected (ha) Flow of rivers connected to aquifers (m^3/s)	Operations and closure

13.1.5 Spatial and Temporal Boundaries

13.1.5.1 Spatial Boundaries

For hydrogeology, the Local Study Area (LSA) has been defined (Map 13.1) according to the extent of the expected drawdown cone, i.e. the area in which groundwater pumping and drainage associated with mining activities could lead to a measurable drop in water table levels. This approach makes it possible to include areas where direct and indirect impacts on groundwater availability can be assessed with a higher degree of confidence, while taking into account the concerns of local stakeholders, notably land users.

As for the Regional Study Area (RSA), it was determined (Map 13.2) in conjunction with the one used for the surface water assessment. This integrated approach ensures a coherent analysis of interactions between groundwater and watercourses, particularly in areas where aquifers feed wetlands and river systems. The RSA also establishes the necessary framework for assessing cumulative impacts, taking into account past, present and foreseeable projects that may influence groundwater resources on a wider scale. Its scope has been defined to encompass areas where hydrogeological changes could have a significant impact on water uses.



LÉGENDE / LEGEND

Zone de développement du projet / Project development area

Zone d'étude locale /Local Study Area

RÉV.	DESCRIPTION	AA/MM/YY	BY	VERIF.
1				

RÉFÉRENCES/REFERENCES

Zones d'étude: BluMetric, 18 June 2025
Base Map: Bing, 06 June 2023

NOTES

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CLIENT

Troilus Gold Corp.

PROJET/PROJECT

Étude d'impact sur l'environnement et le milieu social pour le projet de mine Troilus / Environmental and Social Impact Assessment for the Troilus Mine Project

TITRE/TITLE

Zone d'étude locale / Local Study Area

BluMetric® Environnement — Stantec

NO. PROJET / PROJECT NO.	DATE
240433 / 167040485	06/ 18/ 2025

CONÇU / CHECKED	RÉVISÉ / VERIFIED
É. Hudon-Gagnon	C. Gardois

DESSINÉ / DRAWN	Figure No.	ED./REV.
M. Baker	13.1	1

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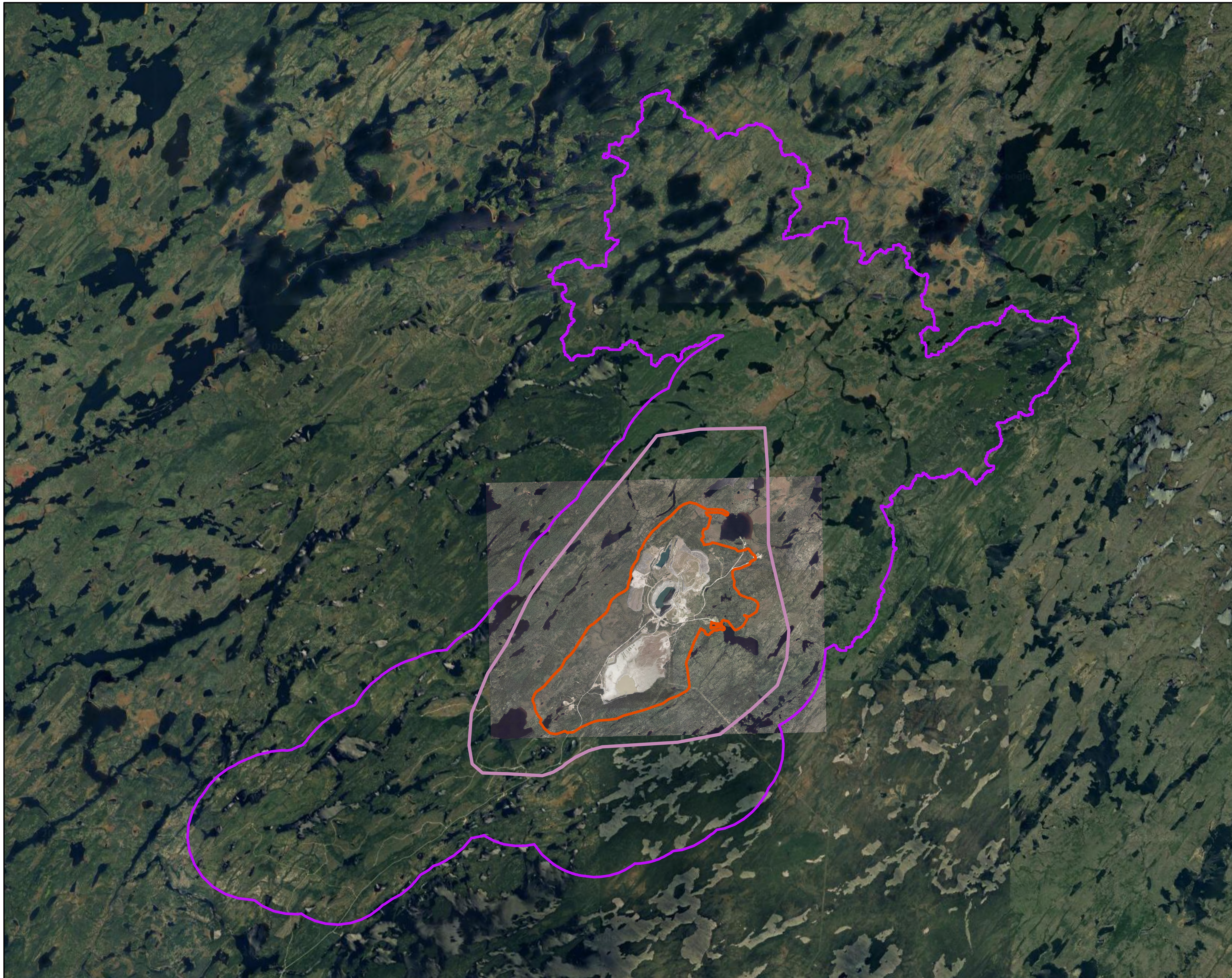

LÉGENDE / LEGEND

- Zone de développement du projet / Project development area
- Zone d'étude locale / Local Study Area
- Zone d'étude régionale / Regional Study Area

RÉV.	DESCRIPTION	AA/MM/YY	BY	VERIF.
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RÉFÉRENCES/REFERENCES

Zones d'étude: BluMetric, 18 June 2025
Base Map: Bing, 06 June 2023

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CLIENT

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PROJET/PROJECT

Étude d'impact sur l'environnement et le milieu social pour le projet de mine Troilus / Environmental and Social Impact Assessement for the Troilus Mine Project

TITRE/TITLE

Zone d'étude régionale / Regional Study Area

BluMetric® Environnement — Stantec

NO. PROJET / PROJECT NO.	*DATE*	
240433 / 167040485	06/ 18/ 2025	
CONÇU / CHECKED	*RÉVISÉ / VERIFIED*	
É. Hudon-Gagnon	C. Gardois	
DESSINÉ / DRAWN	*Figure No.*	*ED./REV.*
M. Baker	13.2	1

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13.1.5.2 Temporal Boundaries

The temporal boundary of the assessment includes all Project phases from the start of construction through to the end of closure. Based on the current Project schedule, the Project phases include:

- Construction (Year -3 to Year -1)
- Operations
  - Operations phase 1 (Year 1 to Year 21): milling with ore extraction
  - Operations phase 2 (Year 22): milling with no ore extraction
- Decommissioning and closure
  - Active closure (Year 22 to Year 24)
  - Passive closure (Year 24+)

Refer to Chapter 3 of the ESIA (Project Description) for a detailed description of the activities anticipated to occur during each phase.

13.1.6 Residual Impacts Characterization

Table 13.3 Characterization of residual impacts on hydrogeology

Characterization	Description	Quantitative Measure or Definition of Qualitative Categories
Direction	The long-term trend of the residual impact	**Positive -** a residual impact that moves measurable parameters in a direction beneficial to (VC name) relative to baseline. **Adverse** - a residual impact that moves measurable parameters in a direction detrimental to (VC name) relative to baseline. **Neutral -** no net change in measurable parameters for the VC compared with the baseline.
Magnitude	The amount of change in measurable parameters or the VC relative to existing conditions	**No measurable change -** no measurable change in impact can be observed compared to the baseline condition. **Low -** Groundwater drawdown due to the project is expected to be less than 5 m. **Moderate** - Groundwater drawdown due to the project is expected to be between 5 and 10 m. **High -** Groundwater drawdown due to the project is expected to exceed 10 m.
Geographic extent	The geographic area in which a residual impact occurs	**PDA -** residual impacts are limited to the Project Development Area (PDA). **LSA -** residual impacts extend to the LSA. **RSA -** residual impacts extend to the RSA.
Timing	Considers when the residual impact is expected to occur, where relevant to the VC.	**No sensitivity -** The timing selected has no impact on the VC. **Moderate sensitivity -** The impact may occur during an insensitive period of a critical life stage; for many species, this is

Characterization	Description	Quantitative Measure or Definition of Qualitative Categories
		the onset (e.g. groundwater abstraction during important traditional gatherings such as goose hunting). **High sensitivity -** The impact occurs at a critical life stage (e.g. fish spawning or bird nesting) or during culturally significant activities (e.g. fish spawning).
Duration	The time required until the measurable parameter or the VC returns to its existing condition, or the residual impact can no longer be measured or otherwise perceived	**Short term -** residual impact limited to construction, dismantling and active closure phases (<5 years). **Medium-term** - residual impact continues during operation but should diminish after shutdown (5 to 50 years). **Long term** - residual impact extends beyond the life of the project (50 years and more).
Frequency	Identifies how often the residual impact occurs and how often during the project or in a specific phase	**Single event** **Multiple irregular event -** occurs at irregular intervals. **Multiple regular event -** occurs at regular intervals. **Continuous** - occurs continuously
Reversibility	Pertains to whether a measurable parameter or the VC can return to its existing condition after the project activity ceases	**Reversible** - the residual impact is likely to be reversed after completion of the activity and reclamation. **Irreversible** - the residual impact is unlikely to be reversed.

13.1.7 Significance Definition

The significance of residual impacts is determined by the following thresholds:

- Negligible or low: Impacts on groundwater quantity are limited or negligible if they result in a minimal or low variation in groundwater level or flow, which is short-lived, localized, infrequent and reversible. Withdrawals or hydrogeological modifications have no significant impact on aquifer recharge or on access to water resources for land users. Mitigation measures make it possible to maintain reference conditions virtually unchanged;
- Moderate : Impacts are considered moderate if withdrawals or hydrogeological disturbances cause a measurable but partially reversible decrease in groundwater level or flow, temporarily affecting certain wells or groundwater-dependent ecosystems. Impacts may be localized, but of longer duration, and require mitigation measures to limit their extent. Although the impact may be perceptible to some land users, it does not lead to a critical reduction in available water resources;
- High: Impacts are deemed high when withdrawals or disturbances result in a significant, permanent or long-term drop in groundwater levels or flows, compromising aquifer recharge and access to water for local ecosystems and users. The impact is spatially widespread, frequent, irreversible or difficult to mitigate. It can lead to a significant loss of the resource, with a high risk for communities, traditional Cree uses and vulnerable ecosystems. The effectiveness of mitigation measures is uncertain or insufficient to avoid major consequences.

13.2 Existing Conditions

13.2.1 Methods

The hydrogeological context of the site and the impact of mining operations on the site prior to the establishment of the mine in 1996 are summarized here from information drawn from the following reports:

- Geocon, July 1993, Hydrological and Hydrogeological Study - Project Troilus;
- Genivar, 2009, Closure and Restoration Plan of Troilus Site.

The existing hydrogeological context is based on the results of hydrogeological investigations carried out between 2020 and 2022, included in the hydrogeological study of the projected pits carried out in 2022 (Golder, 2022), and updated in April 2024 (WSP, 2024c)) (see Appendix G1.9 of the ESIA), and groundwater quality monitoring in 2022 and 2023 (WSP, 2024a and b) (Appendices G1.10 and G.1.11 of the ESIA), in addition to the results of hydrogeological database searches. In addition, a numerical groundwater flow model was developed (BluMetric, 2025) to provide a groundwater balance and reference conditions (Appendix H.6 of the ESIA).

Observations from boreholes in unconsolidated deposits and in bedrock, piezometric readings from installed wells, and the results of hydrogeological tests and chemical analyses of groundwater samples taken on site provide local and regional hydrogeological representation.

Hydrogeological data collected to date during field work includes:

- Thirty-two hydraulic tests with pneumatic packers (*packer tests*), carried out in 11 boreholes to characterize the hydraulic properties of the rock over various intervals covering depths ranging from 15.74 m to 546.00 m below surface;
- Twenty-seven permeability tests (*slug test*) in 18 observation wells, including 15 in overburden or shallow bedrock, 4 in bedrock and 1 in tailings;
- Monitoring the dewatering of the J4 pit, pumped at an average rate of 1,600 m^3/h between July and October 2021;
- Piezometric level measurements in 35 observations well installed on the Troilus mine site (in and around pit areas) during biennial monitoring (summer and fall) between July 2022 and November 2023;
- Continuous monitoring of piezometric levels in five observation wells, coupled with water-level probes in surface water.

13.2.2 Pre-Mining Conditions

13.2.2.1 Hydrostratigraphic Units

Beneath a thin layer of organic deposits (0.22 m on average), two main hydrogeological units have been identified at the site: a till unit, with an average thickness of 6.89 m, and a bedrock unit, with an average depth of 11 m at the top. Organic deposits a few meters thick can also sometimes be observed (Geocon, 1993). In the central part of the site, a layer of sand and gravel and fluvio-glacial deposits are found, generally loose and up to 15 m thick (Geocon, 1993).

The till unit has been subdivided into two sub-units (Techmat (1995) in Genivar (2009)):

- On the surface, a fine to coarse sand with some gravel, of medium grain size, with an average uniformity coefficient (UC) of 6. Its maximum thickness is 13.5 m;
- An underlying level of till itself, with an average grain size of fine to medium silty sand with some gravel, and an average UC of 22 to 35. It extends down to bedrock.

Stratigraphic data from drilling carried out on the site prior to the start of mining operations in September 1996 are presented in Table 13.4.

Table 13.4 Stratigraphy of boreholes drilled prior to the start of mining operations

Borehole	Reference	Thickness (m)			Depth to bedrock (m)	Elevation (mamsl)	
		Organics	Sand	Till		Rock	Soil
TF-01-94	1	0.10	3.90	5.04	9.04	383.05	392,09
TF-02-94	1	2.04	0.00	4.86	6.90	369.20	376,10
TF-03-94	1	0.20	1.88	5.09	6.99	365.63	372,62
TF-04-94	1	0.00	10.00	7.40	-	-	383,39
TF-05-94	1	0.10	2.89	11.72	14.62	361.28	375,90
TF-06-94	1	0.20	0.00	8.92	9.12	363.72	372,84
PM-2	1	1.46	0.00	9.05	10.51	356.35	366,86
PF-1	2	0.00	0.00	11.00	11.00	360.48	371,58
PF-2	2	0.00	13.50	8.00	21.50	357.02	378,52
PH-1	2	1.00	2.00	4.00	7.00	359.25	366,36
FH-2	2	0.00	9.50	0.00	9.50	365.50	375,00
PH-2	2	0.00	0.00	10.60	10.60	360.48	371,72
FH-4	2	0.00	1.50	2.82	4.32	373.68	378,00
PP-13	2	0.00	2.42	0.00	2.42	373.79	376,38
FP-11	2	0.00	5.10	0.00	5.10	374.90	380,00
FP-12	2	0.00	0.00	7.12	7.12	374.88	382,00
PP-10	2	0.00	9.00	11.25	20.75	359.63	380,38
FP-6	2	0.45	1.55	0.00	1.90	385.35	392,00
FP-4	2	0.00	11.00	4.30	15.30	389.70	405,00
PP-3	2	0.00	3.65	7.70	11.35	386.12	397,47
FP-1	2	0.00	11.00	16.85	26.85	391.23	419,08
FP-5	2	0.00	8.86	0.00	8.86	393.14	402,00
PP-2	2	0.00	0.00	28.74	28.74	374.26	403,00
FP-7	2	0.00	2.50	2.23	5.73	384.27	390,00
PP-9	2	0.00	4.00	4.85	8.85	366.34	375,19

Borehole	Reference	Thickness (m)			Depth to bedrock (m)	Elevation (mamsl)	
		Organics	Sand	Till		Rock	Soil
Minimum		0	0.00	0.00	0.00	1.90	356.35
Maximum		2,04	2.04	13.50	28.74	28.74	393.14
Average		0,22	0.22	4.17	6.86	11.00	372.05
Median		0,00	0.00	2.50	5.09	9.08	371.44

Note: mamsl = metres above mean sea level

Source:
1 : Techmat (1995), Genivar (2009)
2: Geocon (1993)

At pit 87, average sand thickness was 1 to 3 m and till thickness 5 to over 7 m (Martin and Frigon (1996), in Genivar (2009)). Two pre-project boreholes at the pit 87 site intercepted 11.1 m of till for one (PF-1) and 13.5 m of sand over 8.0 m of till for the other (PF-2) (Geocon, 1993).

13.2.2.2 Piezometry and Water Flow

According to Geocon (1993), the groundwater elevation measured in September 1992 in two boreholes drilled at pit 87 was 369.88 m in bedrock and 369.68 m in till at borehole PF-2; and 367.34 m in bedrock and 366.14 m in till at borehole PF-1 (Erreur ! Source du renvoi introuvable. 13.5). A slight upward vertical hydraulic gradient was observed, indicating that groundwater flow was partially from bedrock to soils corresponding to a discharge zone.

In the pre-project phase, groundwater was encountered between 3.2 and 6.7 m below surface near the pit 87 site, and between 0.90 and 10.6 m at the site of the existing tailing’s facility (Genivar, 2009).

The overall flow direction was northeastward, consistent with the surface flow network. The flow gradient was 0.5% in the central part, 1% in the northeast, and virtually nil in the tailings area (Geocon, 1993).

Vertical flow was generally upward in boreholes located in the center of the valley, and downward near the rocky reliefs. This would indicate the presence of a groundwater discharge zone in the central part of the valley, and a recharge zone near the rocky reliefs.

Table 13.5 Piezometric data (1992-1994)

Well	Reference	Measurement Date	Static Level below Ground Level (m)	Groundwater Elevation (mamsl)
TF-01-94 S	1	1994-11-28	6.73	375.36
TF-02-94 R	1	1994-11-28	0.26	375.84
TF-03-94 S	1	1994-11-28	0.93	371.69
TF-03-94 R	1	1994-11-28	1.03	371.59
TF-04-94 S	1	1994-11-28	10.59	372.80
TF-05-94 S	1	1994-11-28	3.26	372.64
TF-06-94 S	1	1994-11-28	1.39	371.45
PF-1-S	2	1992-09-15	5.44	366.14

Well	Reference	Measurement Date	Static Level below Ground Level (m)	Groundwater Elevation (mamsl)
PF-1-R	2	1992-09-15	4.24	367.34
PF-2-S	2	1992-09-15	8.84	369.68
PF-2-R	2	1992-09-15	8.64	369.88
PH-1-S	2	1992-09-15	0.23	366.13
PH-1-R	2	1992-09-15	0.11	366.25
PH-2-S	2	1992-09-15	-0.64	372.36
PH-2-R	2	1992-09-15	0	371.72
PP-13-S	2	1992-09-15	2.29	374.09
PP-13-R	2	1992-09-15	0	376.38
PP-10-S	2	1992-09-15	8.00	372.38
PP-10-R	2	1992-09-15	8.06	372.32
PP-3-S	2	1992-09-15	2.16	395.31
PP-3-R	2	1992-09-15	2.49	394.98
PP-2-S	2	1992-09-15	19.05	383.95
PP-2-R	2	1992-09-15	29.92	373.08
PP-9-R	2	1992-09-15	13.45	361.74
PP-2	2	1992-09-15	36.07	403.00
FP-7	2	1992-09-15	24.77	390.00
PP-9	2	1992-09-15	13.54	375.19

Notes: mamsl = metres above mean sea level; *-R= Well in bedrock; *-S= Well in surface deposits.

Sources :
1: Techmat (1995) in Genivar (2009);
2 : Geocon (1993).

13.2.3 Hydrogeological Parameters

The hydraulic conductivity of the sand subunit, calculated at only two sites, is estimated to average 1.67 x 10^{-5}m/s (Techmat, 1994 in Genivar, 2009). In the numerical model, Geocon (1993) used a hydraulic conductivity of 1.0 x 10^{-5} m/s for the sand subunit.

The hydraulic conductivity of the till subunit, estimated from nine tests, is quite variable, from a minimum of 1.0 x 10^{-7} m/s to a maximum of 5.2 x 10^{-5} m/s. However, the average value of 1.12 x 10^{-5} m/s is close to the maximum, representative of the average hydraulic conductivity of the sand.

The hydraulic conductivity of the bedrock unit was estimated by Geocon (1993) with two in situ permeability tests giving values between 1.3 x 10^{-8} m/s and 2.4 x 10^{-7} m/s, giving an average value of 1.2 x 10^{-7} m/s. The hydraulic conductivities of the hydrostratigraphic units and sub-units identified at the site were estimated from existing documentation and from in situ tests carried out in observation wells in unconsolidated deposits or in bedrock (Erreur ! Source du renvoi introuvable. 13.6).

Table 13.6 Hydraulic conductivity values extracted from previous studies

Well	Reference	Unit	Depth (m)	Hydraulic conductivity (m/s)		
				Sand	Till	Roc
TF-01-94	1	Sand	2.6	3.4×10^{-6}	-	-
		Till	8.6	-	1.0×10^{-7}	-
		Roc	10.2	-	-	-
TF-02-94		Till	4.2	-	6.7×10^{-6}	-
		Roc	8	-	-	-
TF-03-94		Till	5.8	-	5.2×10^{-5}	-
		Roc	8	-	-	-
TF-04-94		Sand	4	3.0×10^{-5}	-	-
		Till	11.4	-	2.4×10^{-6}	-
		Till	16.4	-	2.4×10^{-5}	-
TF-05-94		Till	4.2	-	6.8×10^{-6}	-
		Roc	17.3	-	-	-
TF-06-94		Till	2.8	-	9.1×10^{-6}	-
		Till	5.7	-	1.0×10^{-5}	-
		Till	8.9	-	8.1×10^{-6}	-
		Roc	11.2	-	-	-
3 wells	2	Till	-	-	1.3×10^{-6}	-
			-	-	3.2×10^{-6}	-
2 wells		Roc	-	-	-	1.3×10^{-8}
			-	-	-	2.4×10^{-7}
Minimum				3.4×10^{-6}	1.0×10^{-7}	1.3×10^{-8}
Maximum				3.0×10^{-5}	5.2×10^{-5}	2.4×10^{-7}
Average				1.67×10^{-5}	1.12×10^{-5}	1.27×10^{-7}
Median				1.67×10^{-5}	6.8×10^{-6}	1.27×10^{-7}

Sources :
1 : Techmat (1995) in Genivar (2009)
2 : Geocon (1993)

Interpretation of two pumping tests carried out at dewatering wells PT1 and PT2 (Henri Cousineau et Fils, 1997, in Genivar 2009) enabled rock aquifer properties to be calculated (Genivar, 2009) (Erreur ! Source du renvoi introuvable.

Interpretation of these tests enabled us to calculate transmissivities (T) ranging from 14.1 to 38.8 m^2/d for hydraulic conductivities (K) varying between 1.60×10^{-6}m/s and 2.89×10^{-6}m/s, corresponding to an aquifer of intermediate capacity (Krasny, 1993).

Storage coefficients ranging from 2.10×10^{-5} to 6.17×10^{-4} have been calculated, with a median of $1.60 \times 10^{(-4)}$ (Genivar, 2009).

Table 13.7 Hydrogeological parameters in bedrock calculated from interpretation of two pumping tests

Work	Test	T (m^2/d)	K (m/s)	S (without unit)
PT2	Pumping (72 h)	14.1	1.06×10^{-6}	-
	Ascent	14.1	1.06×10^{-6}	-
PZ2-P	Drawdown	20.7	1.56×10^{-6}	6.17×10^{-4}
PT2, PZ2P, PZ3P, PZ1P	Flap-distance	28.8	2.17×10^{-6}	3.90×10^{-4}
PT1	Pumping (72 h)	23.6	1.45×10^{-6}	-
	Ascent	23.8	1.46×10^{-6}	-
PZ4-P	Flap	16.9	1.04×10^{-6}	7.85×10^{-5}
PZ5-P	Flap	28.8	1.77×10^{-6}	1.62×10^{-4}
PT1, PZ4P, PZ5P	Drawdown-distance	38.8	2.89×10^{-6}	2.10×10^{-5}

Notes : T = Transmissivity; K = Hydraulic conductivity; S = Storage coefficient.
Source: Genivar, 2009.

13.2.3.1 Groundwater Flow Regime

Geocon (1993) modeled the site with MODFLOW software, a numerical model using the finite-difference method to solve groundwater flow equations in three dimensions.

The radius of influence of the pits was estimated at 300 m, taking into account a median hydraulic conductivity of 6.8×10^{-6} m/s, or a transmissivity of approximately 4.7 m^2/d, and considering the following three geological layers from surface to depth:

- Overburden, sandy till with a hydraulic conductivity of 10^{-5} m/s;
- Till with a hydraulic conductivity of 10^{-6} m/s;
- Rock, with a hydraulic conductivity of 10^{-8} m/s.

Such a radius of influence is realistic for unconsolidated deposits, but not for bedrock; subsequent pumping tests demonstrated a radius of influence of the order of 1,000 m in bedrock after only 72 hours of pumping, or even 5,000 to 6,000 m after 2 years of pumping, based on extrapolation from the drawdown-distance curve at well PT1 (Genivar, 2009).

13.2.4 Existing Conditions

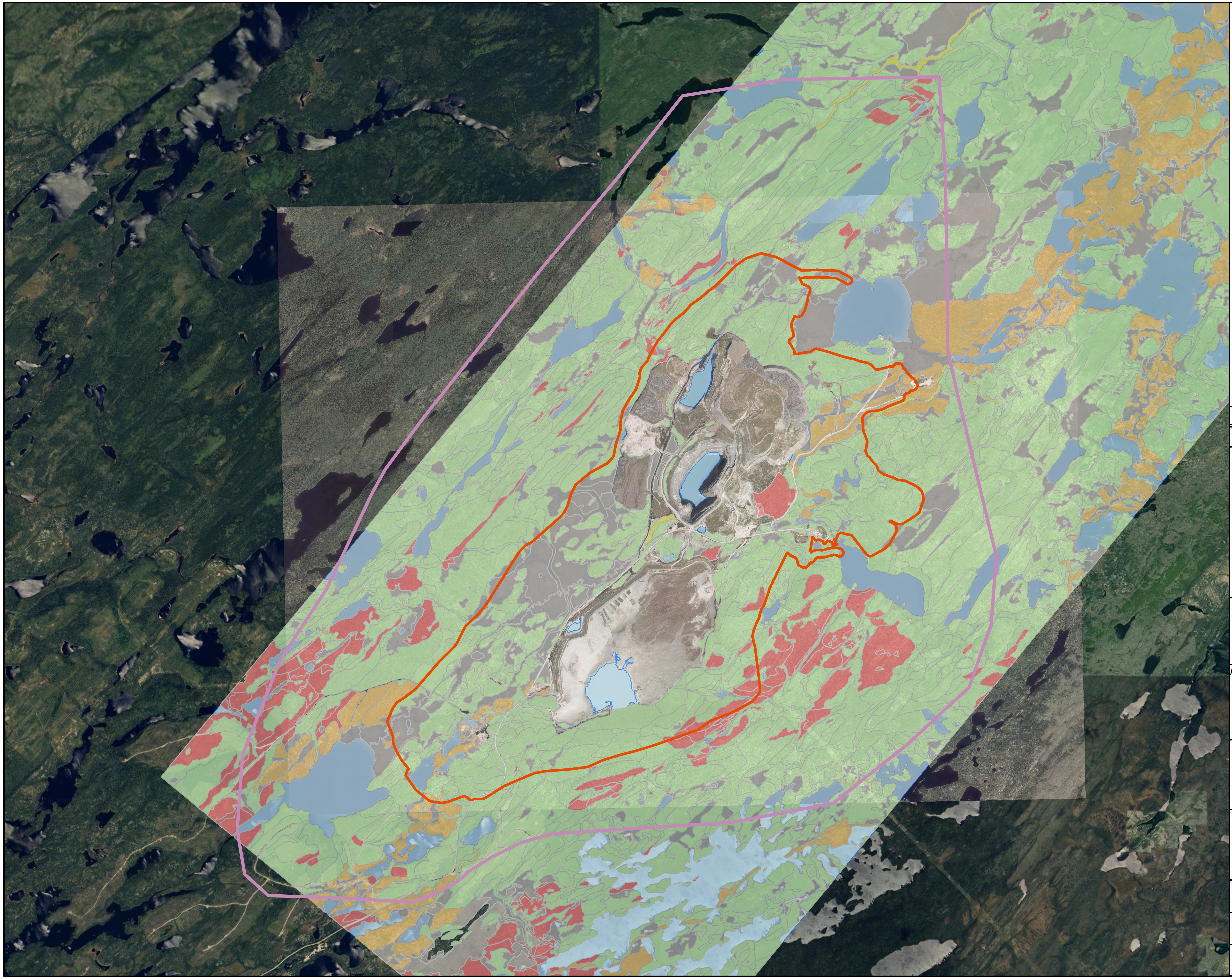
13.2.4.1 Local Geology and Regional Geology

The unconsolidated deposits overlying the bedrock over most of the LSA are essentially Quaternary of glacial, fluvio-glacial and alluvial origin. The bedrock is covered by till up to 30 m thick. It is composed of boulders, pebbles, gravel and sand, with variable proportions of silt and clay. In low-lying areas, beneath peat bogs and around lakes, sand deposits of the order of 2 m thick are found.

Map 13.3 illustrates surface deposits.

The Troilus project is included in the eastern domain of the Frotet-Evans greenstone belt belonging to the Opatica subprovince of the Superior Province. The Frotet-Evans belt consists of a volcano-sedimentary sequence of felsic, intermediate and mafic volcanic rocks. This zone is bounded to the northwest, north and east by felsic intrusive rocks (Simard, 1987). A network of SW-NE-trending structural faults lies to the northwest and southeast of the mine site. The existing and planned pits are located along two folds (synclinal and anticlinal). The Troilus project is located in the dextral Lac Allongé shear zone, 10 km long and 2 km wide, whose orientation is subparallel to the major regional reverse faults (N220°/60°).

Map 13.4 illustrates the geology and structures of the bedrock.



LÉGENDE / LEGEND

- Zone de développement du projet / Project development area
- Zone étude locale / Local Study Area

Dépôt de surface / Surficial Geology

- Anthropogénique / Anthropogenic (A)
- Colluvion / Colluvium (C)
- Fluvial / Fluvial (F)
- Fluvioglaciaire / Fluvioglacial (FG)
- Morainique (Till) / Morainic (Till) (M)
- Eau surfacique / Surface Water (N)
- Organique / Organic (O)
- Roc / Rock (R)

RÉV.	DESCRIPTION	AA/MM/YY	BY	VERIF.
1				

RÉFÉRENCES/REFERENCES

Dépôt Surface: Ressources naturelles et de la faune (MRNF, 2023) et Golder, Dépots de surface, 19131334 - 9000-REV0
Base Map: Bing, 06 June 2023

NOTES

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Étude d'impact sur l'environnement et le milieu social pour le projet de mine Troilus / Environmental and Social Impact Assessement for the Troilus Mine Project

TITRE/TITLE

Géologie des dépôts meubles / Surficial Geology

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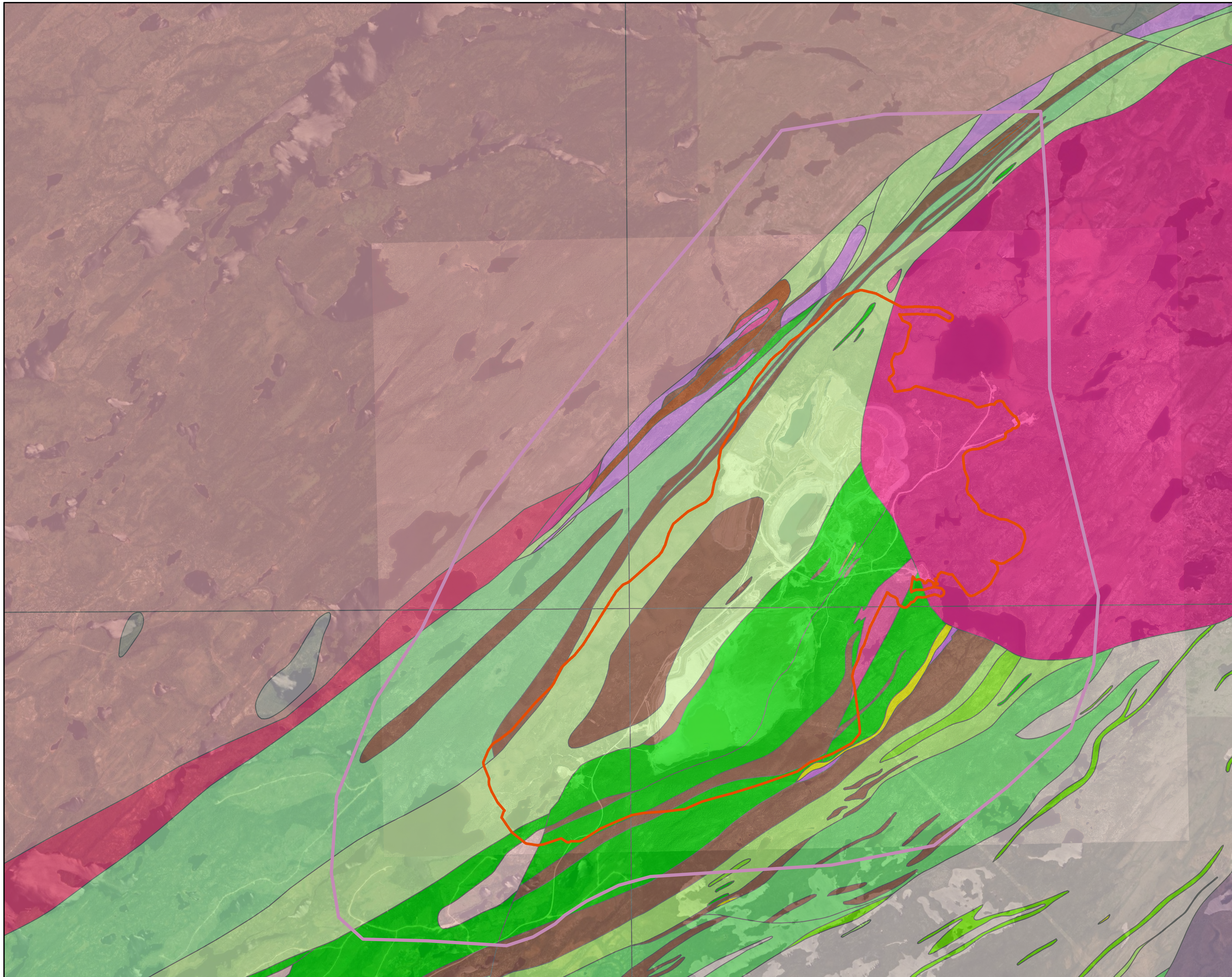

LÉGENDE / LEGEND

- Zone de développement du projet / Project development area
- Zone d'étude locale / Local Study Area
- Faille / Fault

RÉV.	DESCRIPTION	AA/MM/YY	BY	VERIF.
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RÉFÉRENCES/REFERENCES

Dépôt Surface: MINISTÈRE DES RESSOURCES NATURELLES ET DES FORÊTS. Géologie du socle, [Jeu de données], dans Données Québec, 2018, mis à jour le 26 juin 2023. [https://www.donneesquebec.ca/recherche/dataset/geologie-du-socle], (consulté le 18 juin 2025)
Base Map: Bing, 06 June 2023

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Étude d'impact sur l'environnement et le milieu social pour le projet de mine Troilus / Environmental and Social Impact Assessment for the Troilus Mine Project

TITRE/TITLE

Géologie du socle rocheux - Lithologie et Structure / Bedrock Geology - Lithology and Structure

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Socle Rocheux / Bedrock Geology

Roches intruisves indifférenciees, roches intrusives felsiques, roches métamorphiques / Undifferentiated Intrusive Rocks, Felsic Intrusive Rocks, Metamorphic Rocks

- Porphyre felsique à quartz / Quartz Felsic Porphyry
- Veine de quartz / Quartz Vein
- Porphyre à quartz / Quartz Porphyry
- Granite et pegmatite / Granite and Pegmatite
- Granite; Granite massif avec injection de pegmatite / Granite; Solid Granite with Pegmatite Injection
- Porphyre à quartz schisteux / Schistose quartz porphyry

Tectonites indifférenciées / Undifferentiated Tectonites

- Filon-couche de gabbro; Filon-couche de gabbro à quartz; Gabbro / Gabbro Sill Layer; Quartz Gabbro Sill Layer; Gabbro
- Filon-couche de gabbro; Gabbro; Gabbro massif à rubané / Gabbro Sill Layer; Gabbro; Solid to Banded Gabbro
- Gneiss avec injections de roches intrusives felsiques / Gneiss with Felsic Intrusive Rock Injections
- Gneiss avec injections de roches intrusives felsiques / Gneiss with Felsic Intrusive Rock Injections

Dolomites, roches métamorphiques / Dolomites, Metamorphic Rocks

- Filon-couche de pyroxénite; Filon-couche de pyroxénite et de péridotite / Pyroxenite Sill; Pyroxenite-Peridotite Sill
- Pyroxénite; Pyroxénite et péridotite / Pyroxenite; Pyroxenite and Peridotite

Tonalites / Tonalites

- Tonalite; Tonalite massive / Tonalite ; Massive Tonalite
- Tonalite / Tonalite

Roches volcaniques felsiques / Felsic volcanic rocks

- Roche volcanique felsique et mudrock / Felsic Volcanic Rock and Mudrock
- Tuf de composition felsique à intermédiaire; Tuf felsique; Tuf felsique à intermédiaire, tuf à cristaux et à lapilli et andésite / Felsic to Intermediate Tuff; Felsic tuff; Felsic to Intermediate Tuff, Crystal and Lapilli Tuff and Andesite
- Roche volcanique felsique et tuf intermédiaire / Felsic Volcanic Rock and Intermediate Tuff

Roches volcaniques indifférenciées, roches volcaniques intermédiaires, roches volcaniques mafiques, amphibolite / Undifferentiated Volcanic Rocks, Intermediate Volcanic Rocks, Mafic Volcanic Rocks, Amphibolite

- Amphibolite; Basalte; Basalte andésitique, andésite coussinée à rubanée; Basalte andésitique, andésite coussinée, tuf felsique à intermédiaire; Basalte andésitique, andésite et tufs intermédiaires à felsique; Basalte andésitique, andésite, tuf felsique à intermédiaire; Basalte andésitique, basalte et andésite; Basalte, gabbro amphibolitisé, tuf felsique à intermédiaire; Laves mafiques à intermédiaires, rubanées et amphibolitisées; Roche volcanique mafique; Roche volcanique mafique, roche volcanique intermédiaire, rubanée et amphibolitisée et tuf felsique; Roches volcaniques mafiques rubanées / Amphibolite; Basalt; Andesitic basalt, pillowed to banded andesite; Andesitic basalt, pillowed andesite, felsic to intermediate tuff; Andesitic basalt, andesite and intermediate to felsic tuff; Andesitic basalt, andesite, felsic to intermediate tuff; Andesitic basalt, basalt and andesite; Basalt, amphibolitized gabbro, felsic to intermediate tuff; Banded and amphibolitized mafic to intermediate lavas; Mafic volcanic rock; Banded and amphibolitized mafic volcanic rock, intermediate volcanic rock and felsic tuff; Banded mafic volcanic rocks
- Tuf intermédiaire / Intermediate Tuff
- Basalte magnésien / Magnesian Basalt
- Basalte; Basalte amphibolitisé; Basalte d'affinité tholéiitique; Basalte massif à coussiné; Basalte massif à rubané amphibolitisé; Basalte massif à rubané, tuf intermédiaire et gabbro avec injection granitique; Basalte massif, rubané, coussiné et amphibolitisé / Basalt; Amphibolitized basalt; Basalt of tholeiitic affinity; Massive to pillowed basalt; Massive to banded amphibolitized basalt; Massive to banded basalt, intermediate tuff and gabbro with granitic injection; Massive, banded, pillowed and amphibolitized basalt
- Basalte rubané et gabbro rubané amphibolitisé; Basalte rubané, gabbro et tuf intermédiaire; Ferrotholéiite rubanée, coussinée et amphibolitisée; Lave mafique rubanée et tuf intermédiaire; Lave mafique rubanée, gabbro et tuf intermédiaire; Lave mafique rubanée, tuf intermédiaire et gabbro amphibolitisé
- Basalte rubané amphibolitisé; Basalte, tuf felsique à intermédiaire / Amphibolitized Banded Basalt; Basalt, Felsic to Intermediate Tuffs
- Roche volcanique felsique et tuf intermédiaire; Roche volcanique felsique, tuf intermédiaire et tuf à cristaux; Tuf de composition intermédiaire à felsique; Tuf felsique à intermédiaire; Tuf felsique à intermédiaire et tuf à cristaux; Tuf felsique et tuf intermédiaire à cristaux; Tuf felsique, tuf à cristaux et mudrock; Tuf intermédiaire à cristaux; Tuf intermédiaire à felsique; Tuf intermédiaire à felsique et mudrock; Tuf intermédiaire à felsique, tuf à lapilli et à blocs et mudrock / Felsic volcanic rock and intermediate tuff; Felsic volcanic rock, intermediate tuff and crystal tuff; Intermediate to felsic tuff; Felsic to intermediate tuff; Felsic to intermediate tuff and crystal tuff; Felsic tuff and intermediate crystal tuff; Felsic tuff, crystal tuff and mudrock; Intermediate crystal tuff; Intermediate felsic tuff; Intermediate felsic tuff and mudrock; Intermediate felsic tuff, lapilli and boulder tuff and mudrock
- Tuf felsique, tuf intermédiaire à cristaux et tuf à lapilli; Tuf intermédiaire à lapilli et à blocs / Felsic tuff, intermediate crystal tuff and lapilli tuff; intermediate lapilli and boulder tuff
- Tuf felsique à intermédiaire, tuf cherteux et mudrock; Tuf felsique cherteux et mudrock graphiteux / Felsic to intermediate tuff, cherty tuff and mudrock; Cherty felsic tuff and graphite mudrock
- Basalte; Roche volcanique mafique massive à rubanée; Roches volcaniques mafiques rubanées; Tuf intermédiaire à felsique; Tuf intermédiaire à felsique et mudrock; Tuf intermédiaire à lapilli, à blocs, à cristaux et tuf felsique; Tuf intermédiaire, tuf à cristaux, tuf à lapilli et tuf felsique / Basalt; Massive to banded mafic volcanic rock; Banded mafic volcanic rocks; Intermediate to felsic tuff; Intermediate to felsic tuff and mudrock; Intermediate lapilli, boulder, crystal and felsic tuff; Intermediate tuff, crystal tuff, lapilli and felsic tuff.
- Tuf felsique; Tuf intermédiaire à felsique; Tuf intermédiaire à felsique; Tuf intermédiaire à felsique rubané et porphyre felsique à quartz et feldspath; Tuf intermédiaire à felsique, rubané et injecté de granite; Tuf intermédiaire à felsique, tuf à lapilli et à blocs, grès et mudrock amphibolitisé; Tuf intermédiaire et felsique rubanés et gabbro; Tuf intermédiaire rubané; Tuf intermédiaire rubané avec injection de granite; Tuf intermédiaire rubané et tuf felsique / Felsic tuff; Intermediate felsic tuff; Intermediate felsic tuff; Banded felsic tuff and felsic porphyry with quartz and feldspar; Intermediate felsic tuff, banded and granite-injected; Intermediate felsic tuff, lapilli and boulder tuff, sandstone and amphibolitized mudrock; Banded intermediate and felsic tuff and gabbro; Banded intermediate tuff; Banded intermediate tuff with granite injection; Banded intermediate tuff and felsic tuff

Altérites indifférenciées / Undifferentiated Alterites

- Migmatite à trame de paragneiss et d'amphibolite / Migmatite with paragneiss and amphibolite frameworks

Gneiss / Gneiss

- Gneiss à biotite, granite et pegmatite / Biotite Gneiss, Granite and Pegmatite

Roches intrusive indifférenciées, roches intrusices intermédiaires, roches métamorphiques / Undifferentiated Intrusive Rocks, Intermediate Intrusive Rocks, Metamorphic Rocks

- Schiste à biotite et à grenat; Schiste à sillimanite, cordiérite, grenat et tuf intermédiaire à felsique / Schist with biotite and garnet; Schist with sillimanite, cordierite, garnet and intermediate to felsic tuff

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Dépôt Surface: MINISTÈRE DES RESSOURCES NATURELLES ET DES FORÊTS. Géologie du socle, [Jeu de données], dans Données Québec, 2018, mis à jour le 26 juin 2023. [https://www.donneesquebec.ca/recherche/dataset/geologie-du-socle], (consulté le 18 juin 2025)

Base Map: Bing, 06 June 2023

NOTES

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Troilus Gold Corp.

PROJET/PROJECT

Étude d'impact sur l'environnement et le milieu social pour le projet de mine Troilus / Environmental and Social Impact Assessment for the Troilus Mine Project

TITRE/TITLE

Géologie du socle rocheux - Lithologie et Structure / Bedrock Geology - Lithology and Structure

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13.2.4.2 Groundwater Use and Aquifer Classification

According to the Hydrogeological Information System (HIS) of the Ministry of the Environment, the Fight against Climate Change, Wildlife and Parks (MELCCFP) consulted on February 19, 2024, there are no wells listed in the Local and Regional assessment Areas. However, water supply wells are currently present in the LSA:

- Well PU-4, currently used to supply drinking water to the temporary camp;
- Well PU-2, used solely for the industrial sector's non-potable water supply;
- Well PO-DET 4, used to supply drinking water to the Awashish family camp, and as a voluntary monitoring point for the landfill in-trench (LEET).

The groundwater flow is generally north and northeast, towards Lake A (PE43), which is the main groundwater receiving environment (WSP, 2024b). However, there may be local variations due to underground infrastructures or the physical particularities of the site and its periphery (hydrology, topography, etc.). A major Rupert/Broadback watershed boundary (Map 11.3 in Chapter 11) is located just south of the PDA.

On a regional scale, the mine site lies within the Rupert River watershed, which drains into James Bay. The mine site drainage system empties into Boisfort Lake, the first major water body downstream of the PDA.

According to the MELCCFP Groundwater Classification System (2012), a groundwater body can be Class I, II or III depending on its hydrogeological properties, quality and potential for use. A Class I groundwater table is an irreplaceable source of water supply. A Class II hydrogeological formation is an existing rent or potential source of water supply, with acceptable water quality and sufficient quantity. Finally, a Class III hydrogeological formation is not a source of water supply (unsatisfactory quality and insufficient quantity).

The fractured bedrock aquifer is an existing source of drinking water, particularly for the temporary camp, and corresponds to a Class II aquifer. The fluvioglacial deposit horizon has good aquifer potential by its very nature. It is therefore also considered a Class II aquifer.

13.2.4.3 Local Hydrogeology

Data from nearly 283 mineral exploration, geotechnical and observation boreholes distributed across the site, and hydrogeological characterization work, have identified the main hydrostratigraphic units and determined their hydraulic properties (Golder, 2022).

Hydraulic properties of unconsolidated deposits

The surface unit of juxtaglacial deposits consists of narrow bands of sand and gravel, mostly present 1.2 km east of pit 87 and on the eastern and western edges of Lac Amont (PE2). Two observation wells cored in this hydrostratigraphic unit (MW-21-11 and MW-21-16) show 5.8 m and 2.14 m of sand, respectively. Permeability tests carried out at these wells show hydraulic conductivities of 4.0×10^{-5} m/s and 2.0×10^{-4} m/s respectively, giving a geometric mean for this unit of 8.9×10^{-5} m/s.

The glacial till unit, which underlies the juxtaglacial deposits, has a loosely cohesive sandy-silty to silty-sandy composition, with variable amounts of gravel. With an average thickness varying between 2.0 and 5.7 m, with an average of 3.0 m, it is essentially intercepted between 4.1 m and 21.4 m below the topographic surface. Twelve hydraulic conductivity tests carried out in this unit have estimated its hydraulic conductivity at between 3.8 x 10^{-7} m/s and 3.3 x 10^{-4} m/s, with an average value of 1 x 10^{-5} m/s.

In addition to natural unconsolidated deposits, tailings and mine waste rock were also considered as two other hydrostratigraphic units. Hydraulic tests conducted in observation shaft MW-21-06, located on the east side of the tailing's impoundment, yielded a hydraulic conductivity value of 2.7 x 10^{-6} m/s for the tailings, while no hydraulic tests were conducted in the waste rock.

Hydraulic properties of bedrock

Data from geotechnical drilling and pneumatic plug tests carried out in the J4 and 87 pit areas, and the southwest (SW) sector in 2020 and 2021 by WSP-Golder (Golder, 2022) have enabled us to determine hydraulic conductivity values specific to these areas. For example,

- In the J4 pit area, hydraulic conductivity varies between 2 x 10^{-8} m/s and 8 x 10^{-6} m/s, with a geometric mean of 2 x 10^{-7}m/s;
- In the pit 87 area, hydraulic conductivity ranges from 1 x 10^{-9} m/s to 3 x 10^{-6} m/s, with a geometric mean of 5 x 10^{-8} m/s;
- In the south-western sector, hydraulic conductivity is generally higher, ranging from 7 x 10^{8} m/s to 2 x 10^{-5} m/s, with a geometric mean of 2 x 10^{-6} m/s.

In his conceptual model, Golder (2022) defined five stratigraphic rock subunits and the geometric mean of their hydraulic conductivities using packer tests:

- Superficial bedrock (bedrock top at 60 m depth): 3 x 10^{-7} m/s;
- Intermediate rock 1 (60 m to 150 m depth): 1 x 10^{-7} m/s;
- Intermediate rock 2 (150 m to 300 m depth): 5 x 10^{-8} m/s;
- Deep rock (300 m to 500 m depth): 2 x 10^{-9} m/s;
- SW mineralized zone: 2 x 10^{-5} m/s.

Piezometric levels and flow direction

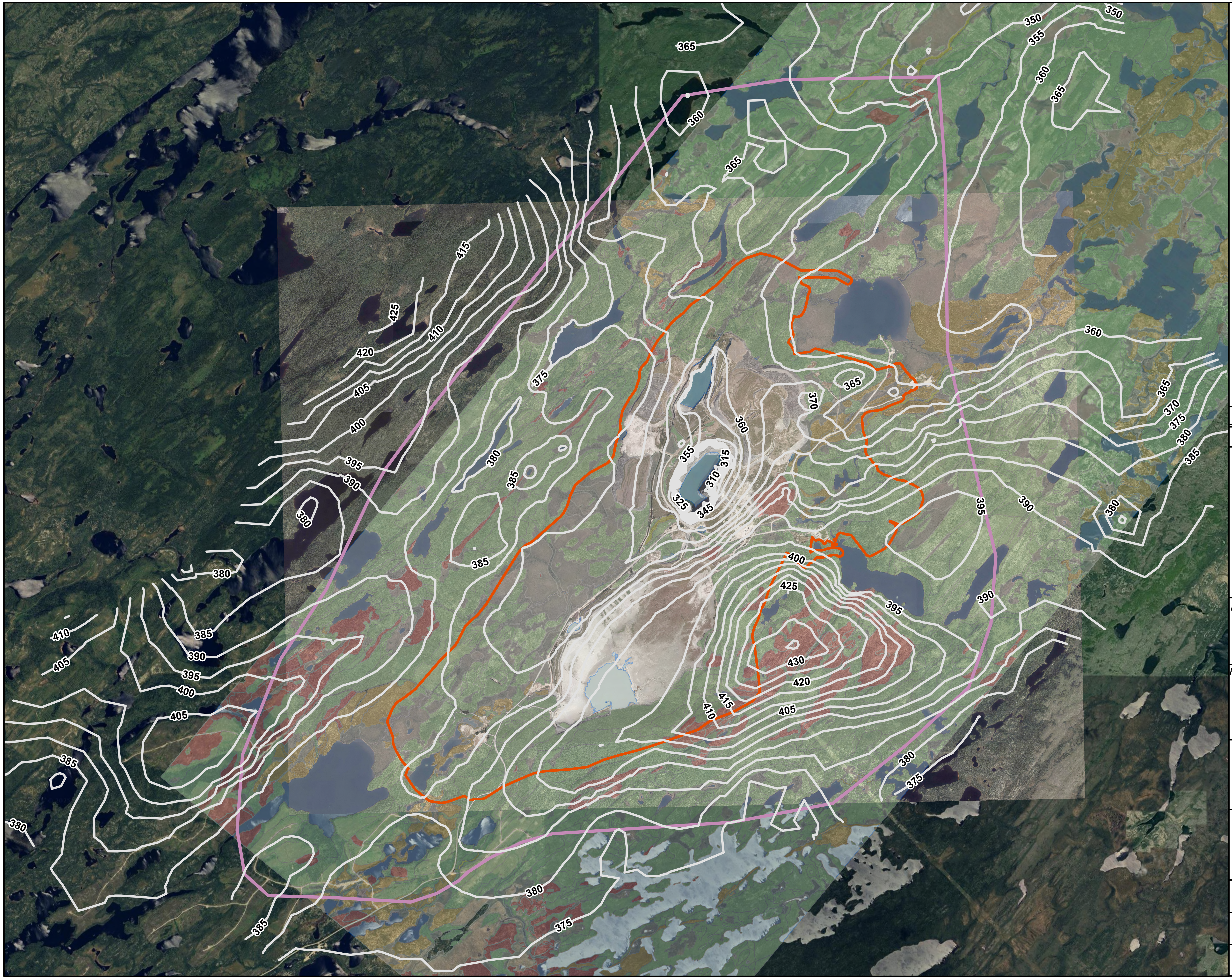
As part of groundwater quality monitoring at the Troilus project site (WSP, 2024b), water level measurements were taken in 2022 and 2023, in spring and fall (WSP, 2024a and b). Based on the most recent data, water level depths below the ground surface in unconsolidated deposits or bedrock ranged from 0.85 m to 10.98 m in spring 2023, and from 0.34 m to 11.29 m in fall 2023.

Results from piezometric monitoring campaigns conducted in summer and fall 2022 (WSP, 2024a) indicate that groundwater flow in unconsolidated deposits and bedrock is generally controlled by topography, and flows generally northward, following the surface hydraulic network. This is consistent with the numerical simulation of groundwater flow (BluMetric, 2025) carried out to establish baseline conditions. Maps 13.5 and 13.6 show the simulated piezometries in the unconsolidated deposits and bedrock respectively.

Locally, groundwater flow is influenced by pit 87, which acts as a groundwater drain. The area of wells MW-21-07, MW-21-08 and MW-21-09 to the southeast of the tailing's facility has the highest piezometric levels in the region, making this area a groundwater recharge zone. From this topographic high point, flows are directed northwest towards the mine site.

The existing water level in pit 87 creates a local drawdown of almost 70 m in relation to the surrounding piezometric level. In the area of the proposed SW pit, underground flows follow the northeasterly direction of Bibou Creek.

Extended monitoring of water elevations in observation wells and surface water stations (MW-21-10(Roc)/Probe1, MW-21-05(Roc)/Probe2a, X22-23-069/Probe2a) were compared by BluMetric to assess the interaction between surface water and groundwater. Figures 13.1 to 13.3 show the paired levels.



LÉGENDE / LEGEND

- Zone de développement du projet / Project development area
- Zone d'étude locale / Local Study Area
- Piézométrie - dépôts meubles / Piezometry - Surficial Geology

Dépôt de surface / Surficial Geology

- Anthropogénique / Anthropogenic (A)
- Colluvion / Colluvium (C)
- Fluvial / Fluvial (F)
- Fluvioglaciaire / Fluvioglacial (FG)
- Morainique (Till) / Morainic (Till) (M)
- Eau surfacique / Surface Water (N)
- Organique / Organic (O)
- Roc / Rock (R)

RÉV.	DESCRIPTION	AA/MM/YY	BY	VERIF.
1				

RÉFÉRENCES/REFERENCES

Dépôt Surface: Ressources naturelles et de la faune (MRNF, 2023) et Golder, Dépots de surface, 19131334 - 9000-REV0
Piézométrie: BluMetric, 18 June, 2025
Base Map: Bing, 06 June 2023

NOTES

1:50,000 — 0 — 1,000 — 2,000 m
ÉCHELLE (m) / SCALE (m)

LES DIMENSIONS DE CETTE ÉCHELLE DOIVENT ÊTRE UTILISÉES À TITRE D'INFORMATION SEULEMENT
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Troilus Gold Corp.

PROJET/PROJECT
Étude d'impact sur l'environnement et le milieu social pour le projet de mine Troilus / Environmental and Social Impact Assessment for the Troilus Mine Project

TITRE/TITLE
Piézométrie simulée dans les dépôts meubles / Simulated Piezometry in Surficial Geology

BluMetric Environnement
Stantec

NO. PROJET / PROJECT NO.	DATE
240433 / 167040485	06/ 18/ 2025
CONÇU / CHECKED: É. Hudon-Gagnon	RÉVISÉ / VERIFIED: C. Gardois
DESSINÉ / DRAWN: M. Baker	Figure No. 13.5 — ED./REV. 1

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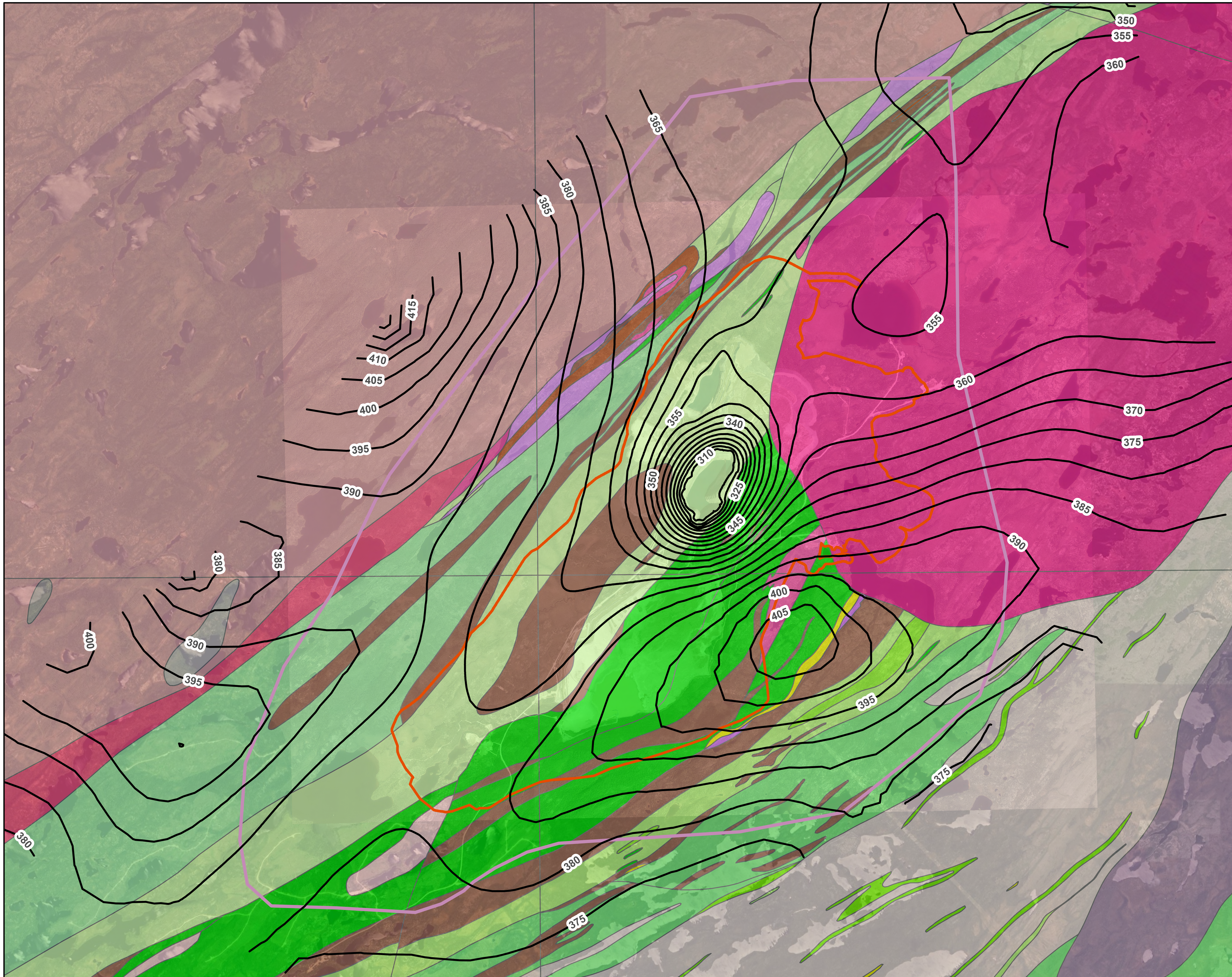

LÉGENDE / LEGEND

- Zone de développement du projet / Project development area
- Zone d'étude locale / Local Study Area
- Piézométrie - socle rocheux / Piezometry - Bedrock Geology

RÉV.	DESCRIPTION	AA/MM/YY	BY	VERIF.
1				

RÉFÉRENCES/REFERENCES

Dépôt Surface: MINISTÈRE DES RESSOURCES NATURELLES ET DES FORÊTS. Géologie du socle, [Jeu de données], dans Données Québec, 2018, mis à jour le 26 juin 2023. [https://www.donneesquebec.ca/recherche/dataset/geologie-du-socle], (consulté le 18 juin 2025)
Base Map: Bing, 06 June 2023

NOTES

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ÉCHELLE (m) / SCALE (m)

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Troilus Gold Corp.

PROJET/PROJECT

Étude d'impact sur l'environnement et le milieu social pour le projet de mine Troilus / Environmental and Social Impact Assessment for the Troilus Mine Project

TITRE/TITLE

Piézométrie simulée dans le socle rocheux / Simulated Piezometry in Bedrock Geology

BluMetric® Environnement
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NO. PROJET / PROJECT NO. 240433 / 167040485	*DATE* 06/ 19/ 2025
CONÇU / CHECKED É. Hudon-Gagnon	*RÉVISÉ / VERIFIED* C. Gardois
DESSINÉ / DRAWN M. Baker	*Figure No.* 13.6a — *ED./REV.* 1

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Socle Rocheux / Bedrock Geology

Roches intruisves indifférenciées, roches intrusives felsiques, roches métamorphiques / Undifferentiated Intrusive Rocks, Felsic Intrusive Rocks, Metamorphic Rocks

- Porphyre felsique à quartz / Quartz Felsic Porphyry
- Veine de quartz / Quartz Vein
- Porphyre à quartz / Quartz Porphyry
- Granite et pegmatite / Granite and Pegmatite
- Granite; Granite massif avec injection de pegmatite / Granite; Solid Granite with Pegmatite Injection
- Porphyre à quartz schisteux / Schistose quartz porphyry

Tectonites indifférenciées / Undifferentiated Tectonites

- Filon-couche de gabbro; Filon-couche de gabbro à quartz; Gabbro / Gabbro Sill Layer; Quartz Gabbro Sill Layer; Gabbro
- Filon-couche de gabbro; Gabbro; Gabbro massif à rubané / Gabbro Sill Layer; Gabbro; Solid to Banded Gabbro
- Gneiss avec injections de roches intrusives felsiques / Gneiss with Felsic Intrusive Rock Injections
- Gneiss avec injections de roches intrusives felsiques / Gneiss with Felsic Intrusive Rock Injections

Dolomites, roches métamorphiques / Dolomites, Metamorphic Rocks

- Filon-couche de pyroxénite; Filon-couche de pyroxénite et de péridotite / Pyroxenite Sill; Pyroxenite-Peridotite Sill
- Pyroxénite; Pyroxénite et péridotite / Pyroxenite; Pyroxenite and Peridotite

Tonalites / Tonalites

- Tonalite; Tonalite massive / Tonalite ; Massive Tonalite
- Tonalite / Tonalite

Roches volcaniques felsiques / Felsic volcanic rocks

- Roche volcanique felsique et mudrock / Felsic Volcanic Rock and Mudrock
- Tuf de composition felsique à intermédiaire; Tuf felsique; Tuf felsique à intermédiaire, tuf à cristaux et à lapilli et andésite / Felsic to Intermediate Tuff; Felsic tuff; Felsic to Intermediate Tuff, Crystal and Lapilli Tuff and Andesite
- Roche volcanique felsique et tuf intermédiaire / Felsic Volcanic Rock and Intermediate Tuff

Roches volcaniques indifférenciées, roches volcaniques intermédiaires, roches volcaniques mafiques, amphibolite / Undifferentiated Volcanic Rocks, Intermediate Volcanic Rocks, Mafic Volcanic Rocks, Amphibolite

- Amphibolite; Basalte; Basalte andésitique, andésite coussinée à rubanée; Basalte andésitique, andésite coussinée, tuf felsique à intermédiaire; Basalte andésitique, andésite et tufs intermédiaires à felsique; Basalte andésitique, andésite, tuf felsique à intermédiaire; Basalte andésitique, basalte et andésite; Basalte, gabbro amphibolitisé, tuf felsique à intermédiaire; Laves mafiques à intermédiaires, rubanées et amphibolitisées; Roche volcanique mafique; Roche volcanique mafique, roche volcanique intermédiaire, rubanée et amphibolitisée et tuf felsique; Roches volcaniques mafiques rubanées / Amphibolite; Basalt; Andesitic basalt, pillowed to banded andesite; Andesitic basalt, pillowed andesite, felsic to intermediate tuff; Andesitic basalt, andesite and intermediate to felsic tuff; Andesitic basalt, andesite, felsic to intermediate tuff; Andesitic basalt, basalt and andesite; Basalt, amphibolitized gabbro, felsic to intermediate tuff; Banded and amphibolitized mafic to intermediate lavas; Mafic volcanic rock; Banded and amphibolitized mafic volcanic rock, intermediate volcanic rock and felsic tuff; Banded mafic volcanic rocks
- Tuf intermédiaire / Intermediate Tuff
- Basalte magnésien / Magnesian Basalt
- Basalte; Basalte amphibolitisé; Basalte d'affinité tholéiitique; Basalte massif à coussiné; Basalte massif à rubané amphibolitisé; Basalte massif à rubané, tuf intermédiaire et gabbro avec injection granitique; Basalte massif, rubané, coussiné et amphibolitisé / Basalt; Amphibolitized basalt; Basalt of tholeiitic affinity; Massive to pillowed basalt; Massive to banded amphibolitized basalt; Massive to banded basalt, intermediate tuff and gabbro with granitic injection; Massive, banded, pillowed and amphibolitized basalt
- Basalte rubané et gabbro rubané amphibolitisé; Basalte rubané, gabbro et tuf intermédiaire; Ferrotholéiite rubanée, coussinée et amphibolitisée; Lave mafique rubanée et tuf intermédiaire; Lave mafique rubanée, gabbro et tuf intermédiaire; Lave mafique rubanée, tuf intermédiaire et gabbro amphibolitisé
- Basalte rubané amphibolitisé; Basalte, tuf felsique à intermédiaire / Amphibolitized Banded Basalt; Basalt, Felsic to Intermediate Tuffs
- Roche volcanique felsique et tuf intermédiaire; Roche volcanique felsique, tuf intermédiaire et tuf à cristaux; Tuf de composition intermédiaire à felsique; Tuf felsique à intermédiaire; Tuf felsique à intermédiaire et tuf à cristaux; Tuf felsique et tuf intermédiaire à cristaux; Tuf felsique, tuf à cristaux et mudrock; Tuf intermédiaire à cristaux; Tuf intermédiaire à felsique; Tuf intermédiaire à felsique et mudrock; Tuf intermédiaire à felsique, tuf à lapilli et à blocs et mudrock / Felsic volcanic rock and intermediate tuff; Felsic volcanic rock, intermediate tuff and crystal tuff; Intermediate to felsic tuff; Felsic to intermediate tuff; Felsic to intermediate tuff and crystal tuff; Felsic tuff and intermediate crystal tuff; Felsic tuff, crystal tuff and mudrock; Intermediate crystal tuff; Intermediate felsic tuff; Intermediate felsic tuff and mudrock; Intermediate felsic tuff, lapilli and boulder tuff and mudrock
- Tuf felsique, tuf intermédiaire à cristaux et tuf à lapilli; Tuf intermédiaire à lapilli et à blocs / Felsic tuff, intermediate crystal tuff and lapilli tuff; intermediate lapilli and boulder tuff
- Tuf felsique à intermédiaire, tuf cherteux et mudrock; Tuf felsique cherteux et mudrock graphiteux / Felsic to intermediate tuff, cherty tuff and mudrock; Cherty felsic tuff and graphite mudrock
- Basalte; Roche volcanique mafique massive à rubanée; Roches volcaniques mafiques rubanées; Tuf intermédiaire à felsique; Tuf intermédiaire à felsique et mudrock; Tuf intermédiaire à lapilli, à blocs, à cristaux et tuf felsique; Tuf intermédiaire, tuf à cristaux, tuf à lapilli et tuf felsique / Basalt; Massive to banded mafic volcanic rock; Banded mafic volcanic rocks; Intermediate to felsic tuff; Intermediate to felsic tuff and mudrock; Intermediate lapilli, boulder, crystal and felsic tuff; Intermediate tuff, crystal tuff, lapilli and felsic tuff.
- Tuf felsique; Tuf intermédiaire à felsique; Tuf intermédiaire à felsique; Tuf intermédiaire à felsique rubané et porphyre felsique à quartz et feldspath; Tuf intermédiaire à felsique, rubané et injecté de granite; Tuf intermédiaire à felsique, tuf à lapilli et à blocs, grès et mudrock amphibolitisé; Tuf intermédiaire et felsique rubanés et gabbro; Tuf intermédiaire rubané; Tuf intermédiaire rubané avec injection de granite; Tuf intermédiaire rubané et tuf felsique / Felsic tuff; Intermediate felsic tuff; Intermediate felsic tuff; Banded felsic tuff and felsic porphyry with quartz and feldspar; Intermediate felsic tuff, banded and granite-injected; Intermediate felsic tuff, lapilli and boulder tuff, sandstone and amphibolitized mudrock; Banded intermediate and felsic tuff and gabbro; Banded intermediate tuff; Banded intermediate tuff with granite injection; Banded intermediate tuff and felsic tuff

Altérites indifférenciées / Undifferentiated Alterites

- Migmatite à trame de paragneiss et d'amphibolite / Migmatite with paragneiss and amphibolite frameworks

Gneiss / Gneiss

- Gneiss à biotite, granite et pegmatite / Biotite Gneiss, Granite and Pegmatite

Roches intrusive indifférenciées, roches intrusices intermédiaires, roches métamorphiques / Undifferentiated Intrusive Rocks, Intermediate Intrusive Rocks, Metamorphic Rocks

- Schiste à biotite et à grenat; Schiste à sillimanite, cordiérite, grenat et tuf intermédiaire à felsique / Schist with biotite and garnet; Schist with sillimanite, cordierite, garnet and intermediate to felsic tuff

RÉV.	DESCRIPTION	AA/MM/YY	BY	VERIF.
2				

RÉFÉRENCES/REFERENCES

Dépôt Surface: MINISTÈRE DES RESSOURCES NATURELLES ET DES FORÊTS. Géologie du socle, [Jeu de données], dans Données Québec, 2018, mis à jour le 26 juin 2023. [https://www.donneesquebec.ca/recherche/dataset/geologie-du-socle], (consulté le 18 juin 2025)

NOTES

CLIENT

Troilus Gold Corp.

PROJET/PROJECT

Étude d'impact sur l'environnement et le milieu social pour le projet de mine Troilus / Environmental and Social Impact Assessment for the Troilus Mine Project

TITRE/TITLE

Géologie du socle rocheux - Lithologie et Structure / Bedrock Geology - Lithology and Structure

NO. PROJET / PROJECT NO. 240433 / 167040485	*DATE* 06/ 20/ 2025
CONÇU / CHECKED É. Hudon-Gagnon	*RÉVISÉ / VERIFIED* C. Gardois
DESSINÉ / DRAWN M. Baker	*Figure No.* 13.6b — *ED./REV.* 2

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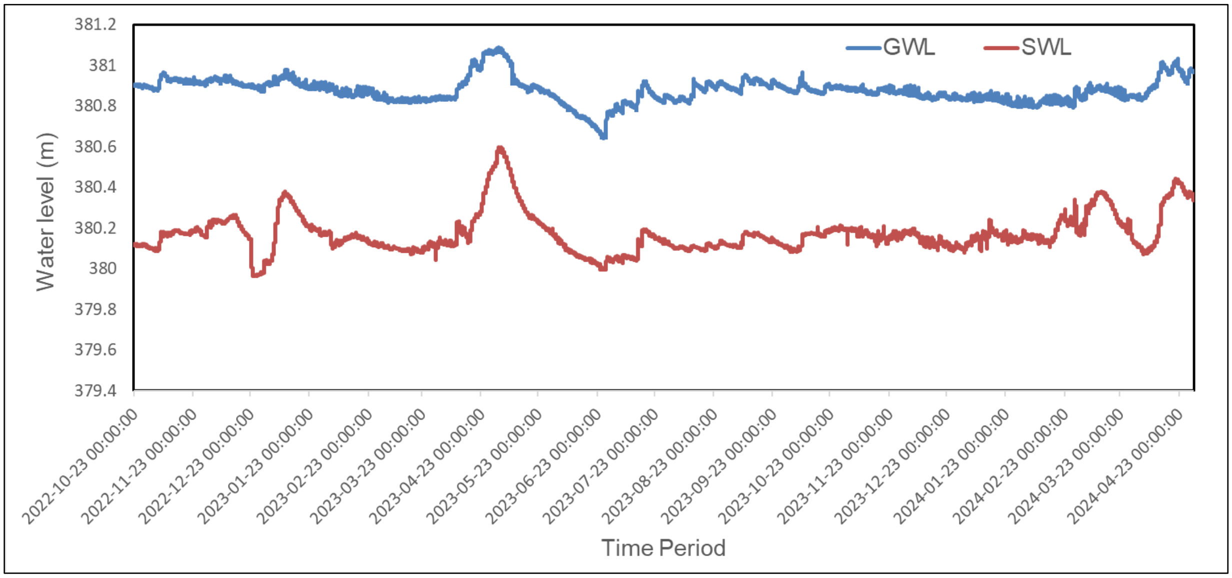


Figure 13.1 Water level interaction between MW-21-10(GWL) and Probe 1 (SWL)

Source: BluMetric, 2025

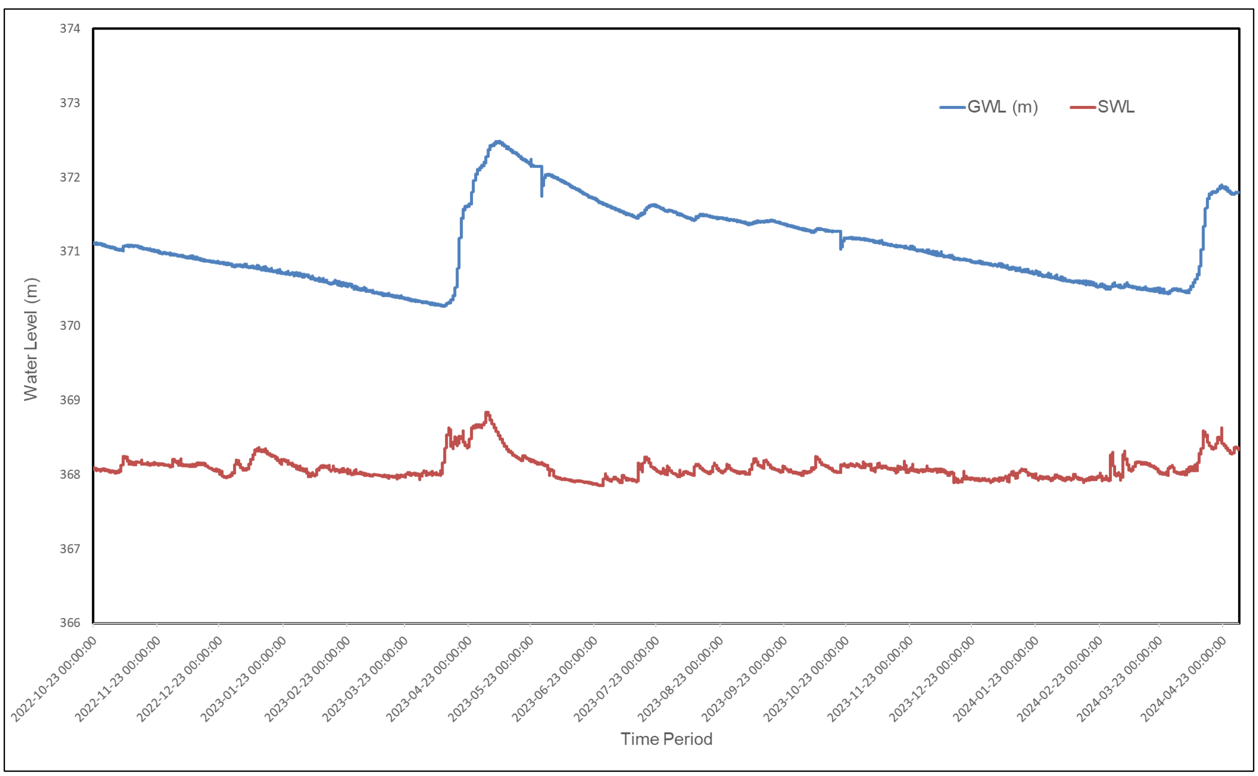


Figure 13.2 Water level interaction between MW-21-05(GWL) and Probe 2a (SWL)

Source: BluMetric, 2025

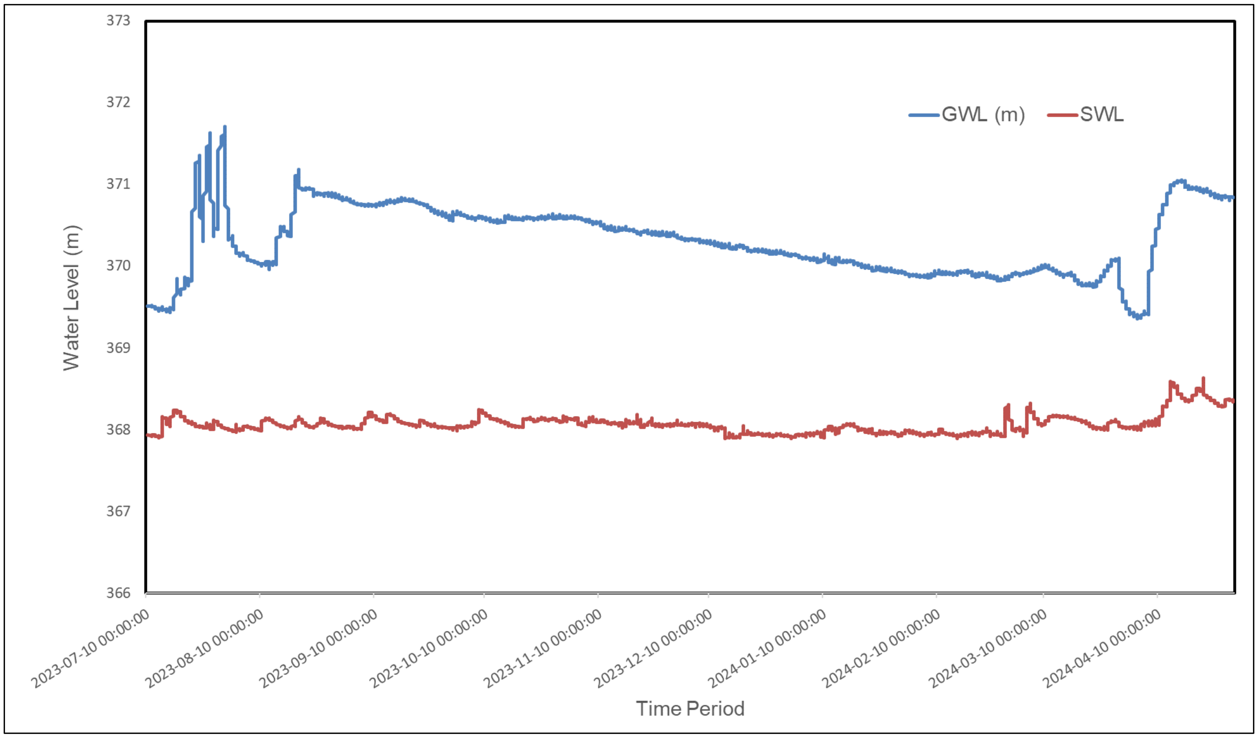


Figure 13.3 Water level interaction between X22-23-069(GWL) and Probe 2a (SWL)

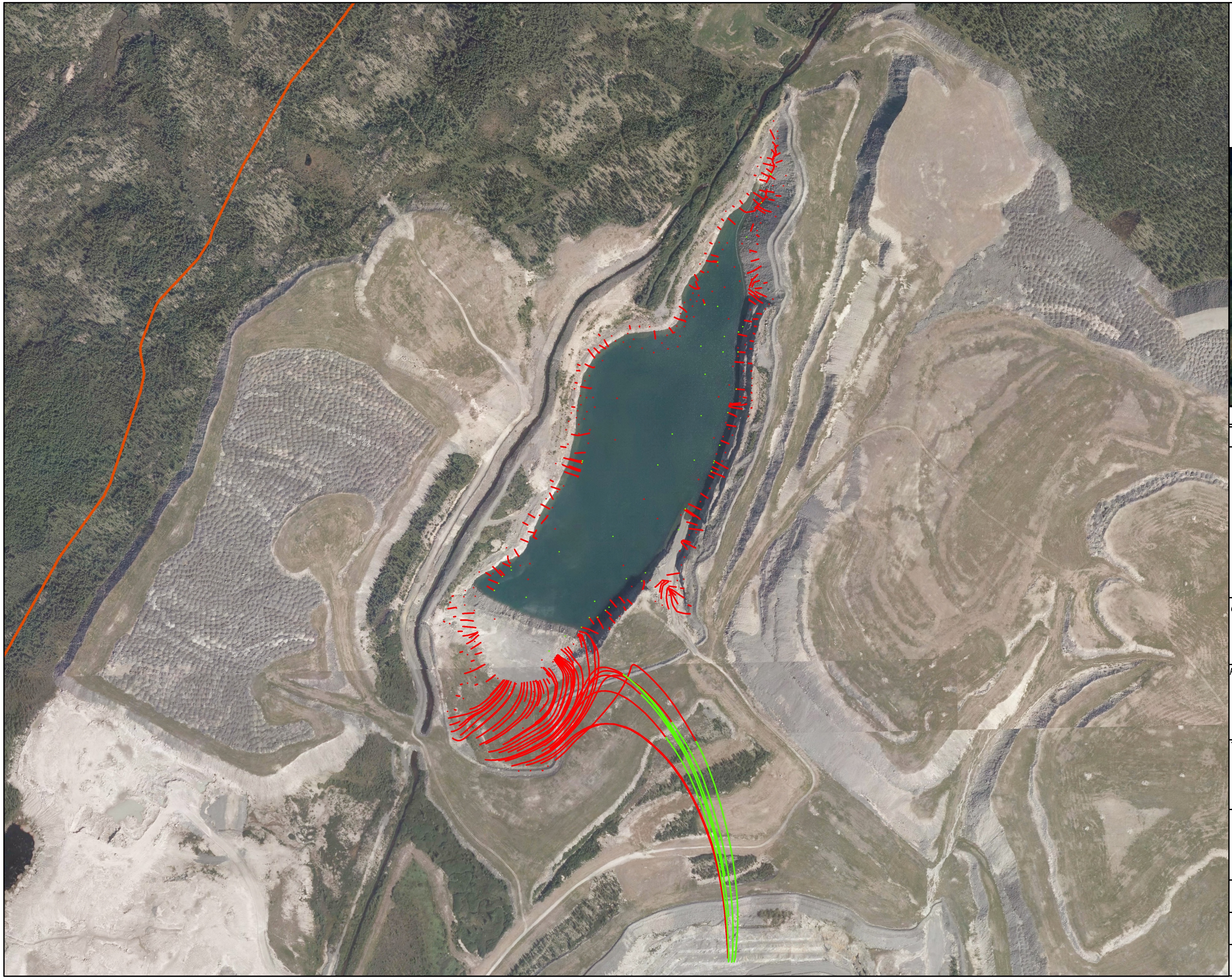
Source: BluMetric, 2025

Analysis of groundwater and surface water levels shows that Bibou Creek is hydraulically connected to groundwater. Level comparisons between monitoring wells and surface water measurement points show similar trends, with synchronized peaks in water levels, confirming the existence of a connection between groundwater and the creek. These variations suggest that groundwater actively contributes to and recharges Bibou Creek, rather than the other way around.

Reference groundwater balance

A three-dimensional steady-state groundwater flow model was developed by BluMetric (2025) using FEFLOW software and calibrated to represent regional groundwater flow prior to mining activities. This model characterized groundwater flow by estimating hydraulic head and was used to perform particle tracking analysis. The result (distribution of hydraulic head over the entire model domain) from the steady-state simulation was considered representative of the existing situation and used as the baseline condition. Hydraulic head measurements for the years 2021 and 2022 were used to calibrate the baseline scenario, as these were the only head measurements available prior to future mining activities in the area.

Forward and backward particle tracking analyses were conducted to investigate basic hydraulic connections between existing pit locations and surrounding surface water bodies. In these analyses, particles were released and tracked forwards and backwards in time as they moved through geological structures throughout the subsurface. A large number of simulated particles were released at all depths in pits J4 and 87 to capture all existing interactions. The results of these analyses are presented in Map 13.7 for the J4 pit and Map 13.8 for the 87 pit. Based on these maps, we can conclude that both pits J4 and 87 are hydraulically connected to Bibou Creek. A large number of simulated particles were released at all depths of Bibou Creek, and particles were tracked forwards and backwards (Map 13.9) over time. These monitoring results also support the hydraulic connection of Bibou Creek to the two pits.



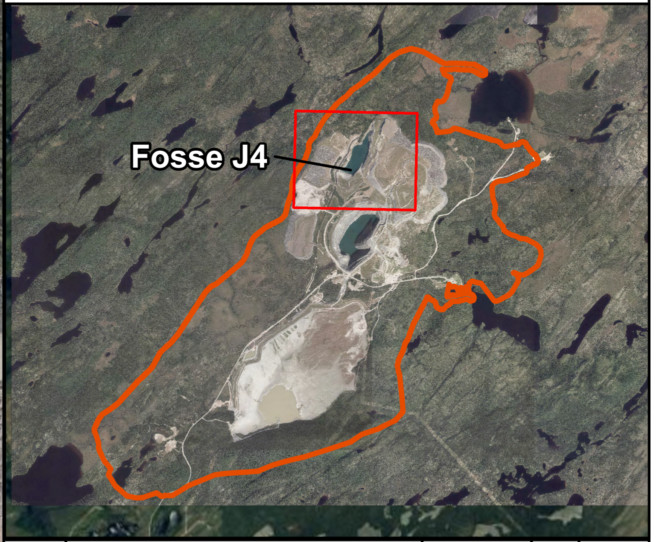
LÉGENDE / LEGEND

Zone de développement du projet / Project development area

Durée du voyage (Jours) / Travel Time (Days)

0 - 36500

36500 - 73000



1				
RÉV.	DESCRIPTION	AA/MM/YY	BY	VERIF.

RÉFÉRENCES/REFERENCES

Durée de voyage, ZDP: BluMetric, 2025
Base Map: Bing, 06 June 2023

NOTES

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1:6,000 — 0 — 120 — 240 m

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PROJET/PROJECT

Étude d'impact sur l'environnement et le milieu social pour le projet de mine Troilus / Environmental and Social Impact Assessement for the Troilus Mine Project

TITRE/TITLE

Suivi des particules vers l'avant dans le scenario de base- Fosse J4 / Base Scenario Forward Particle Tracking - Pit J4

BluMetric® Environnement — Stantec

NO. PROJET / PROJECT NO.	*DATE*
240433 / 167040485	06/ 19/ 2025
CONÇU / CHECKED	*RÉVISÉ / VERIFIED*
É. Hudon-Gagnon	C. Gardois
DESSINÉ / DRAWN	*Figure No.* / *ED./REV.*
M. Baker	13.7a / 1

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LÉGENDE / LEGEND

Zone de développement du projet / Project development area

Durée du voyage (Jours) / Travel Time (Days)

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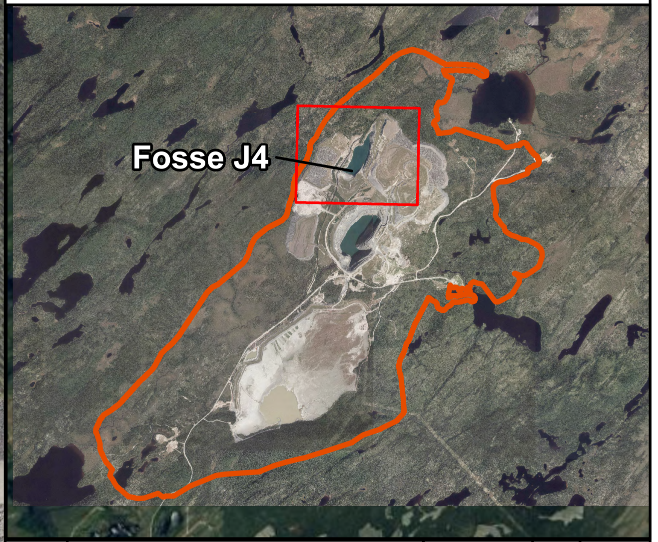

RÉV.	DESCRIPTION	AA/MM/YY	BY	VERIF.
1				

RÉFÉRENCES/REFERENCES

Durée de voyage, ZDP: BluMetric, 2025
Base Map: Bing, 06 June 2023

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1:6,000 — 0 — 120 — 240 m

ÉCHELLE (m) / SCALE (m)

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PROJET/PROJECT

Étude d'impact sur l'environnement et le milieu social pour le projet de mine Troilus / Environmental and Social Impact Assessement for the Troilus Mine Project

TITRE/TITLE

Suivi des particules vers l'arrière dans le scénario de base - Fosse J4 / Base Scenario Backward Particle Tracking - Pit J4

BluMetric® Environnement — Stantec

NO. PROJET / PROJECT NO.	DATE
240433 / 167040485	06/ 19/ 2025
CONÇU / CHECKED	RÉVISÉ / VERIFIED
É. Hudon-Gagnon	C. Gardois

DESSINÉ / DRAWN	Figure No.	ED./REV.
M. Baker	13.7b	1

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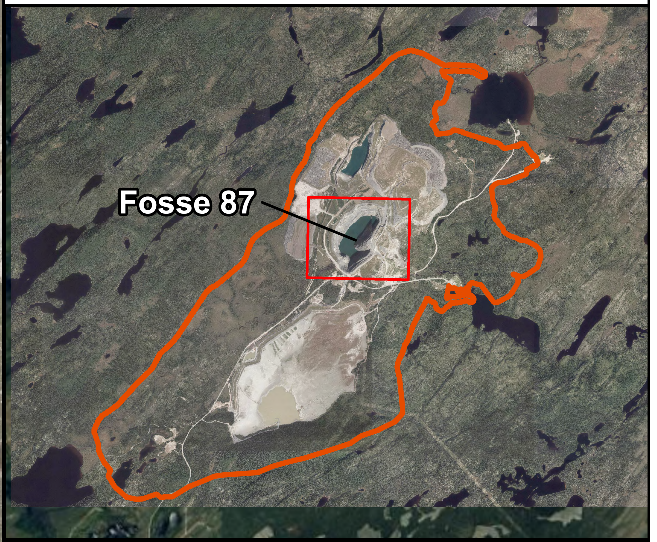
LÉGENDE / LEGEND

Zone de développement du projet / Project development area

Durée du voyage (Jours) / Travel Time (Days)

- 0 - 36500
- 36500 - 73000



RÉV.	DESCRIPTION	AA/MM/YY	BY	VERIF.
1				

RÉFÉRENCES/REFERENCES

Durée de voyage, ZDP: BluMetric, 2025
Base Map: Bing, 06 June 2023

NOTES

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1:5,000 — 0 100 200 m — ÉCHELLE (m) / SCALE (m)

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CLIENT

Troilus Gold Corp.

PROJET/PROJECT

Étude d'impact sur l'environnement et le milieu social pour le projet de mine Troilus / Environmental and Social Impact Assessement for the Troilus Mine Project

TITRE/TITLE

Suivi des particules vers l'avant dans le scénario de base - Fosse 87 / Base Scenario Forward Particle Tracking - Pit 87

BluMetric Environnement — Stantec

NO. PROJET / PROJECT NO.	DATE
240433 / 167040485	06/ 19/ 2025
CONÇU / CHECKED É. Hudon-Gagnon	*RÉVISÉ / VERIFIED* C. Gardois
DESSINÉ / DRAWN M. Baker	*Figure No.* 13.8a — *ED./REV.* 1

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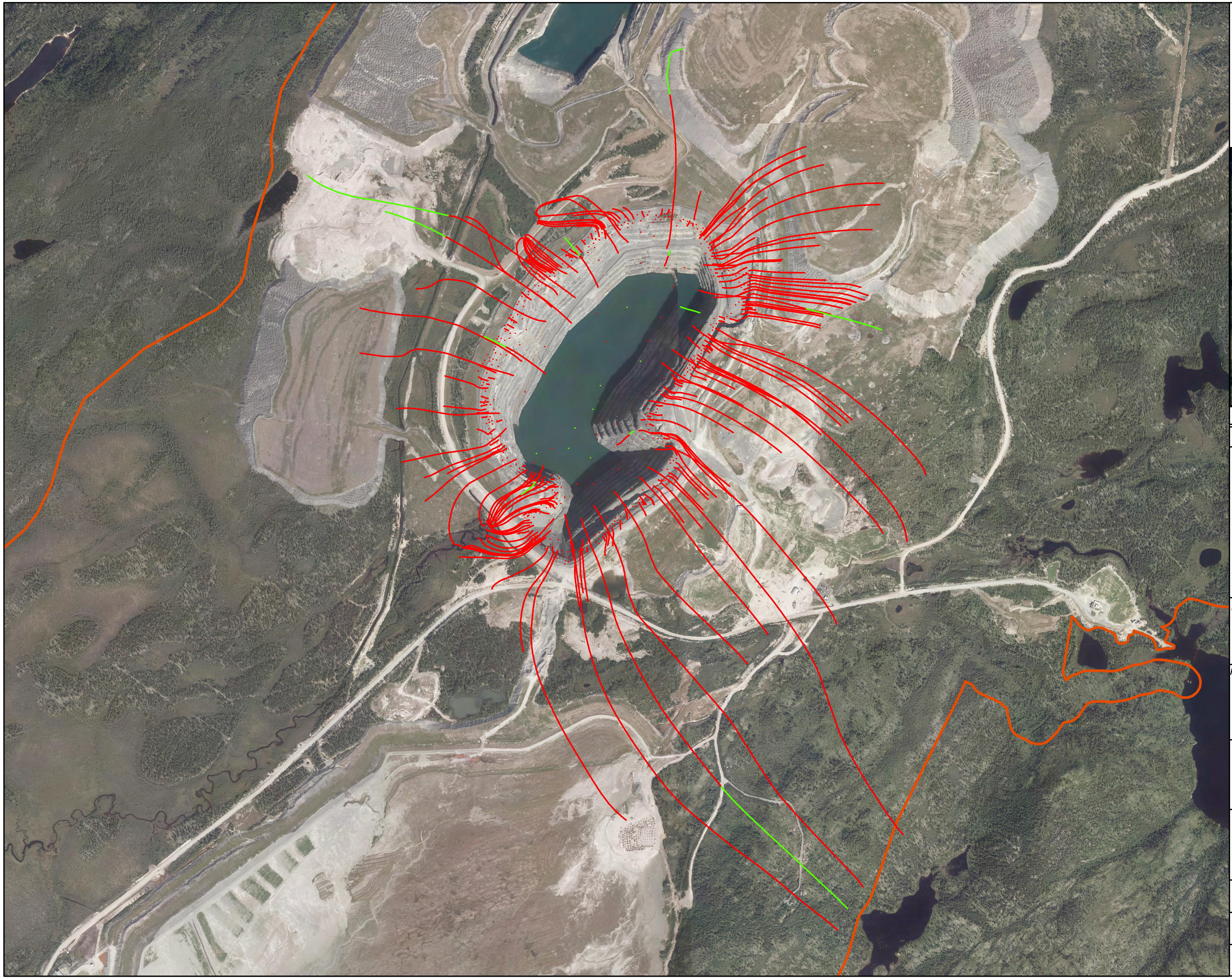
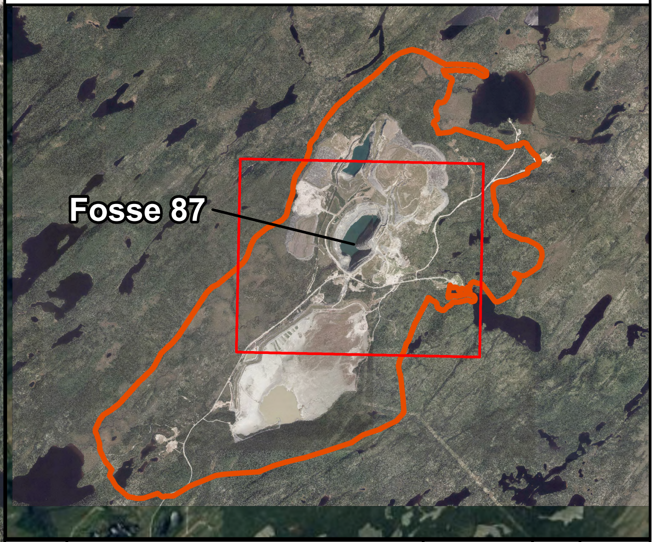


LÉGENDE / LEGEND

Zone de développement du projet / Project development area

Durée du voyage (Jours) / Travel Time (Days)

- 36500 - 0
- 73000 - 36500



1				
RÉV.	DESCRIPTION	AA/MM/YY	BY	VERIF.

RÉFÉRENCES/REFERENCES

Durée de voyage, ZDP: BluMetric, 2025
Base Map: Bing, 06 June 2023

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ÉCHELLE (m) / SCALE (m)

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Troilus Gold Corp.

PROJET/PROJECT

Étude d'impact sur l'environnement et le milieu social pour le projet de mine Troilus / Environmental and Social Impact Assessement for the Troilus Mine Project

TITRE/TITLE

Suivi des particules vers l'arrière dans le scénario de base - Fosse 87 / Base Scenario Backward Particle Tracking - Pit 87

BluMetric Environnement — Stantec

NO. PROJET / PROJECT NO. 240433 / 167040485	*DATE* 06/ 19/ 2025
CONÇU / CHECKED É. Hudon-Gagnon	*RÉVISÉ / VERIFIED* C. Gardois
DESSINÉ / DRAWN M. Baker	*Figure No.* 13.8b — *ED./REV.* 1

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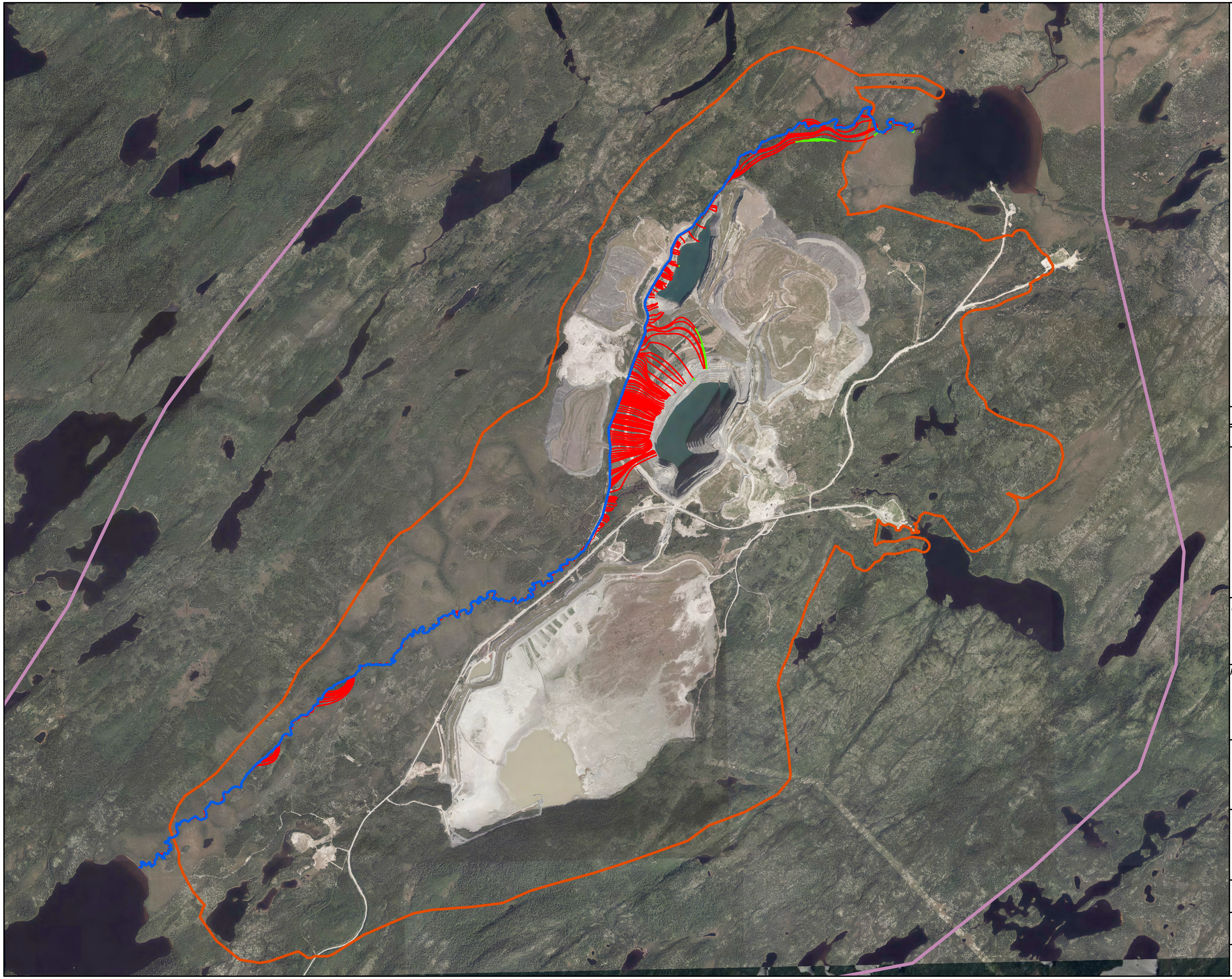

LÉGENDE / LEGEND

- Zone de développement du projet / Project development area
- Zone d'étude locale / Local Study Area
- Ruisseau Bibou (Wachiih)

Durée du voyage (Jours) / Travel Time (Days)

- 0 - 36500
- 36500 - 73000

RÉV.	DESCRIPTION	AA/MM/YY	BY	VERIF.
1				

RÉFÉRENCES/REFERENCES

Durée de voyage, ZDP, ZEL: BluMetric, 2025
Base Map: Bing, 06 June 2023

NOTES

1:30,000 — 0 / 500 / 1,000 m

ÉCHELLE (m) / SCALE (m)

LES DIMENSIONS DE CETTE ÉCHELLE DOIVENT ÊTRE UTILISÉES À TITRE D'INFORMATION SEULEMENT — *THE DIMENSIONS OF THIS SCALE ARE FOR INFORMATION PURPOSES ONLY*

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Troilus Gold Corp.

PROJET/PROJECT

Étude d'impact sur l'environnement et le milieu social pour le projet de mine Troilus / Environmental and Social Impact Assessement for the Troilus Mine Project

TITRE/TITLE

Suivi des particules vers l'avant dans le scénario de base - Ruisseau Bibou / Base Scenario Forward Particle Tracking - Bibou Creek

BluMetric Environnement — Stantec

NO. PROJET / PROJECT NO. 240433 / 167040485	*DATE* 06/ 19/ 2025
CONÇU / CHECKED É. Hudon-Gagnon	*RÉVISÉ / VERIFIED* C. Gardois
DESSINÉ / DRAWN M. Baker	*Figure No.* 13.9a — *ED./REV.* 1

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LÉGENDE / LEGEND

- Zone de développement du projet / Project development area
- Zone d'étude locale / Local Study Area
- Ruisseau Bibou (Wachiih)

Durée du voyage (Jours) / Travel Time (Days)

- 36500 - 0
- 73000 - 36500

RÉV.	DESCRIPTION	AA/MM/YY	BY	VERIF.
1				

RÉFÉRENCES/REFERENCES

Durée de voyage, ZDP, ZEL: BluMetric, 2025
Base Map: Bing, 06 June 2023

NOTES

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1:30,000 — 0 — 550 — 1,100 m
ÉCHELLE (m) / SCALE (m)

LES DIMENSIONS DE CETTE ÉCHELLE DOIVENT ÊTRE UTILISÉES À TITRE D'INFORMATION SEULEMENT — *THE DIMENSIONS OF THIS SCALE ARE FOR INFORMATION PURPOSES ONLY*

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PROJET/PROJECT

Étude d'impact sur l'environnement et le milieu social pour le projet de mine Troilus / Environmental and Social Impact Assessement for the Troilus Mine Project

TITRE/TITLE

Suivi des particules vers l'arrière dans le scénario de base - Ruisseau Bibou / Base Scenario Backward Particle Tracking - Bibou Creek

BluMetric® Environnement — Stantec

NO. PROJET / PROJECT NO.	*DATE*	
240433 / 167040485	06/ 19/ 2025	
CONÇU / CHECKED É. Hudon-Gagnon	*RÉVISÉ / VERIFIED* C. Gardois	
DESSINÉ / DRAWN M. Baker	*Figure No.* 13.9b	*ED./REV.* 1

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According to the water balance analysis, the groundwater infiltration rate simulated for pits J4 and 87 in the baseline scenario was 1,633.3 and 2,197.8 m^3/d respectively. On the other hand, the simulated groundwater infiltration rate for Bibou Creek (i.e., groundwater contribution) was 1,401.6 m^3/d.

13.3 Project Interactions with Hydrogeology

Table 13.8 identifies, for each potential impact, the activities likely to interact with the Valued Component (VC) and result in the identified impact. These interactions are indicated by a check or dash and are discussed in detail in Section 13.4, in the context of pathways, standard and project-specific mitigation/improvement measures, and residual impacts.

Table 13.8 Project interaction with hydrogeology

	Impacts			
Physical Activities	**Lowering / raising of aquifer levels**	**Reduced flow to community springs and wells**	**Reduced recharge of local aquifers**	**Drainage of aquifer-dependent wetlands and watercourses**
Construction				
Labour, equipment and materials transport to the site.	-	-	-	-
Vehicles and equipment operation and maintenance within the PA.	-	-	-	-
Tree cutting, vegetation clearing, soil stripping and earthworks.	√	√	√	√
Handling and use of explosives, including blasting	-	-	-	-
Construction of temporary and permanent buildings, including wastewater treatment system and drinking water collection and distribution system.	√	√	-	-
Construction of mining infrastructures such as stockpiles, pits and the raising of tailings management facility.	√	√	√	√
Construction of roads and preparation of construction surfaces including the crushing of material used for construction. Relocation of a section of the access road and the power line.	-	-	-	-
Construction of water management systems including ditches, diversion channel, sedimentation ponds and the water treatment plant.	-	-	-	-
Dewatering of natural water bodies and pits, lowering water level in tailings management facility and management of contact water.	-	-	√	√
Diversion of Bibou Creek (CE2).	√	-	-	√
Management of waste materials, including hazardous waste.	-	-	-	-
Purchases of goods and services	-	-	-	-
Employment	-	-	-	-

Physical Activities	Impacts			
	Lowering / raising of aquifer levels	Reduced flow to community springs and wells	Reduced recharge of local aquifers	Drainage of aquifer-dependent wetlands and watercourses
Operations				
Labour, equipment and materials transport to the site.	-	-	-	-
Vehicles and equipment operation and maintenance within the PA.	-	-	-	-
Handling and use of explosives, including blasting	-	-	-	-
Ore extraction from pits including drilling and hauling of waste rock.	-	-	-	-
Ore, waste rock and tailings storage.	-	-	-	-
Ore processing including conveyor, crushing, loading and hauling on site.	√	√	√	√
Transportation of concentrate to a smelter or a wharf.	-	-	-	-
Management and treatment of water on the mine site and to the environment, including drainage and contact water.	-	-	-	-
Progressive reclamation of disturbed areas.	√	-	-	-
Management of waste materials, including hazardous waste.	√	-	√	-
Purchases of goods and services	-	-	-	-
Employment	-	-	-	-
Decommissioning and Closure	-	-	-	-
Labour, equipment and materials transport to the site.				
Vehicles and equipment operation and maintenance within the PA.	-	-	-	-
Decommissioning, dismantling and disposal of buidings and equipment.	-	-	-	-
Pits flooding, surface and groundwater management.	-	-	-	-
Reclamation of disturbed areas, including earthwoks, placement of overburden and revegetation.	√	-	-	-
Management of waste materials, including hazardous waste.	√	-	-	-
Purchases of goods and services	-	-	-	-
Employment	-	-	-	-

NOTES:

✓ = Potential interaction

– = No interaction

13.4 Assessment of Residual Impact on Hydrogeology

A residual impact is defined as the environmental effect that remains after all reasonable and effective mitigation measures have been implemented. In other words, it is the impact that remains despite all efforts to avoid and reduce adverse impacts. The mining project will result in a decrease in groundwater levels due to the dewatering of open pits, mainly in the bedrock unit, but also in surface hydrostratigraphic units. This drop could affect local groundwater users, which are very minimal near the Troilus project, located in the project's zone of influence. Groundwater levels are also expected to rise, mainly in the tailings and waste rock storage area.

As part of the mining project, changes to the groundwater flow regime will influence water exchanges between groundwater and surface water, thus affecting the quantity of water available. Dewatering pumping and pit excavation will lower the water table, reducing underground inflows to streams, lakes and wetlands, particularly during low-flow periods. This reduction in inflow can lead to a lowering of surface water levels, thus modifying local hydrological regimes. On the contrary, changes in drainage or water table drawdown can also lead to a redistribution of underground flows, increasing the water supply to certain areas. An in-depth analysis of these dynamics is essential to anticipate and manage these impacts on the regional water regime.

Modifications to site development can lead to a decrease or increase in aquifer recharge, thus affecting long-term groundwater availability. Soil sealing, watershed disruption and changes to natural drainage can reduce the infiltration of precipitation into water tables, limiting their renewal. Insufficient recharge of aquifers can lead to a gradual decline in groundwater levels, compromising the water supply to wells, watercourses and the wetlands that depend on them. This reduction in groundwater resources can also exacerbate the impact of drought periods and affect human and ecological uses of water.

13.4.1 Lowering/Raising of Aquifer Levels

13.4.1.1 Project Pathways

Construction

The construction of buildings and infrastructure will require earthworks and excavation work that may lower or raise the piezometric level in aquifers.

During the two years of the mine construction, digging and excavation activities will temporarily modify the hydrogeological balance in the LSA. The lowering of aquifer levels will be caused mainly by the drainage required for excavation of underground and surface infrastructure, and by the pumping of seepage water. This drop may lead to a temporary reduction in flows in certain springs or streams connected to the affected aquifers, as discussed in Section 13.4.4.

On the contrary, some areas may experience a temporary rise in groundwater levels due to the redistribution of underground flow or the cessation of pumping in certain sections. However, no significant rise in aquifer levels is anticipated during the construction phase.

Construction of the Bibou Creek diversion channel could modify groundwater levels by affecting the intersected hydrostratigraphic units and altering the interaction between surface and groundwater.

Operations

The development of tailings ponds and tailings management facilities will modify the ground surface, reducing (ponds) or increasing (tailings storage facility) the infiltration of rainwater into aquifers due to sealing or a reduction in sealing compared with the baseline condition. Water flowing through tailings and waste rock areas will be directed to collection systems, reducing the natural recharge of local aquifers. Groundwater pumping to dewater mining pits will lower aquifer levels at different stages of mining.

Groundwater levels are also expected to rise, mainly in the tailings and waste rock storage areas. The accumulation of these materials can reduce soil permeability, limiting groundwater circulation and leading to a rise in piezometric levels in these areas.

Closure

Once mining operations have ceased and pumping has stopped, a natural rise in piezometric levels will be observed. This causes the pits to be progressively filled by groundwater and surface water, modifying the local hydraulic gradient. These changes influence the direction and velocity of groundwater flows, which can affect surrounding aquifers.

13.4.1.2 Mitigation and Enhancement Measures

To limit these impacts and promote sustainable management of water resources, a number of mitigation and enhancement measures will be implemented.

- Implement temporary, adaptive water management measures during construction of the Bibou Creek diversion, so as to maintain a balanced or non-negative water balance. This involves in particular:
  - Implementing a temporary diversion system (e.g. diversion canal, controlled pumping and backflow) to ensure continuity of downstream inflows;
  - Real-time monitoring of water levels and flows, upstream and downstream of the work;
  - Adjustment of artificial inflows as required (e.g., addition of pumped water or impoundment) to compensate for any losses;
  - Documentation of measurements and observations to support compliance with environmental and aquatic habitat conservation requirements.
- Limit groundwater pumping to what is strictly necessary to avoid excessive drawdown.
- Discharge treated water in a controlled manner to avoid sudden fluctuations in aquifer levels.
- Encourage natural recharge through soil restoration and revegetation.

These measures will limit the adverse impacts of the mining project while improving the long-term resilience of groundwater resources.

13.4.1.3 Project Residual Impacts

Construction

The lowering or raising of the water table during the construction phase has not been specifically simulated as a scenario in the hydrogeological modelling (BluMetric, 2025). However, it is expected that there will be a transition in levels between the baseline scenario and the Year 10 scenario (end of SW pit operations).

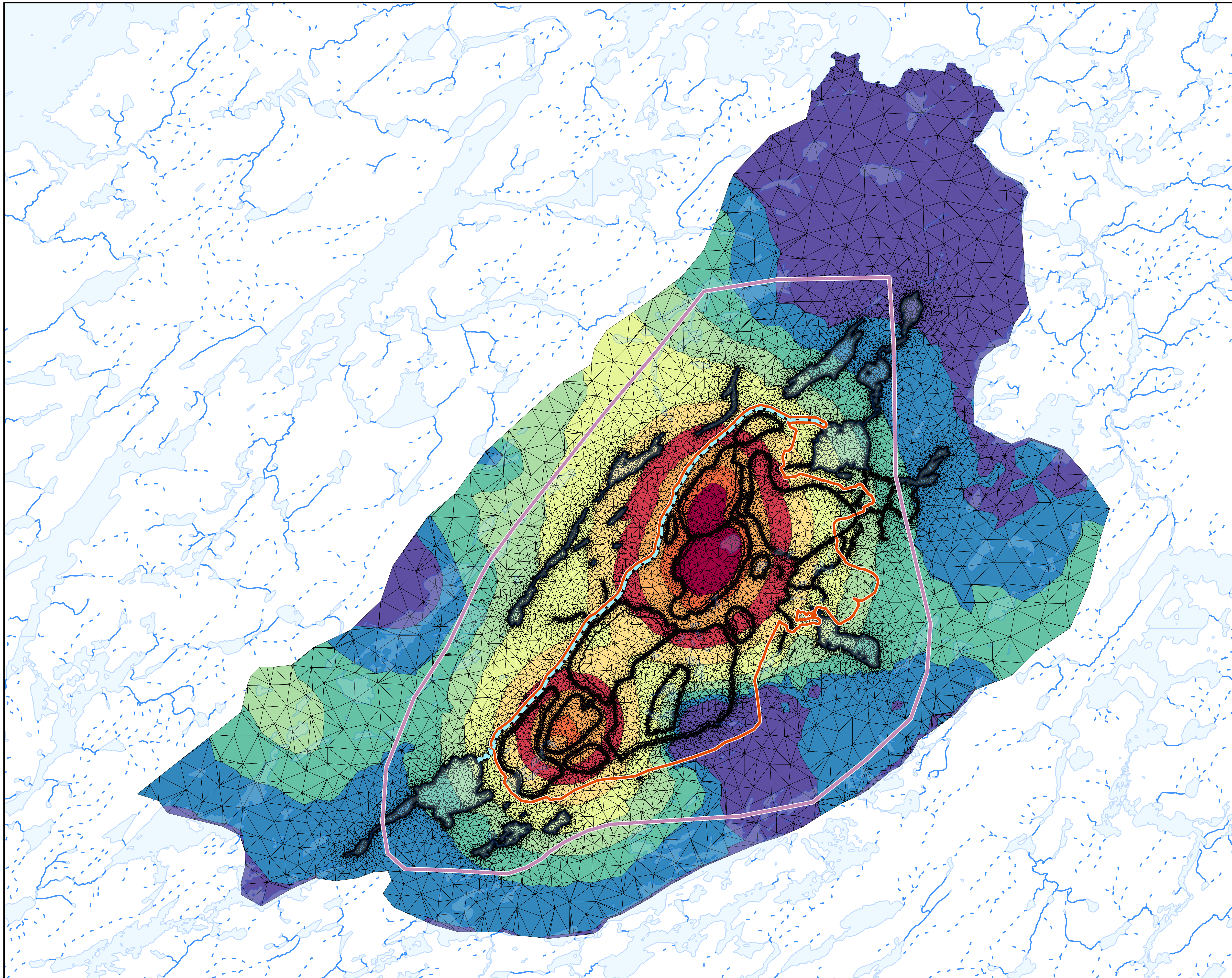
Earthworks and excavation work planned for the construction of mine buildings and infrastructure will have a temporary impact on LSA aquifer levels. These activities, spread over a two-year period, will only slightly disturb the existing hydrogeological balance, with the exception of the Bibou Creek diversion, which will have a significant and permanent impact.

The profile of the planned diversion will be mainly above the water table (baseline scenario), with the exception of an area northwest of pits 87 and J4. In this area, the channel will induce a drawdown proportional to the degree of fracturing of the bedrock. Initially, therefore, there will be a greater contribution from and impact on groundwater, before a steady-state regime is reached. In other areas where the channel profile is higher than the water table, the opposite phenomenon could occur, leading to infiltration of water from the channel into the aquifers, particularly if the environment is highly permeable. This will depend on the level of drawdown achieved by the pumping initiated in 2024 in pit J4.

During the construction phase, stripping, excavation and infrastructure installation work may temporarily disrupt surface hydrogeological conditions. The residual impact on aquifers will be mainly in the form of a local lowering of the piezometric level, due to occasional drainage and dewatering operations. This impact is characterized as adverse, of high magnitude, over a short period of time, continuous and irreversible, due to the physical modifications to aquifers specifically associated with the diversion of the Bibou Creek.

Operations

The anticipated drawdown or upwelling during the operational phase was simulated by comparing water levels in the unconsolidated deposits and in the bedrock obtained by numerical modelling (BluMetric, 2025). Two scenarios were selected: Year 10 of operation (end of SW pit operation) and Year 21 (end of operation). The simulated steady-state scenarios (hydrogeological equilibrium) represent the maximum expected scenarios. Maps 13.10 and 13.11 show the expected drawdowns in bedrock for the different scenarios considered.



LÉGENDE / LEGEND

- Zone de développement du projet / Project development area
- Zone d'étude locale / Local Study Area
- Infrastructure projetée - YR10 / Projected Infrastrucutre - YR10
- Déviation du ruisseau Bibou / Bibou Creek Diversion Channel

Cours d'eau naturel / Natural Watercourses

- Permanent / Permanent
- Intermittent / Intermittent
- Plan d'eau / Lake

Rabattement de l'eau souterraine (mètres) / Groundwater Drawdown (Metres)

- ≤ 0
- 0.1 - 2
- 2- 5
- 5- 10
- 10 - 25
- 25 - 50
- 50 - 100
- 100 - 200
- 200 - 300
- >300

RÉV.	DESCRIPTION	AA/MM/YY	BY	VERIF.
1				

RÉFÉRENCES/REFERENCES

Rbattement, ZDP, ZEL, Infrastructure YR10: BluMetric, 2025
Cours d'eau: GRHQ, 2025
Base Map: Bing, 06 June 2023

NOTES

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1:70,000 — 0 — 1,500 — 3,000 m

ÉCHELLE (m) / SCALE (m)

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CLIENT

Troilus Gold Corp.

PROJET/PROJECT

Étude d'impact sur l'environnement et le milieu social pour le projet de mine Troilus / Environmental and Social Impact Assessment for the Troilus Mine Project

TITRE/TITLE

Rabattement de l'eau souterraine simulé dans le roc pour l'an 10 / Simulated Groundwater Drawdown in Bedrock for Year 10

BluMetric Environnement — Stantec

NO. PROJET / PROJECT NO. 240433 / 167040485	*DATE* 06/ 19/ 2025	
CONÇU / CHECKED É. Hudon-Gagnon	*RÉVISÉ / VERIFIED* C. Gardois	
DESSINÉ / DRAWN M. Baker	*Figure No.* 13.10	*ED./REV.* 1

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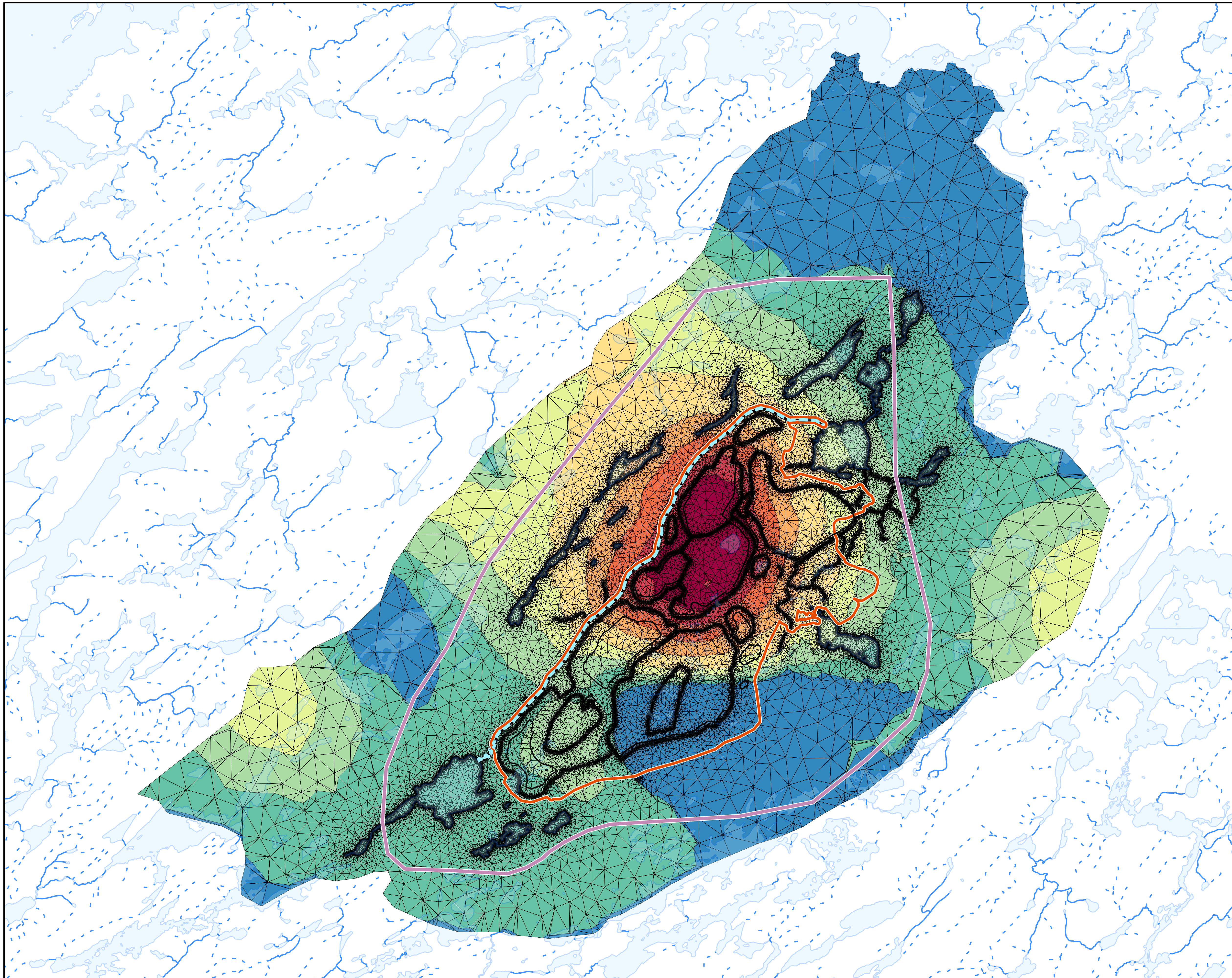

LÉGENDE / LEGEND

- Zone de développement du projet / Project development area
- Zone d'étude locale / Local Study Area
- Infrastructure projetée - YR21 / Projected Infrastrucutre - YR21
- Déviation du ruisseau Bibou / Bibou Creek Diversion Channel

Cours d'eau naturel / Natural Watercourses

- Permanent / Permanent
- Intermittent / Intermittent
- Plan d'eau / Lake

Rabattement de l'eau souterraine (mètres) / Groundwater Drawdown (Meters)

- ≤ 0
- 0.1 - 2
- 2 - 5
- 5 - 10
- 10 - 25
- 25 - 50
- 50 - 100
- 100 - 150
- > 150

RÉV.	DESCRIPTION	AA/MM/YY	BY	VERIF.
1				

RÉFÉRENCES/REFERENCES

Rbattement, ZDP, ZEL, Infrastructure YR21: BluMetric, 2025
Cours d'eau: GRHQ, 2025
Base Map: Bing, 06 June 2023

NOTES

1:70,000 — 0 — 1,500 — 3,000 m
ÉCHELLE (m) / SCALE (m)

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PROJET/PROJECT

Étude d'impact sur l'environnement et le milieu social pour le projet de mine Troilus / Environmental and Social Impact Assessment for the Troilus Mine Project

TITRE/TITLE

Rabattement de l'eau souterraine simulé dans le roc pour l'an 21 / Simulated Groundwater Drawdown in Bedrock for Year 21

BluMetric Environnement — Stantec

NO. PROJET / PROJECT NO.	DATE
240433 / 167040485	06/ 19/ 2025
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É. Hudon-Gagnon	C. Gardois

DESSINÉ / DRAWN	Figure No.	ED./REV.
M. Baker	13.11	1

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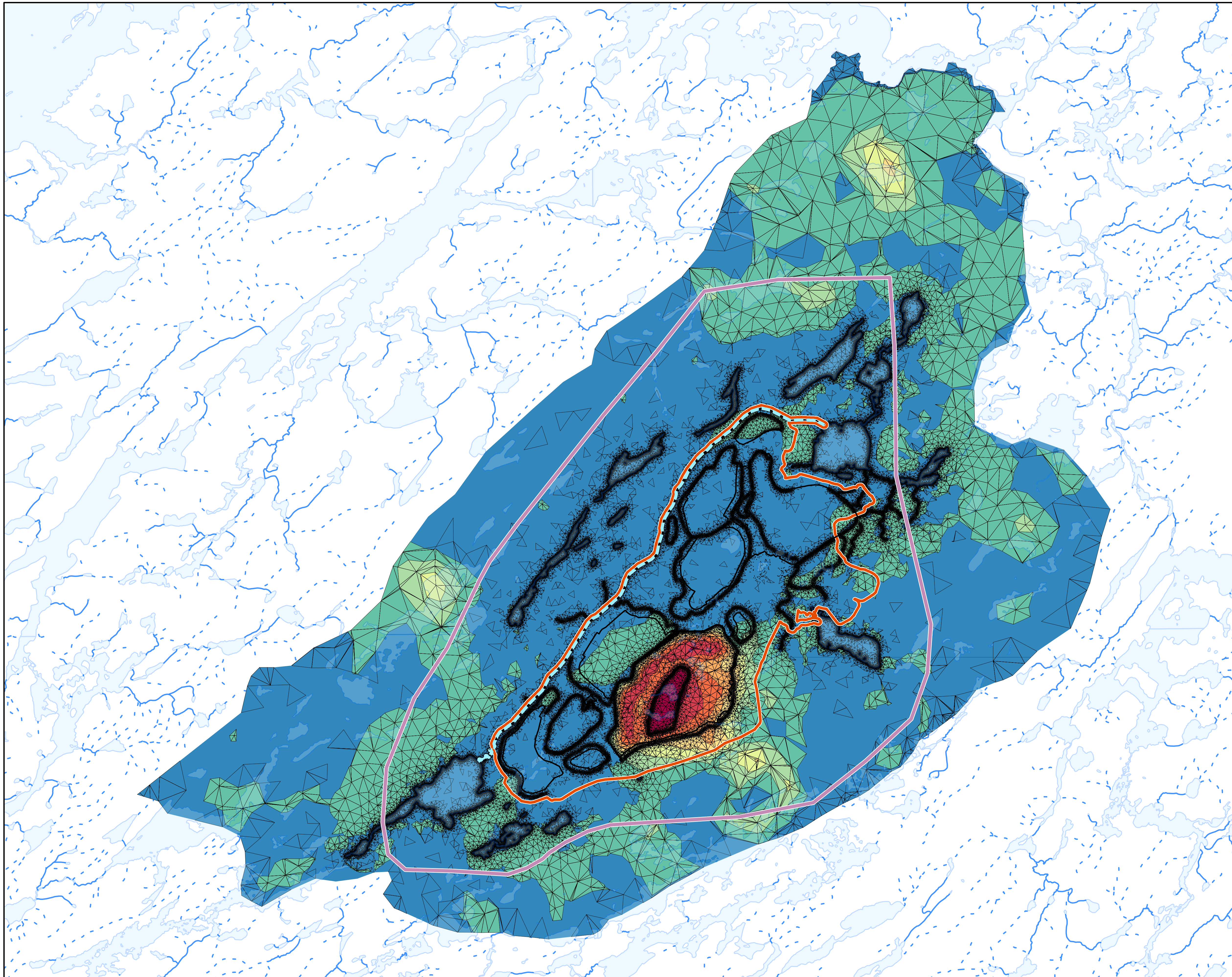
The large extent of the model, coupled with limited data on the hydrostratigraphy of unconsolidated deposits outside the PDA, results in greater uncertainty away from this zone. At Year 10, the estimated drawdown (rock) caused by pumping in the SW pit will reach 247 m in depth, and could reach 10 m at a distance of 1,500 m.

The drawdown in the bedrock unit caused by pumping in pits J4 and 87 could reach 10 m at a distance of 2,800 m from the pit.

Maps 13.12 and 13.13 show the expected upwelling according to the different scenarios.



LÉGENDE / LEGEND

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- Zone d'étude locale / Local Study Area
- Infrastructure projetée - YR10 / Projected Infrasrucutre - YR10
- Déviation du ruisseau Bibou / Bibou Creek Diversion Channel

Cours d'eau naturel / Natural Watercourses

- Permanent / Permanent
- Intermittent / Intermittent
- Plan d'eau / Lake

Remontée de l'eau souterraine (mètres) / Groundwater Upwelling (Metres)

- ≤ 0
- 0.1 - 5
- 5 -10
- 10 - 15
- 15 - 20
- 20 - 25
- 25 - 30
- 30 - 35
- > 35

RÉV.	DESCRIPTION	AA/MM/YY	BY	VERIF.
1				

RÉFÉRENCES/REFERENCES

Remontée, ZDP, ZEL, Infrastructure YR10: BluMetric, 2025
Cours d'eau: GRHQ, 2025
Base Map: Bing, 06 June 2023

NOTES

1:70,000 — 0 — 1,350 — 2,700 m

ÉCHELLE (m) / SCALE (m)

LES DIMENSIONS DE CETTE ÉCHELLE DOIVENT ÊTRE UTILISÉES À TITRE D'INFORMATION SEULEMENT — *THE DIMENSIONS OF THIS SCALE ARE FOR INFORMATION PURPOSES ONLY*

N / E / S / W

CLIENT

Troilus Gold Corp.

PROJET/PROJECT

Étude d'impact sur l'environnement et le milieu social pour le projet de mine Troilus / Environmental and Social Impact Assessement for the Troilus Mine Project

TITRE/TITLE

Rremontée de l'eau souterraine simulé dans les dépôts meubles pour l'an 10 / Simulated Groundwater Upwelling in Surface Deposits for Year 10

BluMetric® Environnement — Stantec

NO. PROJET / PROJECT NO.	*DATE*	
240433 / 167040485	06/ 19/ 2025	
CONÇU / CHECKED	*RÉVISÉ / VERIFIED*	
É. Hudon-Gagnon	C. Gardois	
DESSINÉ / DRAWN	*Figure No.*	*ED./REV.*
M. Baker	13.12	1

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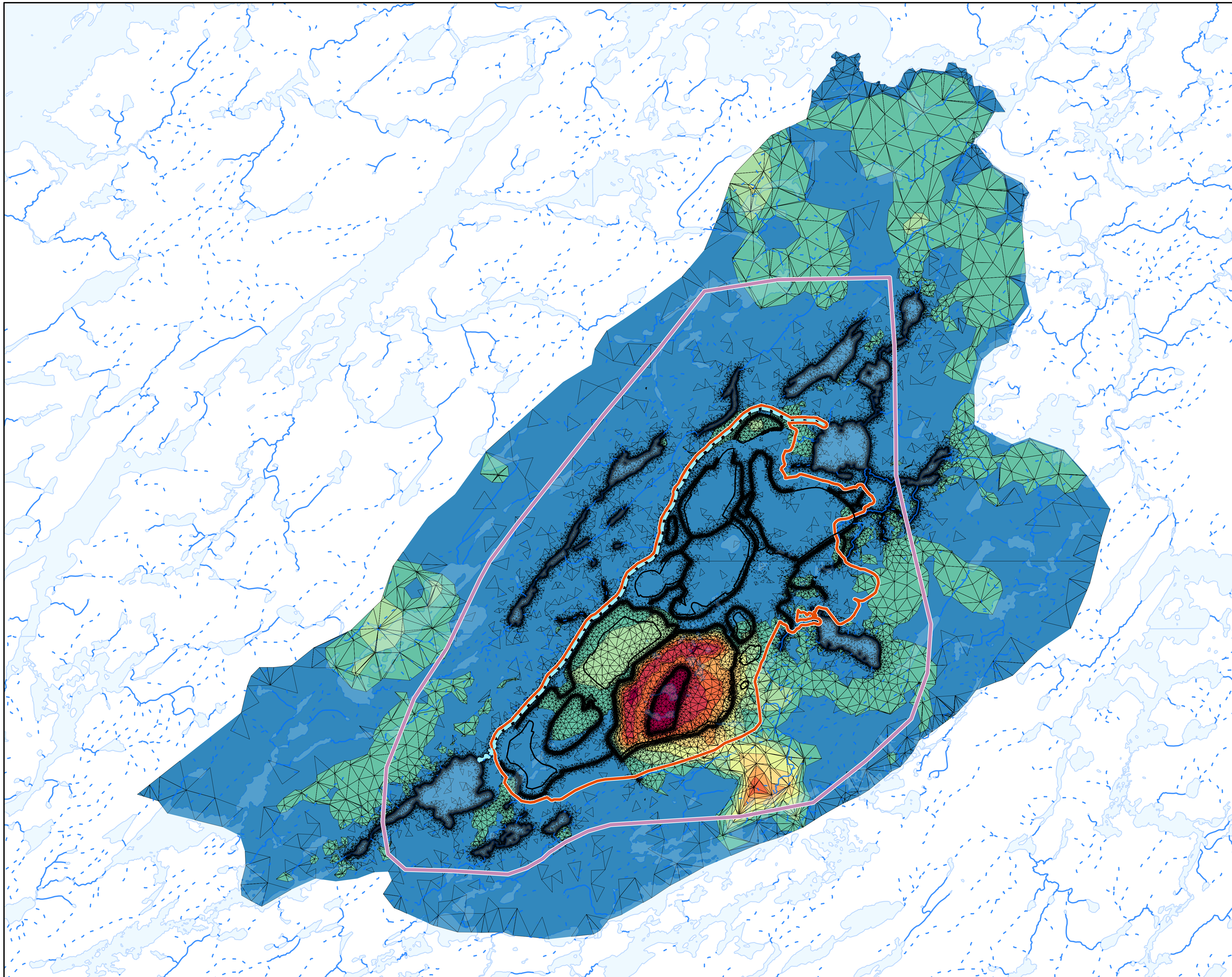

LÉGENDE / LEGEND

- Zone de développement du projet / Project development area
- Zone d'étude locale / Local Study Area
- Infrastructure projetée - YR21 / Projected Infrastrucutre - YR21
- Déviation du ruisseau Bibou / Bibou Creek Diversion Channel

Cours d'eau naturel / Natural Watercourses

- Permanent / Permanent
- Intermittent / Intermittent
- Plan d'eau / Lake

Remontée de l'eau souterraine (mètres) / Groundwater Upwelling (Metres)

- ≤ 0
- 0.1 - 5
- 5 - 10
- 10 - 15
- 15 - 20
- 20 - 25
- 25 - 30
- 30 - 35
- > 35

RÉV.	DESCRIPTION	AA/MM/YY	BY	VERIF.
3				

RÉFÉRENCES/REFERENCES

Remontée, ZDP, ZEL, Infrastructure YR21: BluMetric, 2025
Cours d'eau: GRHQ, 2025
Base Map: Bing, 06 June 2023

NOTES

1:70,000 — 0 — 1,500 — 3,000 m

ÉCHELLE (m) / SCALE (m)

LES DIMENSIONS DE CETTE ÉCHELLE DOIVENT ÊTRE UTILISÉES À TITRE D'INFORMATION SEULEMENT
THE DIMENSIONS OF THIS SCALE ARE FOR INFORMATION PURPOSES ONLY

N / W / E / S

CLIENT

Troilus Gold Corp.

PROJET/PROJECT

Étude d'impact sur l'environnement et le milieu social pour le projet de mine Troilus / Environmental and Social Impact Assessement for the Troilus Mine Project

TITRE/TITLE

Remontée de l'eau souterraine simulé dans les dépôts meubles pour l'an 21 / Simulated Groundwater Upwelling in Surface Deposits for Year 21

BluMetric Environnement

Stantec

NO. PROJET / PROJECT NO.	*DATE*	
240433 / 167040485	06/ 19/ 2025	
CONÇU / CHECKED É. Hudon-Gagnon	*RÉVISÉ / VERIFIED* C. Gardois	
DESSINÉ / DRAWN M. Baker	*Figure No.* 13.13	*ED./REV.* 3

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The exploitation phase represents the most critical stage for groundwater resources. The continuous pumping required to keep the pit dry will cause a sustained and widespread lowering of aquifer levels, likely to modify natural hydraulic gradients and impact downstream uses (water catchments, wetlands, dependent ecosystems). The residual impact here is adverse, of high magnitude localized to the LSA, but potentially diffuse depending on geological conditions, with medium-term occurrence, medium duration, continuous frequency, and irreversibility linked to lasting disruption of the hydrogeological regime.

Closure

Closure is assessed from the timing when the pits are at their maximum operating level. At this timing, the equilibrium will have been reached and the J4, 87 and X22 pits will have been converted to pit lakes and maintained at the same water level (i.e. 363.1 m) in the pits. The SW pit will already have been backfilled with tailings and covered with waste rock after Year 10 of operation. Comparison of the hydraulic head of the mine closure scenario with that of the baseline scenario reveals that the maximum anticipated drawdown (approx. 18.84 m) would occur in the waste rock pile, located just east of the J4 pit. A rise in the water table (approx. 54.53 m) would occur in pit 87, as it is at this maximum level that the pits will remain closed.

Under the mine closure scenario, pits J4, 87 and X22 will be converted to pit lakes. No water will be diverted from the Bibou Creek diversion channel to fill the pits. Filling will rely solely on mine site runoff, groundwater infiltration and evaporation losses. Six scenarios were analyzed, taking into account average precipitation, climate change impacts (4% and 8% increase in precipitation), and annual lake evaporation. The results indicate that the time required to fill the lakes varies from 18.5 to 21.3 years. These estimates are based on simplified modelling integrating the hydrological and hydrogeological data available for the site.

Particle tracking analysis was carried out for three pits. Figures 13.4 and 13.5 show that pits J4 and X22 would be hydraulically connected to the Bibou Creek diversion channel, based on forward particle tracking analyses over 200 years (73,000 days). However, pit 87 would not be hydraulically connected to the Bibou Creek diversion channel. Consequently, it would receive no water from the Bibou Creek diversion channel, as demonstrated by the simulated forward particle tracking results for the Bibou Creek diversion channel (Figure 13.5).

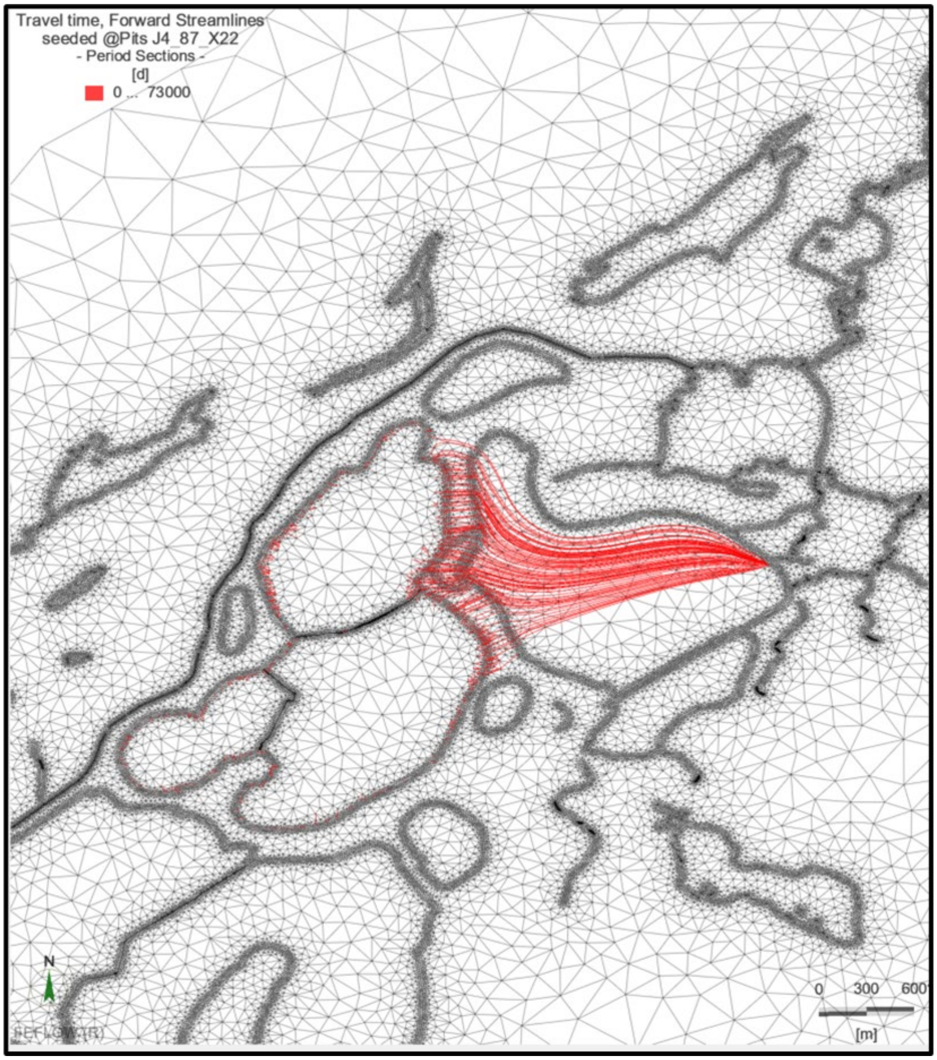

Figure 13.4 Forward particle tracking for pits J4, X22 and 87 - Closure

Source: BluMetric, 2025

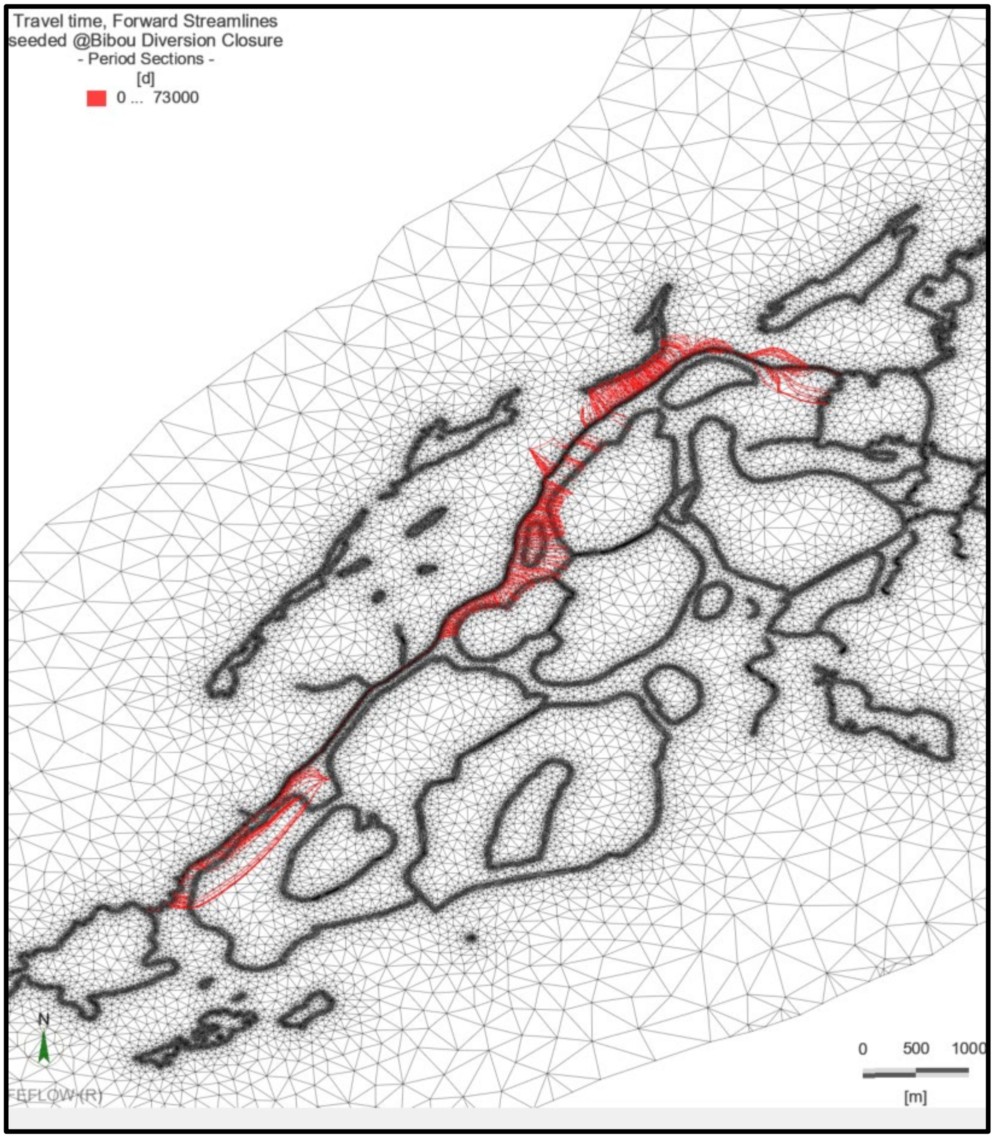

Figure 13.5 Forward particle tracking for the Bibou Creek diversion channel - Closure

Source: BluMetric, 2025

When the facilities are closed, the gradual cessation of pumping operations will lead to a natural rise in water table levels. This impact is considered adverse, high in magnitude, localized (LSA), occurring in the short term after pumping operations cease, over a medium duration, continuously, and will remain irreversible.

13.4.2 Reduced flow from community springs and wells

13.4.2.1 Project Pathways

With the anticipated drawdown of groundwater levels caused by dewatering activities, groundwater supplies could be adversely affected. In the LSA, where impacts on levels are expected, only the mine supply wells and the Awashish family camp well are currently present.

13.4.2.2 Mitigation and Enhancement Measures

- Evaluate the capacity of the mine well to supply drinking water to the mining operation with the expected drawdown.
- Relocate the Awashish family camp further north outside the LSA and develop a new drinking water supply well.

13.4.2.3 Project Residual Impact

Although the mining camp's existing drinking water supply will be affected, alternative supply solutions are possible, either by drawing groundwater from several wells, or by relocating this intake to a more favorable hydrogeological zone within the project perimeter.

During the construction phase, the anticipated residual impact is characterized as adverse, of low to moderate magnitude, and localized to the PDA. The impact is short term, of limited duration and continuous, but reversible, notably due to the shallow depth and natural recharge dynamics of the aquifers concerned.

During the operational phase, continued pumping to dewater the pit or galleries will maintain or accentuate the piezometric depression in the aquifers, which may lead to a reduction in the flow of certain springs and wells used by the communities. This impact is considered to be adverse, of low to moderate magnitude, localized to the PDA, occurring over the medium term, over a medium duration, on a continuous basis, and remains reversible, insofar as a stabilization of water table levels is anticipated at the end of operations or with the implementation of compensatory measures (e.g.: replacement wells, water redistribution).

When the site closes, flooding of the pits will allow a gradual rise in groundwater levels, thus reducing the impact on springs and wells. The anticipated residual impact is therefore considered to be neutral to slight adverse, of moderate magnitude, localized to the PDA, occurring in the short term, over a medium to long duration, on a continuous basis, and remains reversible, subject to appropriate management of the hydrogeological transition phase.

13.4.3 Modified Recharge of Local Aquifers

13.4.3.1 Project Pathways

Construction

During the construction phase of a mining project, a number of activities can influence the recharge of local aquifers, reducing or increasing it depending on local conditions and the facilities put in place. Deforestation and soil stripping, necessary for the construction of mining infrastructures (roads, processing facilities, tailings storage facility), may modify vegetation cover and soil permeability. These changes can reduce the natural infiltration of rainwater and increase surface runoff, thereby limiting groundwater recharge.

However, in some areas, changes in landforms and soils can also increase infiltration. For example, the excavation of foundations and the creation of sedimentation basins or permeable storage areas can locally increase aquifer recharge by redirecting water towards more permeable formations.

The installation of drainage systems and temporary or permanent diversion of watercourses can modify the recharge regime of aquifers, resulting in either a reduction or an increase in recharge depending on the management of water flows. Thus, the overall impact on local aquifer recharge will depend on the interactions between these various factors and the mitigation measures implemented to optimize water management on site.

Operation

During the operational phase, ore extraction and groundwater pumping associated with mining operations can influence local aquifer recharge, either by reducing or increasing it, depending on the facilities put in place.

However, certain infrastructures put in place during mining operations can also contribute to increased aquifer recharge. For example, sedimentation ponds and tailings storage facility, depending on their design and the nature of the materials used, may allow increased infiltration of surface water into the ground. In addition, mine drainage management can, in some cases, redirect pumped water to areas of controlled infiltration, thereby promoting local recharge.

The overall impact on aquifer recharge will therefore depend on how groundwater and surface water are managed on the mine site. Optimized hydraulic infrastructure design can mitigate recharge losses while maximizing infiltration opportunities in strategic areas.

Closure

After mine closure, several factors may continue to influence aquifer recharge, either reducing or increasing it. The dismantling of mining infrastructures and the restoration and rehabilitation of land will once again modify groundwater dynamics. Reclamation of mined-out areas, including re-vegetation and soil stabilization, can encourage the gradual return of natural infiltration conditions. However, certain permanent structures, such as abandoned pits or compacted areas, could have long-term impacts on aquifer recharge by limiting water infiltration.

The evolution of water levels after the cessation of mining pumping may also influence local recharge. In some cases, the return of the water table to its equilibrium level can extend over several years, temporarily impacting regional hydrogeological dynamics. Long-term monitoring of water levels and groundwater flows is often necessary to assess the evolution of these impacts and adjust rehabilitation measures accordingly.

However, progressive restoration of impacted surfaces can improve soil infiltration capacity and thus increase aquifer recharge through rainwater infiltration. The formation of new topographical depressions resulting from the operation may also act as water retention zones, encouraging increased infiltration. On site closure, the cessation of groundwater pumping will lead to a gradual rise in the water table, which may help to re-establish natural hydraulic connections. However, the application of impermeable coverings on tailings pits and tailings storage facility may, on the contrary, limit infiltration and thus reduce local recharge. The effectiveness of rehabilitation measures will therefore influence the final impact on aquifer recharge.

13.4.3.2 Mitigation and Enhancement Measures

- Adopting construction techniques that promote the use of permeable materials, such as honeycomb pavers, porous asphalt or compacted gravel, for access roads and parking areas, will help maintain the natural infiltration of rainwater and limit surface runoff. These developments will also support groundwater recharge and reduce the hydraulic head on stormwater management systems.
- Progressive reclamation of the project's tailings and waste rock piles.
- Reuse and recycling processed water during operation will reduce reliance on groundwater withdrawals, thereby mitigating impacts on local aquifers.
- In compacted or artificialized areas, soil restoration techniques such as decompaction and organic amendment will be used to improve infiltration capacity.
- Once the available space in the tailings storage facility has been maximized, tailings will be disposed of in the pit SW and a portion of pits J4 and 87.

13.4.3.3 Project Residual Impact

Construction

During the construction phase, activities such as deforestation, soil stripping and installation of mining infrastructure will reduce surface water infiltration, thereby limiting recharge of local aquifers. Despite the application of mitigation measures, such as the construction of retention basins and the use of permeable materials for certain infrastructures, a moderate decrease in recharge will remain unavoidable in the PDA.

This impact will occur in a context of high sensitivity, as aquifer recharge is highly dependent on precipitation and local soil conditions. However, the duration of this impact is considered short-term, since at the end of construction, some areas may be rehabilitated or reconfigured to improve infiltration. The impact will be continuous throughout this phase, but reversible thanks to the restoration measures implemented afterwards.

Operations

During operation, pumping groundwater for mining purposes, storage of tailings and modification of water flows will result in a prolonged reduction in aquifer recharge. Despite efforts to optimize water use and limit the lowering of the water table, the impact will remain moderate in the PDA, as mining and mine water management will directly affect hydrological dynamics.

At the surface of the hydrogeological model (BluMetric, 2025), the expected recharge according to surface deposits are presented in the following Table 13.9.

Table 13.9 Hydrogeological model surface recharge according to surface deposits

Scenario	Recharge (m^3/d)
Base	55,156
Year 10	65,854
Year 21	71,749
Closing	71,749

As part of the analysis of residual impacts on groundwater resources, the assessment of daily aquifer recharge volumes shows a progressively favorable trend over the project life cycle. The baseline scenario, representing initial pre-project conditions, indicates an estimated recharge of 55,156 m3/d. This value rises to 65,854 m3/d at Year 10, then reaches 71,749 m3/d at Year 21, a level that is maintained during the closure phase. This increase is mainly attributable to the placement of the new waste rock pile located to the west of the tailings storage facility, whose materials are more permeable than native soils, encouraging increased infiltration of rainwater into the underlying aquifers. Thus, although certain hydrogeological impacts remain locally irreversible (lowering of piezometry, reduced flow), this gradual increase in recharge constitutes a significant mitigating factor in the assessment of long-term residual impacts.

In the operational phase, the impact is therefore positive of moderate magnitude, and localized to the potential drainage zone. This phase enables better hydrogeological management, with a reversible long-term impact thanks to adjustments made during operation. Aquifer recharge will be improved by the implementation of appropriate measures, such as controlled pumping and readjustment of flow rates as required.

Closure

When the mine closes, progressive land reclamation and restoration and the cessation of groundwater pumping will lead to a gradual rise in the water table and a possible improvement in aquifer recharge. However, certain infrastructures, such as mine pits and tailings storage facilities, will continue to have residual impacts on surface water infiltration.

On site closure, the anticipated impact will be positive, moderate in magnitude and localized to the potential drainage area. Although the reduction in recharge could persist over a longer period, the impact will become reversible in the long term, as groundwater levels will continue to recover once operations are completed. Post-mining management and reclamation measures will promote improved natural recharge of aquifers.

13.4.4 Dewatering of Aquifer-Dependent Wetlands and Watercourses

13.4.4.1 Project Pathways

Construction

The diversion of Bibou Creek will modify the interaction between groundwater and surface water. This modification, and the development of other infrastructures, could result in lower water levels in some nearby wetlands and watercourses, affecting aquifer-dependent ecosystems.

Operations

During mine operations, pumping groundwater required for mining operations could further lower water levels in wetlands and watercourses located within the LSA. These impacts could result in a reduction in aquatic biodiversity and changes to riparian habitats.

Closure

When the mine closes, the cessation of groundwater pumping and the reclamation of mining infrastructure could permanently alter the hydrodynamics of the area. Wetlands and water courses dependent on aquifers could be subject to permanent changes in water regime, prolonging environmental impacts beyond the operating period.

13.4.4.2 Mitigation and Enhancement Measures

Construction: Implement measures to maintain water balance during construction of the Bibou Creek diversion, ensuring that water inflows and outflows are balanced or non-negative in order to preserve aquatic ecosystems and the quality of water resources.

Operation: Continuous monitoring of groundwater levels, and levels in certain streams and lakes.

Closure: Ecological restoration of impacted wetlands and post-closure monitoring to assess the resilience of aquatic ecosystems.

13.4.4.3 Project Residual Impact

Construction

Based on the hydrogeological model (BluMetric, 2025), almost all of the wetlands in the LSA have very little groundwater recharge. Only an area between Lac Requins and Lac Hameçon, northwest of the J4 pit, shows groundwater resurgence in wetlands. In the baseline scenario, an inflow of 416 m^3/d is estimated.

The residual impact of the construction phase is considered adverse, with a low magnitude and a scope limited to the LSA. This impact is perceived with moderate sensitivity and will occur in the short term. It will occur on an ongoing basis and will be irreversible due to the lasting modification of the water regime.

Operation

For the Year 10 operating scenario, a resurgence of 465 m^3/d of groundwater to the wetland area concerned is estimated, while for Year 21, an inflow of 600 m^3/d is estimated. Compared to the base scenario (416 m^3/d), these values suggest a partial and gradual recovery of water resources, thus limiting the long-term adverse impacts on this groundwater-dependent sector.

Table 13.10 shows groundwater infiltration rates to the Bibou Creek/Bibou Creek diversion channel during the various mine phases. Values in parentheses indicate changes in groundwater infiltration rates (in percent) relative to the baseline scenario. A negative sign indicates a decrease in the groundwater infiltration rate.

Table 13.10 Groundwater infiltration rates to the Bibou Creek/Bibou Creek diversion channel during different mine phases

Creek	Groundwater infiltration rate (m^3/d)			
	Base scenario	Year 10	Year 21	Closure
Bibou Creek diversion /Bibou Creek	1401.6	1039.4 (-25.8 %)	2254.0 (60.8 %)	3897.7 (178.1 %)

Expected impacts on the infiltration rate of groundwater into the Bibou Creek diversion channel vary according to the different phases of the project. The infiltration rate, initially stable, will be reduced during the first years of operation, due to changes in groundwater flow associated with infrastructure preparation and installation. This reduction will be followed by a significant increase in the infiltration rate as the project progresses, particularly after several years of operation. This upward trend will continue into the closure phase, when a significant recovery in seepage flux is expected, indicating that the underground aquifers, after mining activities cease, will be able to regenerate and resume functioning close to that observed in the baseline scenario. In short, although there will be fluctuations during operation, the overall anticipated impact will be positive in the long term, with an improvement in infiltration flows at the end of the project.

Table 13.11 shows the groundwater infiltration rates expected in several lakes during the various mine phases. Values in brackets indicate the change in groundwater infiltration rate (in percent) relative to the baseline scenario. A negative sign indicates a decrease in the groundwater infiltration rate.

Table 13.11 Groundwater infiltration rates in several lakes during different mine phases

Lake	Groundwater infiltration rate (m^3/d)			
	Base scenario	Year 10	Year 21	Closure
A (PE43)	824.6	735.1 (-10.8 %)	696 (-15.6 %)	708.7 (-14.1 %)
A4 (PE44)	140.3	88.9 (-36.6%)	88.2 (-37.1%)	88.5 (-36.9%)
B (PE29)	783.2	754.5 (-3.7 %)	827.6 (5.7 %)	827.5 (5.6 %)
Upstream (PE2)	2042.5	2021.7 (-1.0 %)	1934.9 (-5.3 %)	1928.8 (-5.7 %)
C7	-342	-330.6 (3.3 %)	-396.1 (-15.8 %)	-431.7 (-26.2 %)
D	549.2	466.8 (-15 %)	327.2 (-40.4 %)	339.1 (-38.2 %)
D1 (PE58)	519.8	679.2 (30.7 %)	652.5 (25.5 %)	778.3 (49.7 %)
D2 (PE60)	107.45	217.52 (102.4 %)	83.6 (-22.2 %)	85.1 (-20.8 %)
E2 (PE57)	193.1	160.7 (-16.8 %)	89.7 (-53.5 %)	117.3 (-39.2 %)
E3 (PE54)	-141.2	-10.6 (92.5 %)	-10.6 (92.5 %)	-10.6 (92.5 %)
E5 (PE53)	-226.9	-7.8 (96.6 %)	-7.8 (96.6 %)	-7.8 (96.6 %)

The impact on lakes will vary over the various phases of the project, with reductions and increases in infiltration observed in several of them. Some lakes, such as Lake A (PE43) and Lake D, will see a progressive reduction in their infiltration rate, indicating an adverse impact on these areas due to mining activities. Lake A4 (PE44) will also see a significant reduction over time. On the other hand, lakes such as Lake B (PE29) and Lake D1 (PE58) will see an increase in infiltration, particularly over the long term. Other lakes such as Lake Amont (PE2), Lake D2 (PE60), and Lake E2 (PE57) show fluctuations, with periods of reduction followed by partial recovery. Some lakes, such as Lake C7, Lake E3 (PE54), and Lake E5 (PE53), show notable variations in infiltration rates, but remain essentially impacted by significant reductions in recharge as the project progresses.

Lakes E3 (PE54) and E5 (PE53) represent recharge zones for groundwater, but these will be diminished by the diversion of the Bibou Creek.

During the operational phase, the residual impact will remain adverse, with a low magnitude and a scope still limited to the LSA. It will be perceived with moderate sensitivity and will persist in the medium term. As with the construction phase, this impact will be ongoing and irreversible, as groundwater pumping will have a lasting effect on aquatic ecosystems.

Closure

For the closure scenario, an inflow of 351 m^3/d is estimated, slightly lower than that associated with the baseline scenario.

The expected impacts on lakes are presented in Table 13.11.

At mine closure, the residual impact will remain adverse, with a low magnitude and a geographic extent limited to the LSA. Sensitivity will remain moderate, but the duration of the impact will be longer, extending over the long term. The impact will remain continuous and irreversible, as modifications to the water regime will persist even after mining activities have ceased.

13.4.5 Summary of Project Residual Impacts

Table 13.12 summarizes the residual impacts on hydrogeology.

Table 13.12 Residual impacts of the project on hydrogeology

Residual impact	Residual Impact Characterization							
	Project phase	Direction	Magnitude	Geographic extent	Timing	Duration	Frequency	Reversibility
Lowering or raising of aquifer levels	C	A	H	LSA	SM	CT	C	I
	O	A	H	LSA	SE	MT	C	I
	D	A	H	LSA	SM	MT	C	I
Reducing the flow of community springs and wells	C	A	N	PDA	SM	CT	C	R
	O	A	N	PDA	SE	MT	C	R
	D	Neutral	N	PDA	SM	SE	C	R
Reduced recharge of local aquifers	C	A	M	PDA	SE	CT	C	R
	O	P	M	PDA	SE	CT	C	R
	D	P	M	PDA	SE	LT	C	R
Drainage of aquifer-dependent wetlands and watercourses	C	A	L	LSA	SM	CT	C	I
	O	A	L	LSA	SM	MT	C	I
	D	A	L	LSA	SM	LT	C	I

Residual impact	Residual Impact Characterization							
	Project phase	Direction	Magnitude	Geographic extent	Timing	Duration	Frequency	Reversibility

Project phase :
C: Construction
O: Operation
D: Decommissioning and Closure

Direction :
P: Positive
A: Adverse

Magnitude :
N: No measurable change
L: Low
M: Moderate
H: High

Geographic extent :
PDA: Project Development Area
LSA: Local Study Area
RSA: Regional Study Area

Timing :
NS: No sensitivity
SM: Moderate sensitivity
SE: High sensitivity

Duration :
CT : Short term
MT: Medium-term
LT : Long term
n/a Not applicable

Frequency :
S : Single event
IR : Irregular event
R: Regular event
C : Continuous

Reversibility :
R : Reversible

I: Irreversible

13.4.5.1 Summary of Adverse Impacts

Earthworks and excavation work, including the diversion of Bibou Creek, will temporarily affect local aquifers, with a lowering of the piezometric level due to drainage and dewatering operations. Deforestation and earthworks will reduce surface water infiltration, limiting recharge of local aquifers. Continuous pumping to keep the pit dry will lower the water table, modifying hydraulic gradients and impacting downstream ecosystems. Mining activities will continue to reduce aquifer recharge in the short term, despite efforts to optimize water use. At closure, although pumping will have ceased, modification of the hydrogeological regime, particularly in lakes and wetlands, will persist in the long term. Some areas, such as Lake PE44 and the wetlands between Lac Requin and Lac Hameçon, may experience residual impacts.

13.4.5.2 Summary of Positive Impacts

With the development of the waste rock pile, aquifer recharge could increase over time, particularly in Year 21, with a reversible long-term impact. At closure, cessation of pumping will lead to a natural rise in water levels, with a possible improvement in aquifer recharge, although impacts on seepage into some lakes and wetlands persist.

13.5 Prediction Confidence

The assessment of hydrogeological impacts, particularly with regard to variations in groundwater quantity, was carried out using results from the numerical model developed for the site. This model was used to simulate the impact of the various phases of the project on the groundwater flow regime and piezometric levels. Confidence in impact prediction is considered moderate, given that the model is based on a limited data set, particularly with regard to seasonal variability in hydrogeological conditions. In addition, certain simplifying assumptions had to be adopted in order to represent recharge conditions, dewatering flows and water-rock interactions. Although the simulated scenarios are conservative, the results must be interpreted in the light of these uncertainties and the inherent limitations of the modelling framework.

13.6 References

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