ENVIRONMENTAL AND SOCIAL MONITORING PROGRAM

MONITORING REPORT 2019

SEPTEMBER 2020

ENVIRONMENTAL AND SOCIAL MONITORING PROGRAM

2019 Annual Monitoring Report
Renard Mine

Environment Department - Stornoway Diamonds (Canada) Inc.

September 2020

Project Team

Stornoway Diamonds (Canada) Inc.

Martin Boucher	Vice-President, Environment, Health, Safety and Sustainable Development
Diane Marois	Director, Organizational Development and Community Relations
Anissa Amri	Environment Analyst
Maryse Godin	Environment Coordinator
El-Hadji Kane	Water Treatment Advisor
Kevin Gagnon	Geotechnical Engineer

Executive Summary

This report covers the results of the 2019 monitoring activities undertaken as part of the implementation of Renard mine's Environmental and Social Management System (ESMS).

The ESMS emerged from various environmental management tools SWY has developed over the years to promote early detection of environmental and social issues, ensure environmental regulatory compliance and promote continuous improvement.

Included among these tools are the Environmental Surveillance Program, the Environmental and Social Monitoring Program (ESMP), and other internal auditing tools. Although these tools were developed for the construction phase, SWY has continued to use the tools in the Renard mine operations phase.

As a communications tool, the Renard mine's annual environmental and social monitoring report is designed to communicate the results of the various environmental and social management activities to stakeholders, the general public and government authorities. The report covers the results of the environmental monitoring activities in 2019.

Environmental and Social Management System (ESMS)

SWY's ESMS was put in place in 2015 to oversee construction activities at the mine, which were performed without any notice of non-compliance. The implementation of the ESMS on site resulted in an orderly, properly signposted and safe worksite.

Surveillance activities continued during mine operations in order to track the overall environmental performance of SWY's activities. The surveillance activities helped promote early detection of and respond rapidly to a system malfunction or a failure of a mitigation measure.

TSM™ Certification

Towards Sustainable Mining (TSM™) is a system developed by the Mining Association of Canada (MAC) to enable the mining industry to meet its commitments with respect to its environmental and social performance, credibility, transparency and responsibilities. Participation in TSM is mandatory for MAC's member companies, who are required to submit annual reports on the performance of their Canadian locations using protocols and indicators. For each indicator, mining facilities assign a letter grade from "C", the lowest, to "AAA" the highest, which reflects their performance, except in the case of crisis management protocol, which requires a yes or no response.

The goal of the TSM program is to help mining companies achieve Level A or higher, which indicates that the company is managing social and environmental risks effectively and using exemplary environmental management, safety and community engagement practices.

In 2019, SWY conducted its second self-assessment of the seven protocols in the TSM™ initiative. SWY achieved the top AAA level for two protocols and Level AA on five protocols. Self-assessments are externally verified every three years.

Eco-Permits

The Ecopermitting process is an internal procedure SWY put in place during the construction phase to ensure regulatory compliance of work in progress or of any change in working method. A total of 423 Eco-Permits have been submitted to the Environment Department for assessment since 2015, 73 of which were submitted in 2018 and 84 in 2019. The increase in Eco-Permit applications submitted from 2018 to 2019 reflects the increase in development activities to ensure smooth extraction operations in 2019.

Solid Waste Management

The solid waste (SW) management philosophy put in place by SWY is based on the 3R-RD principle (reduce, reuse, recycle, reclaim, dispose). SWY adopted performance indicators to track SW at the Renard mine site where they are separated at source and collected in dedicated containers so that whatever can be re-used is reclaimed.

Since 2018, solid waste quantities have been expressed in percentage of tonnes (%t). This adjustment results in a more accurate weight of solid waste by type of material, not by container. This means SWY can track the change in recycling and landfilling rates more accurately in relation to performance indicators.

Since 2015, 49% of the tonnes of solid waste produced at the mine site was recycled or reclaimed. In 2019, about

52% of the tonnes of solid waste was recycled, as compared with 55% in 2018. SWY has continued to increase its rate of recycling since 2017, and still aims to achieve the government recycling target of 70% set by RECYC-QUÉBEC

The remaining solid waste in 2019, i.e., 48%, sent to the trench landfill site (TLS) consisted of waste with a high organic matter content (kitchen waste and garbage bin materials, etc.) and ICI (institutional, commercial and industrial) waste.

The TLS is managed in compliance with applicable legislation. It includes covering the cells from May to October to minimize the dispersion of waste and prevent odours. An annual report on TLS operations is submitted to the MELCC.

To promote continuous improvement, SWY conducted shredding and baling trials with wood stored at the TLS. Three bales of wood were shipped to the Centre technologique des résidus industriels (CTRI) in Rouyn-Noranda in late August as part of a study to reclaim the wood. The trial is continuing in 2020.

Residual Hazardous Waste Materials

Residual hazardous materials (RHMs) produced at the Renard mine site are recovered, sorted and temporarily stored in the hazardous waste area before being transported off site to be treated, reclaimed or recycled by external specialized firms. Since 2015, about 920 mt of RHMs have been shipped off site, including 224 mt in 2019. Waste oil accounted for 56% of RHMs in 2019, as compared with 33% in 2018. This increase is the result of the uptick in mechanical inspections along with the intermediate spills (20 to 100 litres), which were more frequent in 2019.

Contaminated Soil Management

In 2019, contaminated soil was all shipped to MELCC-authorized centres for storage and then decontamination at the RSI Environnement treatment centre in St-Ambroise.

Environmental Monitoring Program

Air Quality and Atmospheric Emissions

In 2019, no applicable ambient air quality standards for any of the monitoring parameters (total particulates, metals, $PM_{2.5}$, SO_2, NO_2, and dustfall) were exceeded at the Renard mine site property limits.

The Renard mine reported a total of 72,966 t (CO_2 eq.), including 49,167 t (CO_2 eq.) of greenhouse gas emissions (GHG) from stationary equipment in 2019. These emissions were reported in compliance with the Quebec Atmospheric Emissions Inventory (IQÉA) and the federal Greenhouse Gas Emissions Reporting Program.

Vibration and Noise Levels

Vibrations during blasting operations continued to be monitored in 2019. A new measuring point was installed in October 2018 about 65 m from the accommodation complex. At that location, the measurements near the accommodation complex were all within applicable standards, for both vibration and air pressure levels.

No complaints were received from Renard camp residents about nighttime noise levels, even though noise levels were 5 to 9 dBA higher than the Directive 019 threshold of 50 dBA (including the +5 dBA back-up alarm penalty). Noise levels are +8.9 dBA above Stornoway's objectives of 40 dBA at night, and 45 dBA during the day. The variation with the objective is of the same order of magnitude as values recorded in 2018 and 2017.

In terms of mitigation measures, SWY imposed restrictions on the use of vehicle horns in the vicinity of the accommodation complex at all times. SWY is targeting more restrictive targets by conducting tests aimed at reducing the propagation of noise emissions at the mine site.

Hydrological Regime

Hydrological monitoring in 2019 revealed that flood levels in Lake F3294 and Lake Lagopede were similar to levels recorded in the past. The water level in the north basin of Lake Lagopede in the spring 2019 flood was slightly lower than the level in 2018, partly due to the low precipitation recorded in the first quarter of 2019. Lake discharge rating curves were also updated in 2019 with a more extensive range of water flows associated with water level measurements, thereby helping to enhance our understanding of the hydrology of Lake Lagopede.

A comparison of recent water level and flow data since the start of mining operations (as of 2015) with baseline data (2010-2014) shows no significant trend in year-to-year water levels.

There is therefore no significant indication that mining operations have impacted the hydrological regime associated with Lake Lagopede and its tributaries.

In 2019, SWY initiated a study of the hydraulic renewal time in Lake F3298. A HOBO probe was installed in the lake in October 2016 and until spring 2020 to establish a discharge rating curve and estimate the hydraulic renewal time for the waters in Lake 3298.

With regard to water flow at the A-A' shoal in Lake Lagopede, 2019 monitoring during the winter and summer low flow periods indicates that restriction to natural water flow caused by ice upstream of A-A' shoal does not impede water flow between the north and south basins of Lake Lagopede. These findings are deemed to apply to every low flow period in general in Lake Lagopede given that water levels in Lake Lagopede in 2019 were the lowest recorded since the 2010 winter low flow period at the Lake Lagopede station.

The 2019 hydrological monitoring campaigns confirmed alternating thermoclines and seasonal mixing. Natural thermoclines illustrate stratified layers in the north basin which are subject to mixing in the spring and fall. This dynamic ensures that water in the north basin flows to the south basin in Lake Lagopede without any horizontal barrier or vertical restriction. With this study, SWY made a significant contribution to the understanding of both the hydrological regimes in the north and south basins of Lake Lagopede, as well as mine effluent dispersion modelling assumptions.

Drinking Water Quality

In 2019, 38,950 m³ of water was distributed by the Renard mine water treatment plant, with a 100% availability rate. Average consumption of drinking water ranged from 337 to 449 litres/day/person at the mine site, i.e., an average of 372 litres/day/person, or a slight increase of 5% in relation to 2018. This increase is associated with a drinking water system installed in June 2019 in the underground mine at level 290. It is also linked to the average daily distribution of 107 m^3 per day in 2019, or about 9% less than in 2018.

Water quality test results were all in compliance with standards set out in the Drinking Water Quality Regulation.

Surface Water and Sediment Quality

Surface water quality results from the 2019 sampling campaigns are comparable to those measured in the 2015, 2016 and 2017 campaigns, as well as the 2010 baseline conditions. Overall, in 2019, the streams and lakes in the study area:

- Were well oxygenated and had an acidic to slightly acidic pH;
- Were mildly turbid with low total suspended solids (TSS) concentrations;
- Had low nutrient concentrations;
- Contained natural concentrations of some metals, such as aluminum and iron, that exceeded surface water quality criteria.

In 2019, the summer thermocline (warm water on the surface and cold water below) was between 6 and 15 m deep from June to September. The winter thermocline (cold water on the surface and warm water below) was less pronounced, but still significant below the ice cover.

A marked increase in water temperature and conductivity was recorded in summer from the bottom to the surface in Lake Lagopede. These observations confirmed that mine effluent concentrates below the thermocline in summer and winter. The effluent mixes uniformly during seasonal mixing of the water layers in the spring and fall. Monthly temperature and conductivity monitoring in 2019 is consistent with the behaviour of effluent as predicted in dispersion plume modelling.

The quality of sediment sampled in 2019 is comparable to baseline conditions (2010) and 2015-2016 monitoring results. Natural mercury and lead concentrations measured in the lakes and streams exceed sediment quality criteria, which is consistent with concentrations measured in 2019. These results apply to the control area as well as the exposed area in the study area.

Vegetation and Wetlands

Renard mine's wetlands compensation program supports a bogs and fens knowledge acquisition program that was approved by the MELCC. UQAT and UQAM research teams, which have conducted field surveys since 2016, visited the bogs and fens near the mine site in summer 2019.

With regard to revegetation (or agronomic) monitoring activities, a total of 32,000 m² have been revegetated at the mine site since 2017. A second regrowth monitoring campaign was undertaken in 2019 on sites that were reforested in 2017. Some sites showed more than 50% plant regrowth, as compared with 10% in summer 2017.

In addition, regrowth in some sectors of the mine site and the borrow pits along Route 167 North was surveyed in late June 2019.

Agronomic monitoring will continue in summer 2020 in various areas that were reforested in 2019, and in revegetated wetlands along Route 167 North.

Fish and Benthic Communities

In response to the study design submitted in February 2018 for monitoring the environmental effects associated with the Renard mine, Environment Canada issued a set of recommendations in March 2019.

The focus was on optimizing biological monitoring in fall 2020 and assessing the impacts of the treated mine effluent discharged into Lake Lagopede on fish and fish habitat, and the potential use of fish resources by Cree communities.

SWY plans to launch monitoring campaigns associated with the first EEM cycle in the fall 2020 and submit an interpretive report on the first EEM cycle by February 15, 2021.

Fish Habitat and Free Passage of Fish

The third phase of monitoring the effects of Renard mine on the free passage of fish and on fish habitat is scheduled for 2020. The monitoring will focus on Lake F3298 outlet, the tributary and outlet of Lake F3301, Lake F2607 outlet as well as Lake F3300 outlet. No monitoring was carried out in 2019.

The R170 diversion stream was developed in 2015 to divert water from the Lake F3298 outlet to Lake F3295 and hence ensure the migration of fish in the diversion stream. Visual monitoring of water flow carried out in 2019 showed that water flow in the diverted section of the stream was light as in 2018 and varied significantly with precipitation. Fish movement is therefore assured in this stream during high-flow periods or after heavy precipitation. In summer low-flow periods, however, some sections of the stream are less suitable for fish migration, but fish movement conditions remain similar to the baseline observed prior to the diversion.

Fish Habitat Compensation

In 2019, upon analysis of the report on brook trout habitat compensation monitoring, the DFO confirmed that the newly developed habitats were in fact being used by brook trout, that they were passable and that they enabled the free passage of fish in the four streams. Corrective measures originally scheduled for 2019 to improve brook trout spawning grounds have been rescheduled to summer 2020, given that SWY received DFO's feedback in December 2019.

As part of the fish habitat compensation program, the lake trout spawning ground developed in Lake Lagopede was subject to monitoring in 2019 to assess the integrity of the spawning grounds, their use by spawners and water quality on the spawning ground. No irregularities were detected with regards to the spawning grounds. SWY analyzed water quality before and after lake trout spawning period. Water quality was in compliance with all regulatory criteria and remained comparable to baseline conditions for the spawning ground (2015-2016) as well as surface water quality monitoring results for Lake Lagopede. The capture of 12 mature (gravid and milt fish) in the vicinity of the spawning ground indicates that the site was actively used by the species during the 2019 spawning period. There does not seem to be any limiting factors for lake trout reproduction (spawning, incubation, hatching and rearing) in 2019.

In November 2018, SWY received authorization from COMEX to build a temporary jetty on Lake Mistassini to support the development of a walleye spawning ground as part of the compensation program. A walleye spawning ground of about 635 m^2 was built in Lake Mistassini from September 25 to October 4, 2019. The integrity of the spawning ground and its use will be monitored during the walleye spawning period in late May 2020.

Segments C and D on Route 167 Extension

A letter from the DFO, issued on May 18, 2018, confirmed that the measures undertaken by SWY as part of the Route 167 compensation program met the objectives set under Fisheries and Oceans Canada's fish protection program, thereby bringing monitoring to a close on Route 167 North.

Terrestrial Wildlife and Birds

In 2019, a third phase in wildlife monitoring was undertaken. Surveys conducted since 2011 were compared. Moose density in 2019 was lower than that recorded in the control zone in 2011 and 2015. Only a few sightings of woodland caribou were recorded in April 2019 by the MFFP.

Some black bears were sighted at the mine site in the spring and summer of 2019. Most of these animals were simply frightened off the site. Bears are consistently present at the TLS. In 2019, Stornoway made a considerable effort to improve black bear management at the mine site and at the TLS. Lids with sliding mesh doors were added to domestic waste bins at the mine site. A black bear management plan was also prepared and submitted to the MFFP.

A biologist from the MFFP visited the mine site and TLS in June 2019, and two awareness sessions were held for employees by the MFFP. Finally, in the spring, large rocks were placed at regular intervals along the TLS electric fence to ensure it remained impassable and operational

In 2019, wildlife sightings, mostly black bear sightings, were recorded along Route 167 North and at the mine site. At the MFFP's request, all black bear sightings at the TLS were recorded as of June 2019, which explains the increase in sightings recorded as compared with 2018 (23). A total of 13 wildlife sightings, including black bear, caribou and wolf sightings, were recorded along km 430 and km 648 on Route 167 North.

Waterfowl nesting boxes set up around Lake Lagopede and some small lakes nearby are in good condition and no signs of occupation were recorded in 2019.

Mine Water and Effluent Management

Water that comes into contact with mine facilities is intercepted by a network of perimeter ditches and culverts that channel it toward pit R65 (retention basin) before it is treated at the mine wastewater treatment plant (MWWTP) and then discharged into Lake Lagopede.

In 2019, a total volume of 2,237,584 m³ of water was treated then discharged into Lake Lagopede via the final mine effluent outfall. Mine effluent quality complied with Directive 019 requirements. In addition, average concentrations measured in MWWTP effluent, except nitrite and nitrate concentrations, complied with the MELCC's effluent discharge objectives (EDO).

In 2019, additional efforts were made by SWY to reduce nitrogen compound concentrations in MWWTP effluent by optimizing blasting operations, enhancing worker awareness regarding explosive loading procedures, and establishing internal standards for launching investigations in cases where higher concentrations are observed. This action plan is part of ongoing efforts to improve the monitoring of sources of nitrogen compounds in effluent.

As part of its operations in 2019, the Renard mine extracted a total volume of 2.76 Mm^3 of surface and ground water from various sources, which was equivalent to the volume extracted in 2018 (2.75 Mm^3).

These withdrawals are connected with the dewatering of the underground and open pit mines (87%), the ore processing plant's fresh water requirements (11%), the production of drinking water (2%), the production of explosives and the airport sanitary facilities (less than 0.06%).

The Renard mine's wastewater usage in relation to the use of fresh water from Lake Lagopede in 2019 was an estimated 84%, as compared with 88% in 2018 and 58% in 2017.

The mine wastewater re-use rate in 2019 was about 97.1% of the ore processing plant's total consumption in relation to water pumped from Lake Lagopede, which is comparable to the rate in 2018 (97.2%). These results confirm the effectiveness of the upgrades made at the ore processing plant.

Domestic Wastewater

In 2019, the domestic wastewater treatment plant discharged 37,385 m³ into Lake Lagopede, which is comparable with the amount discharged in 2018. Domestic effluent quality was at all times in compliance with:

- The standards set out in the Wastewater Systems Effluent Regulations;
- Environmental discharge objectives (EDO) set by the MELCC, in terms of both concentrations and load allocations.

Water-Oil Separators

In 2019, effluent from water-oil separators at the airport and the underground mine's fresh air raise (FAR) was always in compliance with the hydrocarbon disposal requirement of 15 mg/l. Regarding the mechanical maintenance of the oil-water separator in the garage, some one-off results greater than the 15 mg/L criterion were observed.

As was done in 2018, effective corrective measures were implemented in 2019 and compliant results achieved in each quarter

As in 2018, oil recovered from the separators was transported offsite for recycling at an authorized site, in compliance with applicable regulations.

Hydrogeological Regime and Groundwater Quality

The quality of groundwater collected in 2019 in the three high-risk sectors at the mine site (sectors 1, 2 and 3) is similar to that measured in 2015 to 2018.

In 2019, in sector 1, initial leaching of reworked soil and other materials disposed of in the processed kimberlite containment (MPKC) facility along with water infiltrating into the ground from the MPKC could underlie the increased conductivity and ion concentration values. Special attention should be paid to this in the next round of monitoring.

In sectors 2, 3 (bedrock and unconsolidated deposits), and 5, no major issues seem to have impacted groundwater quality. Soil disturbance and the addition of granular material during construction as well as snow removal operations could have caused an increase in the conductivity and concentration of certain ions in the observation wells downstream from mining facilities.

The quality of groundwater samples collected in sector 4, the trench landfill site (TLS), has remained stable since 2015. Results from 2019 indicate average concentrations below limit values set out in the Regulation respecting the Landfilling and Incineration of Residual Materials, or natural background levels typical of the sector. Annual mean manganese concentrations are comparable with background levels for this sector and were higher than network REIMR criteria only once in 2019. No polycyclic aromatic hydrocarbons (PAHs) were detected. Other parameters such as conductivity and fecal coliforms in TLS observation wells showed an increase in relation to 2018 and should receive special attention in future monitoring campaigns.

Containment Area Surveillance

The objective of monitoring containment areas is to control the integrity hence the stability of the geotechnical structures, verify the application of the materials deposition plan, track changes in the structures over time, and identify any maintenance work required to ensure the structures remain in good working order. For this, various weekly, quarterly and annual inspections along with one-off inspections are carried out by an external auditor on the modified processed kimberlite containment facility.

In 2019, the open pit mine was in operation until April 2019, whereas the underground mine was operated daily for the entire year. Changes made to the modified processed kimberlite containment (MPKC) facility helped ensure the structural stability of the facility and hence demonstrate throughout 2019 the effectiveness of the new design concept for deposition of PK.

No changes were made in 2019 to containment berm inspections. Visual inspections were carried out on a daily basis by supervisors and the Technical Services department, as well as by surveyors during the ongoing construction of the No. 3 permeable containment berm.

Quality control of the construction of the berms confirmed compliance with the designer's specifications, and corrective measures were put in place in cases where any non-compliances were detected.

Non-compliances detected in 2019 were corrected. The issues primarily involved isolated cases of higher water levels in deposited materials. A number of mitigation measures were implemented to reduce water content at source and hence facilitate water management at the site.

Environmental Incident Management

In 2019, SWY's Environment Department reported 126 environmental incidents, which is lower than in 2018 (144), 2017 (153), and 2015 (163), but higher than in 2016 (114). Of this total number of environmental incidents, there were 104 spills, 65% of which involved less than 20 litres, and only 11% that were greater than 100 litres, although that was slightly higher than in 2017. Mechanical failures were the cause of 86% of the spills, with the rest the result of human error.

Social Monitoring Program

The Social Monitoring Program was prepared to meet conditions 5.1, 5.2 and 5.3 set out in the Global CA, as well as Stornoway's commitments specified in the 2011 environmental and social impact assessment (ESIA), and the commitments made by signatories of the Mecheshoo Agreement (Stornoway, Cree Nation of Mistissini and the Grand Council of the Crees) and the Partnership Agreement (Chibougamau and Chapais).

This report therefore presents 2019 findings along with observations regarding primarily the monitoring of:

- Recruitment and job types and numbers;
- The integration of workers from Cree communities and the Chibougamau-Chapais communities;
- The retention of workers from Cree communities and the Chibougamau-Chapais communities;
- The use of traplines;
- Regional economic spinoffs.

Recruitment and Job Types and Numbers

As at December 31, 2019, 156 of the 502 operations employees at the Renard mine were from Chibougamau, Chapais, Mistissini and other Eeyou Istchee James Bay communities. That means that 31.1% of the workforce came directly from the region. In 2019, 2,497 hours were devoted to the professional development of Cree employees in various functions related to surface mining, the processing plant and the underground mine, and 4,281 hours for employees from the Chibougamau and Chapais communities.

As a result of this training, 534 certificates and attestations of qualifications or professional training were awarded to Cree personnel and 790 certifications to personnel from the Chibougamau-Chapais communities.

Enabling our employees to diversify helps bolster retention along with a feeling of belonging. The professional development system in place provides employees with an opportunity to diversify their skills and put them into practice in various positions.

Agreements

With the signature of the Mecheshoo Agreement, three committees were formed: the Jobs and Training and Environment committees under the Renard committee, and the Renard Liaison committee. The focus of these committees is to oversee the implementation of agreements on social and environmental impacts, the economic spinoffs associated with jobs and business development, environmental protection and biodiversity, all in keeping with our sustainable development vision.

In 2019, each of the committees held regular meetings, and 64 activities, meetings and events were organized to ensure ongoing communication with the host communities.

Integration of Cree Workers

Past experience on other projects in the James Bay territory (e.g., the Troïlus mine [Inmet], Eastmain-1-A and Sarcelle power plants and Rupert diversion [Hydro-Québec]) drew attention to the challenges associated with integrating Indigenous workers in the working environment. Indigenous workers face a number of adjustments in terms of language, mentoring, work scheduling and cultural habits that can lead to difficulties adapting.

The smooth integration of workers in the work environment is vital in that it has a significant impact on their health status.

To accomplish this, the Mecheshoo Agreement sets out a number of integration and retention measures for Cree personnel at the mine. The objective is to ensure long-term retention of Cree employees, development of the Cree workforce, in addition to ensuring Cree employees have the same opportunities for advancement as other workers. Along with measures tied to working conditions, the recommended measures take into consideration cultural specificities and the maintenance of family ties.

The work schedule for most Renard mine employees generally consists of two weeks on followed by two weeks off. Cree workers specifically were generally very positive about this schedule, given that it allows them time to practise their traditional activities with their families over an extended period of time on their days off.

A few Cree employees however resigned in 2019 because of this working schedule. They were compelled to make this difficult decision because they had a young family at home. This situation in fact applies equally to Cree and non-Cree employees. The retention of Cree employees in 2019 it should be noted was however remarkable, given that the Cree turnover rate in 2019 decreased from 19.5% to 2.60%. This success is attributed to the numerous events that were organized, improvement in internal communications but especially the opportunities for advancement arising from the professional development and continuous training system.

Integration and Diversity Coordinator Rodney Petawabano works in cooperation with development and training teams as well as human resources to monitor mentoring, apprenticeship booklets, development activities and special diversity-related projects. He ensures inclusion strategies are aligned with company responsibilities while providing advice, guidelines and support for managers with a view to enhancing their knowledge of Cree culture.

Mr. Petawabano takes part in the various meetings held by the committees involved in implementing the Mecheshoo Agreement and provides support at the mine in terms of environmental monitoring with the tallymen and with regard to working relationships with business partners.

He works with the host communities' public relations and organizational development director to promote the hiring, development and retention of a regional workforce within the community, establish open and honest connections with local authorities and address problems that may arise.

Continuous Training/Development System

Stornoway has established structures that promote the development of a culture of integration and diversity through continuous training (in-house coaching) that:

- Provides experienced employees with an opportunity to advance to instructor functions;
- Puts employees from different cultures and age groups into contact (multicultural and multigenerational);
- Offers young aspiring employees opportunities for advancement;
- Offers experienced workers and young aspiring employees an unparalleled sense of pride in working together in a group;
- Solidifies common values;
- Credits hours worked on each piece of equipment and in each function towards the Ministry of Education's, even the Quebec Construction Commission's "prior learning assessment."

Applied on a daily basis this strategy helps:

- Integrate cultural communities in the mining environment (remote mining camps);
- Train employees on a number of specific mining trades, for example, oversized and auxiliary equipment operation, and various ore processing machines, drilling and blasting trades, underground mining functions, and leadership development in a growth context;
- Develop greater flexibility among instructors, trainers and their student-employees;
- Apply innovative teaching methods adapted to our environment that help develop knowledge, along with work-related and behavioural skills: sense of observation, teamwork, desire for learning, entrepreneurship, assuming responsibility, etc.;
- Transfer mining expertise.

Land Use by M-11 Tallymen

The Cree Cultural Center built on the mine site was used by Renard mine employees for a number of community meals and activities in 2019, particularly on weekends. A celebration on National Aboriginal Day was for instance held at the Centre.

Regular meetings were held with M-11 tallymen and some members of their families throughout 2019 to keep them informed regarding progress of the work and operations at the mine, in addition to addressing their questions and concerns.

Under the Mecheshoo Agreement, the Mecheshoo Cultural and Social Fund has been in place since January 1, 2017. It is fully funded by Stornoway and is used by the Mistissini community for activities that meet certain conditions.

Local and Regional Economic spinoffs

In terms of regional benefits, 156 Stornoway employees from our host communities (including 59 Cree employees) contributed as at December 31, 2019, to generating annual benefits in excess of $15.4 million in salaries for Mistissini, Chapais and Chibougamau.

Regarding economic spinoffs, $121 million were invested in purchasing goods and services in 2019, from suppliers throughout Quebec, including $38 million (31%) invested directly in the host region (Cree and James Bay).

Stornoway is particularly proud of the level of collaboration from regional stakeholders and committees, who are also focussed on finding ways to optimize the benefits generated by the Renard mine. The mine continues to have a significant daily impact on Cree and Jamesian stakeholders and Stornoway is proud to be contributing to the economic growth of the region.

Under the Mecheshoo Agreement, the Mistissini/Renard Business Development Fund was initiated on January 1, 2017. Every year, Stornoway and Mistissini jointly contribute equal amounts to the fund, which is intended to support the start-up and development of Mistissini Cree businesses.

In 2019, a total of $147,254 (maximum of $100,000 from each partner) was awarded to three projects submitted to the Mistassini Cree Band Council.

Communications

Fully aware that communications are key to developing relationships with our employees and partners, we deploy various methods internally such as the sharing of quarterly results by our Vice-President, Operations, the labour relations committee, team meetings, and quarterly bulletins.

With regard to external communications, in addition to committee meetings, Stornoway has developed a statistical report that provides monthly jobs and training data. Our partners appreciate this discussion forum because it opens up discussions to continuously improve our results.

Local Community Relations

Stornoway's 2019 communications plan was developed with the goal of consolidating support from local stakeholders (monitoring committees, tallymen, employees, politicians, companies, etc.) and maintaining their respect. The plan was deployed throughout 2019 and the objectives for the most part were achieved.

In 2019, the main thrusts of the communications program included:

- Quarterly meetings with monitoring committees established under the Mecheshoo Agreement with the Cree, as well as the Partnership Declaration with Chibougamau and Chapais communities;
- Regular monitoring and consultation meetings with tallymen;
- Publication of Renard mine's Annual Sustainable Development Report, and its distribution to households in Chapais, Chibougamau and Mistissini;
- Information sessions with Renard mine employees and agreement partners;
- Annual open-door events in the Mistissini community;
- Activities at the Cree Cultural Center at the Renard mine site;
- Recruiting sessions and communication of job opportunities within the local and regional population as well as among Renard mine employees;
- Stornoway's attendance at regional job fairs and various mining association conferences;
- Implementation of skills development programs as regards the mine, open pit and mining equipment maintenance services;
- Presentation of the Cree culture awareness program to main managers;
- Presentation of the revised Cree culture awareness program to the Renard committee for comment before the program was distributed to all employees.

Table of Contents

List of Tables

List of Figures

List of Maps

List of Photos

Appendices

Acronyms and Abbreviations

Abbreviation	***Meaning***
General	
CA	Certificate of authorization
HADD	Harmful alteration, disruption or destruction
EBS	Environmental baseline study
ESIA	Environmental and social impact assessment
ENVS	Environmental and social
FMTM	Formation modulaire du travailleur minier (modular training program for mine workers)
TLS	Trench landfill site
WCP	Wetlands compensation plan
ESMP	Environmental and social monitoring program
RADF	Regulation respecting the sustainable development of forests in the domain of the State
CSR	Comprehensive study report
WSEF	Wastewater Systems Effluent Regulations
RNI	Regulation respecting standards of forest management for forests in the domain of the State
SGENVS	Stornoway environmental and social management system
SWY	Stornoway Diamond Corporation
UQAT	University of Québec in Abitibi-Témiscamingue
UQAM	University of Quebec at Montreal
TSM	Towards Sustainable Mining
Organizations	
CEAA	Canadian Environmental Assessment Agency
MAC	Mining Association of Canada
CCME	Canadian Council of Ministers of the Environment
CEAEQ	Centre d’expertise en analyse environnementale du Québec
NSERC	Natural Sciences and Engineering Research Council
ECCC	Environment and Climate Change Canada
NPRI	National Pollutant Release Inventory
IQÉA	Inventaire québécois des émissions atmosphériques
MAMROT	Ministry of Municipal Affairs and Land Occupancy
MDDELCC	Ministry of Sustainable Development, Environment and the Fight against Climate Change
MDDEFP	Ministry of Sustainable Development, Environment, Wildlife and Parks
MDDEP	Ministry of Sustainable Development, Environment and Parks
MELCC	Ministry of the Environment and the Fight against Climate Change
MFFP	Ministry of Forests, Wildlife and Parks
DFO	Fisheries and Oceans Canada
CWS	Canadian Wildlife Service
MDMER	Metal and Diamond Mining Effluent Regulations

1 Objective

The primary objective of the annual monitoring report is to communicate the results of the various environmental and social management activities at the Renard mine to government authorities and the general public. The report more specifically covers the outcomes of the implementation of the environmental and social management tools that SWY put in place during the project development phases.

This report follows through on commitments to be transparent and disclose the results of implementing the Environmental and Social Management System (ESMS), as set out in the ISO 14001 standard. This management framework promotes early detection of and control over the environmental impact of mine operations, and hence reconciles mine operational requirements with the applicable regulatory framework and industry best practices.

This report presents the results of 2019 monitoring activities connected with the implementation of the Environmental and Social Management System at the Renard mine.

It provides a summary of the various environmental management tools SWY has put in place over the years to promote early detection of environmental and social issues, ensure environmental regulatory compliance and promote continuous improvement.

Included among these tools are the Construction Environmental Surveillance Program, the Environmental and Social Monitoring Program (for both physical and biological components), and other internal auditing tools.

The 2019 monitoring report was examined and validated by Norda Stelo (see Appendix 1) so as to confirm that the activities discussed in the report actually took place and that the monitoring results were consistent with what was documented in the report.

The prevention, risk management, mitigation and compensation measures set out in the environmental and social impact assessment and discussed with stakeholders and government authorities were also validated to ensure they had been implemented.

2 Environmental and Social Management System (ESMS)

In the design phase, SWY developed a Sustainable Development Policy with an environmental component that can be summarized as follows:

- Maintain environmental best practices in all activities;
- Protect the environment and biodiversity in line with the local worksite's specific features;
- Promote progressive restoration of worksites leaving them in a condition that is comparable to their initial condition;
- Collaborate with stakeholders to enhance our knowledge of the host environment.

In line with SWY's sustainable development policy, the company put an environmental and social management system (ESMS) in place in 2015, along with procedures for activities at the mine site. The ESMS resulted in an orderly, clearly signposted and safe worksite.

Since the ESMS was implemented in 2015, the environmental impacts that were anticipated in the impact assessment have been monitored, and compliance with applicable regulations and best practices with regard to controlling and managing impacts has been assured. Monitoring is part of a process to ensure the continuous improvement of environmental management practices.

With the ESMS in place, no notices of non-compliance or infractions in relation to environmental degradation were issued either during construction or operations to date. The ESMS also covers the closure and site restoration phases. In line with the company's environmental policy, SWY hopes to:

- Improve its environmental performance;
- Meet compliance obligations;
- Achieve its environmental objectives.

SWY has also acquired an environmental management software program to implement the ESMS in compliance with the ISO 14001 standard, the applicable regulatory framework, and environmental objectives set by SWY.

The IsoVision© software consists of several distinct modules for monitoring the various components including environmental incidents, documentation management, field sampling, auditing, inspections and so forth.

2.1 TSM™ Program

With the aim of being at the forefront of environmental management, SWY drew on ISO 14001:2015 certification in establishing its environmental management system as of the design phase in 2014 while adhering to the Mining Association of Canada's Toward Sustainable Mining™ (TSM™) initiative. The TSM is a set of tools and indicators deployed as part of an environmental management system to ensure that mining risks are managed responsibly while stimulating continuous and sustainable improvement.

SWY thereby intends to honour commitments set out by the MAC (i.e., credibility, accountability, transparency and performance) as part of its operations at the mine.

2.1.1 Protocols

The MAC's self-assessment tools are grouped under three major categories: communities and people; environmental stewardship; and energy efficiency. Six performance protocols were designed (Figure 2.1) to help companies develop and evaluate their systems against these pillars and hence report to Canadians on their environmental and social performance, and the steps taken to improve their performance.

Each protocol includes three to five performance indicators, for a total of 27 across the seven protocols (Figure 2.1).

Every year, companies conduct self-assessments, which are reviewed externally every three years.

In the self-assessment, they assign a letter grade, from C to AAA, which reflects their performance. Level C is the lowest grade and AAA the highest. The MAC letter grades are outlined in Table 2.1. The risk management protocol is the only one that requires a yes or no answer.

Self-assessments are reviewed by an external third-party every three years to confirm the performance ratings reported for the seven protocols.

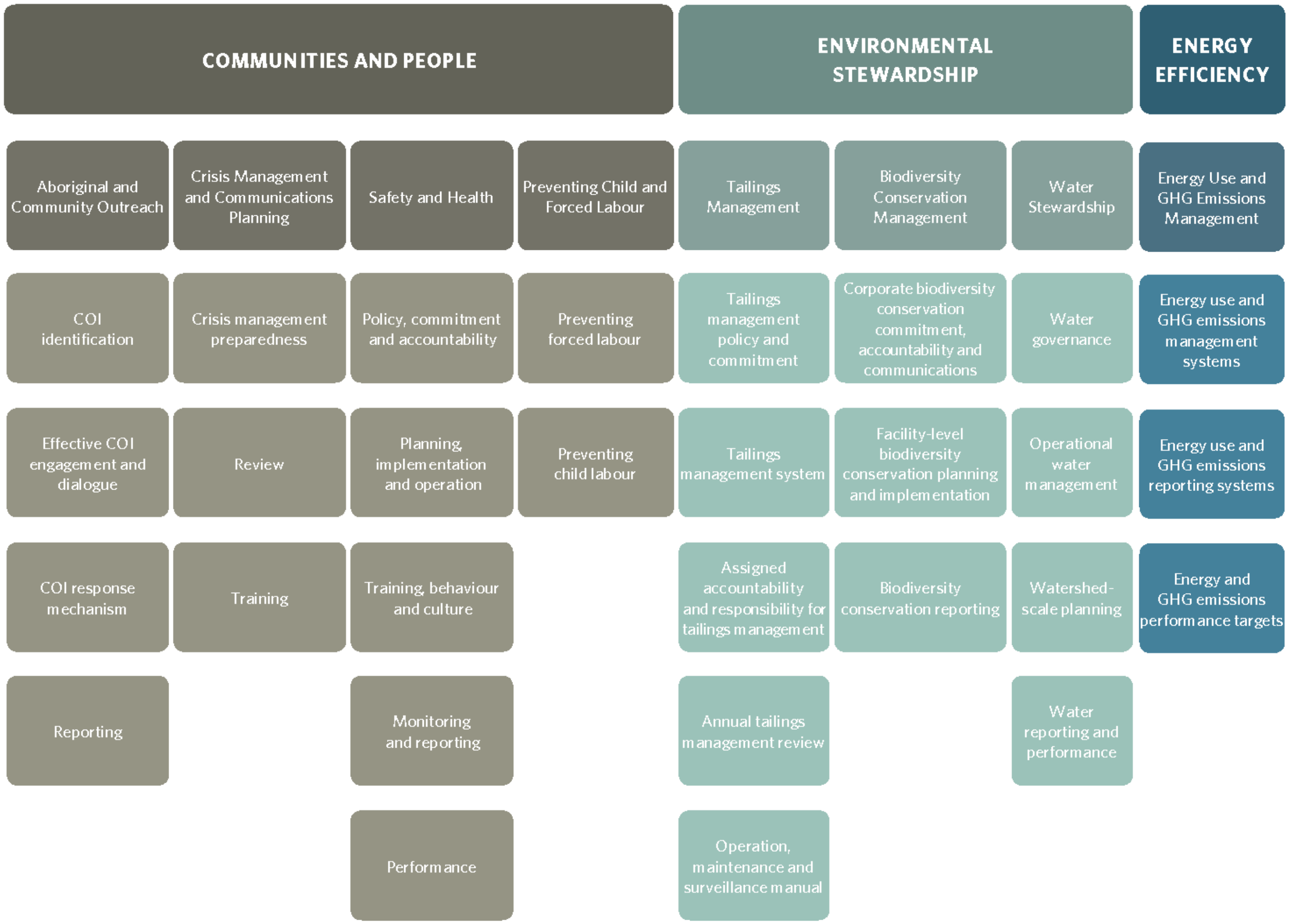


Figure 2.1 Performance protocols and indicators under the TSM initiative

Table 2.1 Definition of TSM's performance rating system

Grade	Description
AAA	Excellence and leadership.
AA	Systems/processes are integrated into management decisions and business functions.
A	Systems/processes are developed and implemented.
B	Actions are not consistent or documented; systems/ processes are planned and being developed.
C	No systems in place; activities tend to be reactive; procedures may exist, but they are not integrated into policies and management systems.

2.1.1.1 External audit of TSM™

SWY plans to have the TSM™ protocols audited by an external auditor in 2021, i.e., three years after the third self-assessment.

2.1.2 Overview of TSM Performance

After conducting its first self-assessment for the six TSM™ protocols in 2018, SWY carried out a self-assessment of the *Water Stewardship* protocol in 2019.

For the seven TSM™ protocols, SWY achieved a Level AAA rating for the *Crisis Management* and *Biodiversity Conservation Management* protocols, and Level AA for the five other protocols (Figure 2.2).

An overview of the activities carried out under the program is presented in the following sections.

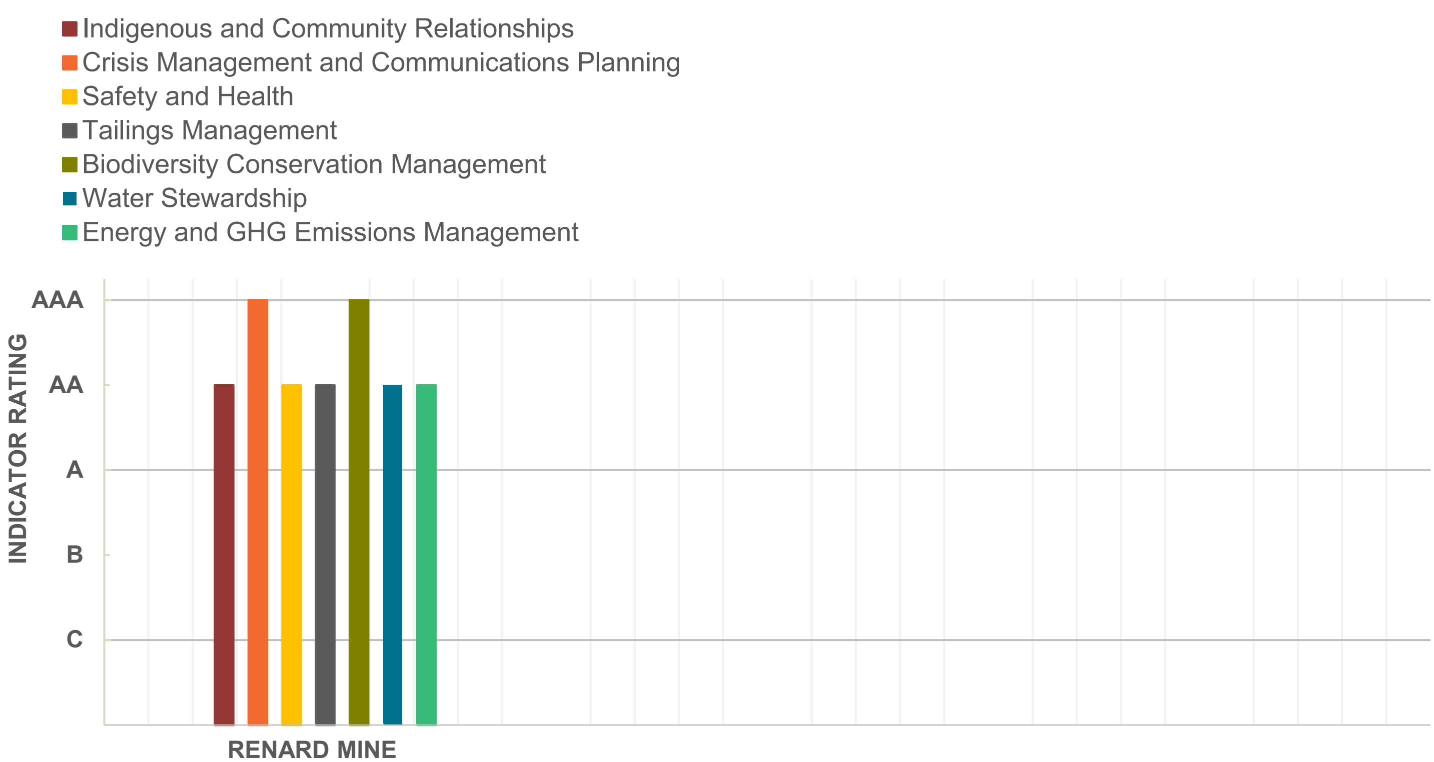


Figure 2.2 Results for TSM™ Protocols

2.1.2.1 Indigenous and community outreach

This protocol defines the MAC's general expectations regarding the way in which its members manage Indigenous and community relations in support of the TSM initiative. In its self-assessment in 2018, SWY's Renard mine achieved the highest rating, Level AAA, for the first three indicators, and Level AA for the fourth indicator associated with the protocol (Figure 2.3).

In 2019, SWY pursued its efforts to maintain the quality of its relations with stakeholders.

Communities of Interest

The environmental and social impact assessment (ESIA) clearly identified the communities of interest (CIs), along with their particular features and needs.

In July 2012, Stornoway signed a "Partnership Agreement" with the Chapais and Chibougamau host communities, which provided a framework for addressing the common issues and initiatives such as communications, jobs, economic diversification, and attracting newcomers to the region.

Communications

Communication and dialogue with the groups of interest are based on a sound communications plan. Committees have been formed to monitor established agreements with stakeholders affected by the Renard mine.

The communications the CIs most appreciate are open-house meetings, the sustainable development and environmental and social monitoring reports, and the many meetings held with the various monitoring committees.

The monitoring meetings held throughout the year have enabled Stornoway to enhance our contact with the communities of interest and ensure constructive and inclusive communications.

The success of the many business, training and communications partnerships along with all the community activities confirms the effective and constructive networking that has been accomplished in relation to the implementation of the Renard project.

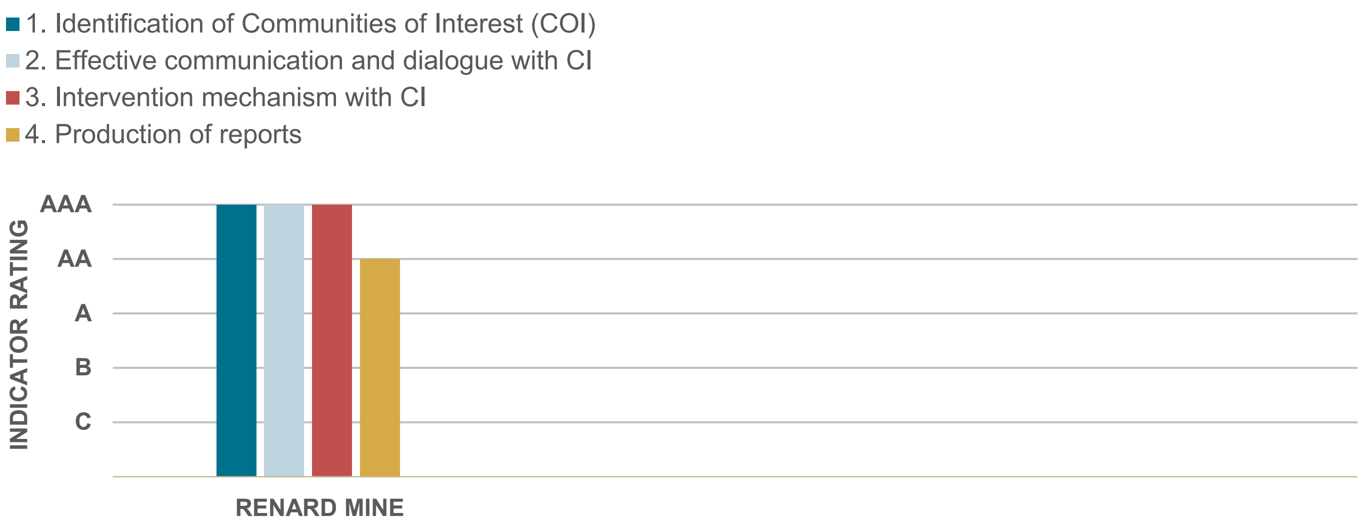


Figure 2.3 Performance indicators for Indigenous and Community Relationships

Communication and effective dialogue with communities of interest

The communities of interest are essential partners for Stornoway. Distinct community activities along with meetings with the CIs have helped establish effective and ongoing dialogue as well as constructive discussions.

The relationship with the CIs has led to a number of forums for discussion being set up, including:

- Partners committee;
- Renard committee including the Environment Committee, and the Jobs and Training Committee;
- Annual public meetings;
- Discussion and consultation panels;
- Joint preparation of local and regional capacity studies and training plan;
- Community involvement.

Response Mechanisms

The many meetings to discuss and communicate issues with the CIs provide the various stakeholders with forums where information is exchanged and concerns discussed by the parties. This dynamic information-gathering process is not only a privilege for Stornoway, but it has a direct impact on Stornoway's decision process. Stornoway also has an informal system for submitting complaints on its website.

Reporting

Maintaining a high level of transparency with communities of interest and the general public fosters discussion and constructive dialogue and the achievement of common objectives.

Stornoway produces a number of monitoring reports on the natural environment, along with the environmental and social monitoring report and the sustainable development report each year, which are made public and accessible at all times on its website. These publications are the result of close consultations and discussions on monitoring and surveillance activities carried out by the committees and our partners.

2.1.2.2 Biodiversity conservation management

In 2019, SWY maintained its AAA rating for the three indicators associated with this protocol and the biodiversity monitoring activities were continued (Figure 2.4). Fish habitat compensation measures were applied to a lake trout spawning ground on the mine site and a walleye spawning ground in Mistissini (Section 3.10). In 2019, SWY also monitored large game, specifically woodland caribou, in partnership with the MFFP (Section 3.12.1). A black bear management plan was produced by SWY and submitted to the MFFP biologist when he visited the mine site in June 2019 (Section 3.12.2).

Commitment

In addition to the voluntary commitments outlined in the 2011 impact assessment (Roche, 2011a), SWY put in place a sustainable development policy in 2011, which was updated in 2016. Under the policy, which is posted on SWY's website, SWY commits to protecting the environment and biodiversity in line with the specific features of the host environment. SWY is also committed to collaborating with stakeholders to enhance our knowledge of the worksite, including Route 167 North.

In 2014, SWY set up an environmental management framework, the ESMS, in line with its sustainable development policy. This framework ensures that SWY's commitments lead to concrete environmental management measures and define the roles and responsibilities of project stakeholders.

In addition, regulatory inspections and meetings with stakeholders such as the Environment Committee, strengthen the quality and credibility of environmental commitments that the Renard mine is required to uphold.

Implementation

Implementing the objectives of the ESMS is guided by procedures specific to each component of the impact assessment, including biodiversity conservation. SWY's main management tool for this is its environmental monitoring program (ESMP). Initiated in 2015, the ESMP tracks changes in the natural environment throughout the year, anticipates issues and validates impact assessments (Roche, 2011a). It also maintains a continuous process for observing and protecting biodiversity.

Monitoring and surveillance work has therefore been carried out on the Renard mine site throughout the year at various frequencies (weekly, monthly, quarterly, bi-annually and annually) since the baseline conditions were established for the Renard mine study area in 2010. A number of animals have enormous importance in Cree culture when it comes to hunting, fishing and gathering activities. SWY therefore reports on all special status species (both fauna and flora) observed in the Renard mine study area.

Monitoring campaigns are undertaken and reports produced on biodiversity conservation covering:

- Vegetation and wetlands
- Terrestrial wildlife and birds;
- Fish and fish habitat;
- Fish habitat compensation measures;
- Big game inventories;
- Quality of the environment (air, water, habitats).

Reports

SWY's commitment to environmental protection and surveillance has been subject to external auditing and annual inspections by federal and provincial authorities, including Environment and Climate Change Canada (ECCC), Fisheries and Oceans Canada (DFO), the Ministry of Forests, Wildlife and Parks (MFFP), and the Ministry of the Environment and the Fight Against Climate Change (MELCC).

Since 2015, SWY has produced an annual environmental monitoring report on the biodiversity data collected through observation and monitoring throughout the year. This annual report covers monitoring results on the quality of the natural environment, and the measures implemented to preserve the area's significant natural heritage.

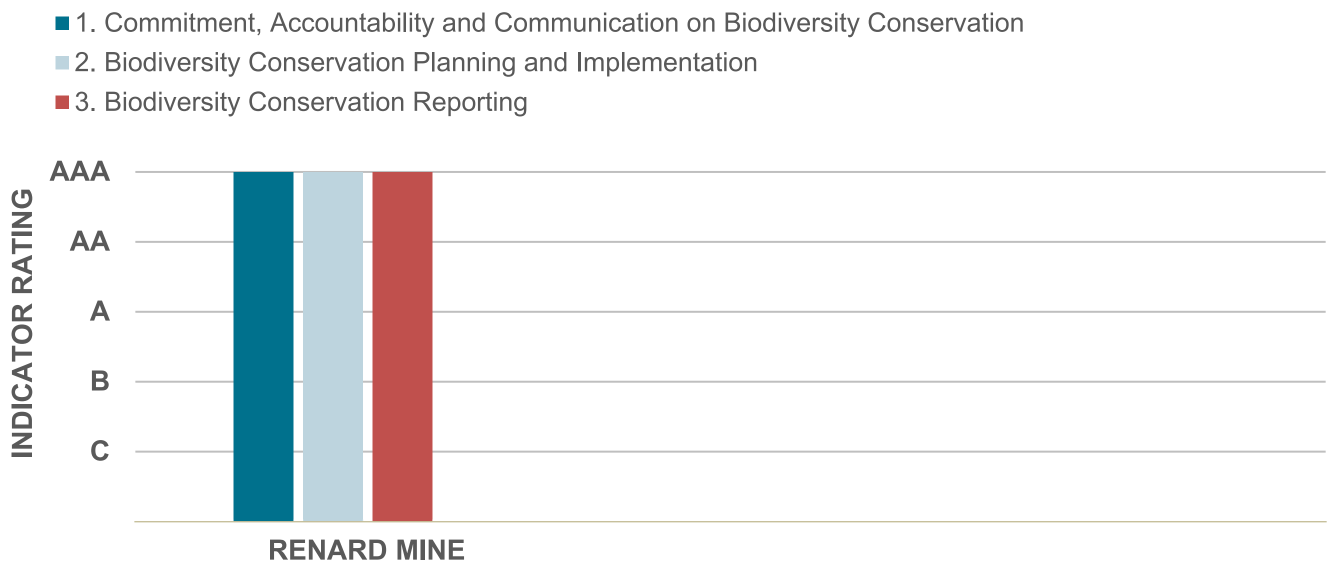


Figure 2.4 Performance indicators for Biodiversity Conservation Management

Monitoring results, specifically biodiversity results, are also reported and communicated internally on a quarterly basis to the board of directors, the Environment Committee and other stakeholders.

2.1.2.3 Water stewardship

The Water Stewardship protocol was added to the TSM™ program in early 2019. In keeping with its commitments, Stornoway conducted a self-assessment in 2019. The self-assessment resulted in Level AAA ratings for indicators 1, 2 and 4, and a Level AA rating for indicator 3.

Water Governance

Since 2010, the Renard mine has had a system in place for structuring the use, treatment, consumption and disposal of water (including mine wastewater, groundwater, domestic water, drinking water, and water from the natural environment). In 2011, SWY made a public commitment in the environmental and social impact assessment (ESIA) (Roche, 2011a) to monitor and track water resources.

This commitment led to the environmental and social monitoring program (ESMP) being implemented at the Renard mine in 2015. The ESMP is designed to detect and correct non-compliance with regulatory requirements and SWY's commitments in the area of water management.

In July 2019, Stornoway strengthened its commitment to water management with the release of its *Water Stewardship Policy,* which aims to:

- maintain excellent water management and quality at every level and throughout every step in the life cycle of the mine;
- ensure ongoing monitoring of efforts to manage water required for mining operations, in keeping with the natural hydrology of watersheds
- remain accountable and transparent when it comes to managing water intended for use by the public and stakeholders;
- position SWY as a leader in the mining industry in the area of water stewardship.

Operations Water Management

In 2014, SWY established and implemented its environmental and social management system (ESMS), which includes tools to monitor water intended for use in mining operations at the Renard mine.

SWY therefore developed procedures for water use and treatment. Water sampling is undertaken in accordance with a strict operational calendar, as specified in the Global CA of December 4, 2012. Emergency response plans have also been established to deal with contaminant spills or regulatory non-compliance involving mine water, domestic water and drinking water.

Finally, SWY logs data to track changes in parameters including pH, water temperature, conductivity and metals. These parameters are used to determine water quality. An operational water balance is also prepared every year to determine the water re-use rate across the mine site. Employees and visitors are made aware of the need for responsible consumption of drinking water in the environment induction session.

Watershed Planning

As part of its 2011 impact assessment, SWY performed a thorough analysis of the watersheds associated with the Renard mine. The impact assessment delimited subwatershed limits and characterized their hydrological conditions and their baseline physical-chemical characteristics.

By identifying and consulting the Renard mine's communities of interest when the baseline was established in 2010, SWY ensured it identified any issues associated with water resources. Discussion groups and open houses were organized in 2012 with the municipalities of Chibougamau and Mistissini to learn about their concerns, practices, customs and beliefs as well as local traditional knowledge with regard to water. SWY also presented its water management and treatment process to the authorities and stakeholders, specifically during public hearings that were held prior to the start-up of the Renard project.

The 2011 impact assessment made it possible to assign roles and responsibilities with regard to watershed planning, encouraging the involvement of communities of interest and identifying the impact of water management on users of water resources. The 2011 impact assessment also made it possible to assess the cumulative effects of mining activities on water quality in the relevant watersheds.

In 2014SWY established a structured management system (ESMS). With procedures and regular monitoring, the system provides a framework for monitoring watersheds identified in the impact assessment that are affected by activities at the Renard mine. This leads to rigorous monitoring of Lake Lagopede's hydrological system, as well as an operational water balance for the mine.

With regard to watershed-related risks, SWY is moreover in regular contact with the Environment Committee, which includes representatives from the communities of interest. SWY ensures they understand mine water management practices, providing them with the annual water balance reports and publishing the results in the annual environmental monitoring report posted to its website.

Every year, SWY informs the communities of interest about watershed-related activities at the Renard mine in its sustainable development and environmental monitoring reports.

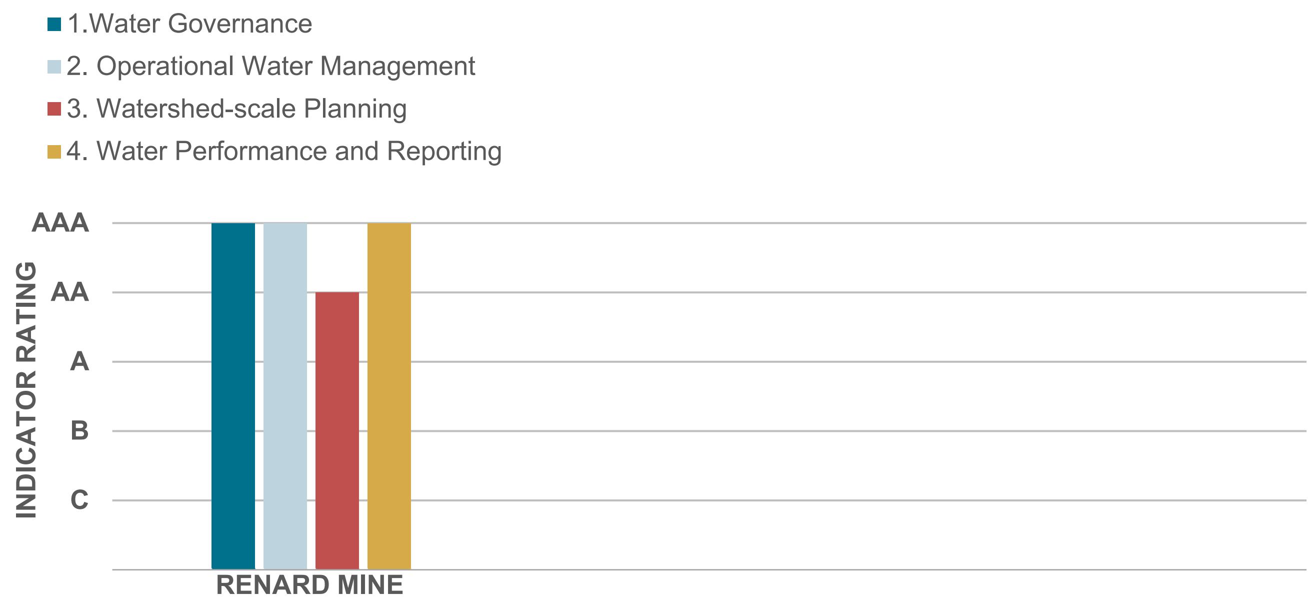


Figure 2.5 Performance Indicators for Water Stewardship

Water Reporting and Performance

As part of the internal water management reporting process, the Environment team:

- Provides other departments with daily reports on the volume of water treated at the mine wastewater water treatment plant (MWWTP);
- Provides employees access to bi-monthly drinking water test results, by posting water quality results on bulletin boards on the mine site;
- Informs the Surface Mine department when daily ammonium nitrogen concentrations in water from the underground mine exceeded the criteria. The water treatment technicians team records stoppages and anomalies observed in the water treatment process in the plants;
- Informs senior management in monthly meetings of the management committee.

SWY closely monitors water management data (water quality, plant operations, treatment performance) on a weekly, monthly, quarterly and annual basis. Water management data are submitted for review to both senior environment officials (internal audit) and government authorities (external audit).

As part of the internal audit, water management personnel review and calibrate the measuring instruments used to collect water quality data (pH meters, and conductivity and turbidity probes) on a weekly basis. They also take daily and weekly samples of water treatment plant effluent and affluent, and conduct internal testing of certain chemical parameters required for operations.

SWY ensures it makes effective decisions and complies with regulatory requirements such as Directive 019 and the RQEP, while enabling continuous improvement in water management on the mine site.

2.1.2.4 Energy use and GHG emissions management

In 2019, SWY achieved an AA performance rating for this protocol, which focusses on measures aimed at managing energy consumption on the mine site from the time of the impact assessment.

In fact, back in 2011, SWY identified and examined every energy source option for the project, including liquefied natural gas (LNG). And since the construction phase at the Renard mine, energy use and greenhouse gas (GHG) emissions have been tracked, controlled, and considered in operational planning.

Energy management has also been subject to internal and external auditing, and SWY integrated the audits into operational planning at the mine site as of 2016.

To enhance energy efficiency, a comprehensive energy management program was developed in 2018. In 2019, SWY launched an initial action plan to reduce energy and fossil fuel consumption, and as a result reduce GHG emissions.

In 2019, SWY prepared energy management procedures and processes for the mine site, which involved analyzing consumption practices at the site. SWY was able to define targets for maintaining energy use at each sector of activity, such as the underground mine, process plant, power plant and the camp site (Figure 2.6).

Energy Use and GHG Emissions Management Systems

After reviewing comparative analyses of energy alternatives, SWY opted to use liquefied natural gas (LNG) as a source of fuel. This resource, which is used primarily for mine site operations, rather than diesel fuel, which was initially planned, helps generate a significant reduction in GHG emissions, in addition to reducing the risk of environmental incidents.

Energy use is being monitored and the power plant regularly tracks user consumption. Since 2016, standardized external reviews have been conducted, with the resulting data archived.

An awareness campaign aimed at reducing energy use was also carried out in 2018. In November 2019, operational controls were put in place for energy required to operate underground ventilation. Fibre optic cables were installed in November 2019 to provide a direct line of communication between the underground mine and the electrical engineer so that the engineer can start up the ventilation system as required and hence optimize power use.

Energy Use and GHG Emissions Reporting Systems

In keeping with the reporting requirement under the National Pollutant Release Inventory (NPRI) and the Quebec Atmospheric Emissions Inventory (IQÉA), atmospheric emissions from mining operations were calculated at the Renard diamond mine in 2019. These emissions include greenhouse gases as well as pollutants likely to be released by mining operations.

In 2019, following the external review report, SWY reported to government authorities that a total of 72,966 t (CO_2 eq.) of GHGs had been released into the atmosphere by the Renard mine during the operations phase.

Energy Use and GHG Emissions Performance Targets

Overall, the most significant performance indicator qualifying Renard mine operations is stationary GHG emissions, which is reported and externally audited, and expressed in kg of greenhouse gases per tonne of processed kimberlite (standard unit). In 2019, this value was 19.2 kg of GHG per tonne of processed kimberlite, for a total of 2,556,459 t of processed kimberlite. The indicator is therefore comparable to the 2018 value of 19.1 kg of GHG per tonne of processed kimberlite, for a total of 2,328,300 t of processed kimberlite.

There was therefore a slight increase of 0.7% in the quantity of GHG emissions per standard unit for stationary equipment at the mine site between 2018 and 2019.

This slight change reflects the shutdown of surface operations as well as a temporary increase in electric power required for the development of level 450 in the underground mine. By late 2020, SWY plans to continue with its implementation of the energy efficiency plan with its quantifiable performance objectives. The plan will compare each management indicator with daily operations planning at the site.

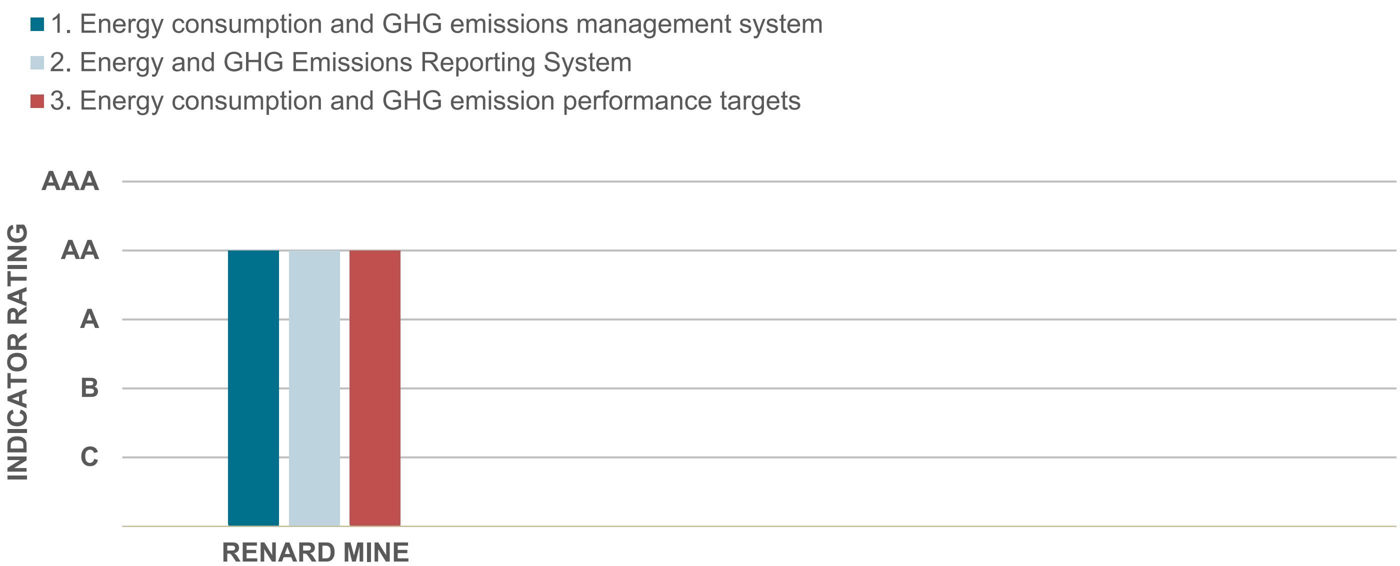


Figure 2.6 Performance indicators for energy use and GHG emissions management

2.1.2.5 Health and safety

In addition to its excellent occupational health and safety performance, the Renard mine achieved an AA rating for three of the five indicators in the protocol and an AAA rating for the two other indicators (Figure 2.7).

In 2019, departmental (sector and personal) action plans put in place increased the quality and safety of the various working environments.

Commitment and Accountability

SWY has a Sustainable Development policy in place incorporating certain occupational health and safety (OHS) components. This policy is based on Stornoway's principles and values and is updated annually by management.

SWY reviews its management strategy and sets yearly objectives for the various OHHS and prevention components. These are based on legal and regulatory health and safety requirements imposed upon all operations at the Renard mine site.

Health and safety objectives, which are reviewed several times each year, are communicated to company workers as well as contractors and service providers. Everyone is held accountable and is required to communicate these objectives.

Stornoway employees are all engaged when it comes to health and safety, embracing OHS values as represented in Stornoway's slogan *Courage to Care!*

Development and Implementation

The occupational hygiene, health and safety (OHHS) management system in place is based on the OHSAS 18001 standard as well as the principles set out in Stornoway's Sustainable Development Policy. The OHHS system addresses Stornoway employees as well as all the contractors and service providers involved in Renard mine operations.

Operational procedures established as part of the system are also based on legal and regulatory requirements to which all Renard mine operations are subject.

The OHHS system includes:

- A definition of roles and responsibilities;
- Administrative and operational procedures;
- Risk management and emergency measures;
- OHS prevention program;
- An occupational hygiene program;
- A control, inspection and auditing schedule.

The OHHS management system is also subject to external auditing to ensure it is relevant, functional and compliant and represents industry best practices.

Training, Behaviour and Culture

Assessing training needs is an essential tool for identifying available OHHS training programs along with those that are mandatory.

Training helps increase the level of vigilance needed to ensure smooth operations at the Renard mine site and maintain a safe working environment for workers. Safety activities, task safety analyses, employee involvement in risk assessments, and support for qualified trainers all help develop a corporate culture that promotes OHHS.

Well-being programs moreover represent an essential part of promoting OHHS within Stornoway. Employee engagement is required and encouraged at every level within the organization.

Surveillance and Reporting

Stornoway's OHHS system incorporates performance indicators, surveillance and review programs, and a regular assessment with senior management of performance results.

The OHHS system includes controls, monitoring and task safety analyses. These surveillance measures and the reporting of results to senior management provide a safer working environment with a focus on continuous improvement.

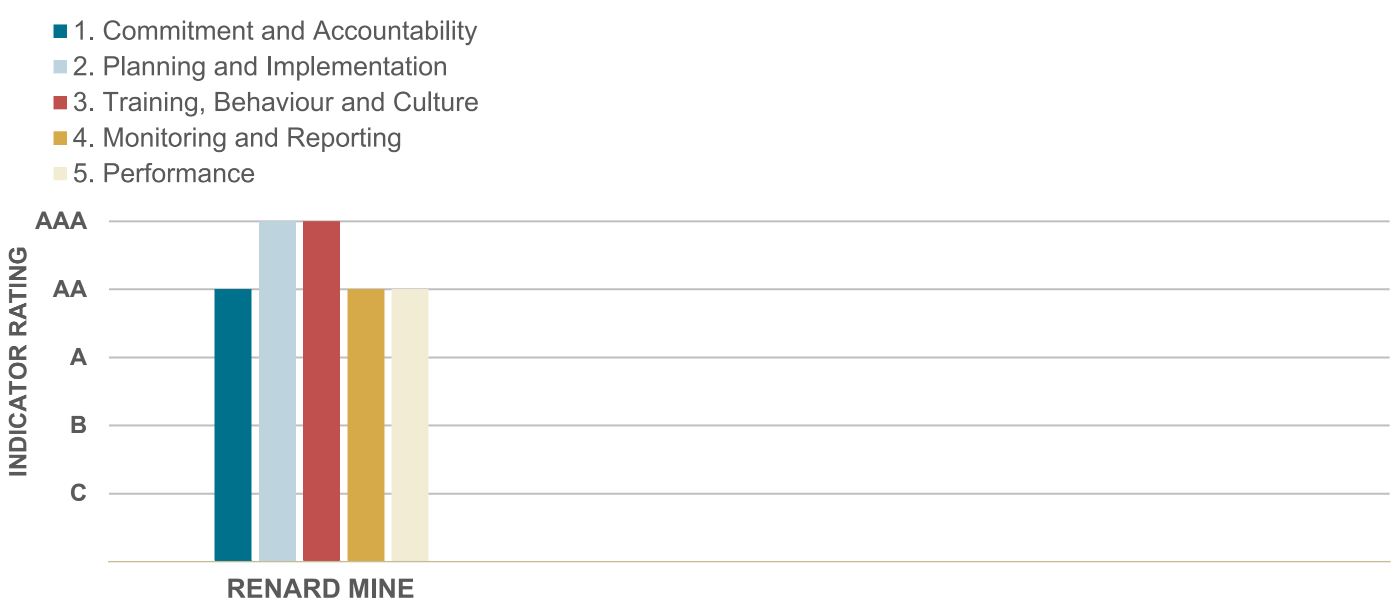


Figure 2.7 Performance Indicators for Health and Safety

Finally, Stornoway informs company employees as well as its contractors and service providers of the results of monitoring and external audits.

Performance

The results obtained from monitoring OHHS objectives are broadly communicated and analyzed by management and workers to ensure they are incorporated into specific improvement plans. Despite the fact that Stornoway is a relatively young company, it is already an industry leader when it comes to occupational health and safety.

2.1.2.6 Crisis management

SWY's head office and Renard mine site operations are in full compliance with the requirements set out in the three performance indicators associated with this protocol (Table 2.2). As in 2018, SWY's mine rescue team demonstrated it had the quality, numbers and perseverance to win the 2019 mine rescue competition for the second consecutive year, once again proving SWY's skill when it comes to mine rescues.

Table 2.2 Assessment of performance indicators for the crisis management protocol

WORKSITE	INDICATORS		
	PREPARATION	REVIEW	TRAINING
RENARD MINE	✓	✓	✓

Crisis Management Preparation

Stornoway reviews its crisis management plan (CMP) and emergency measures plan (EMP) on an annual basis to ensure it remains relevant. This annual exercise helps the company identify its exposure to credible risks and threats and hence develop or implement emergency response protocols accordingly.

Emergency response equipment and logistics are in place and are tested on a regular basis. Roles and responsibilities and the alert process are well defined, and control and command centres are in place, identified and well known.

The CMP and EMP are control documents that are distributed internally and to the relevant authorities annually. The last update to the EMP was dated June 27, 2019.

Evaluation of the CMP and EMP

New employees need to be informed about emergency measures on their first day of work, and management must also be familiar with the CMP and EMP. Alert procedures and mechanisms are tested on a regular basis by management and employees to ensure everyone responds quickly in emergency situations.

Training and Implementation of the Crisis Management Plan

Crisis simulations are regularly organized so that the organization remains operational and efficient in managing emergency measures:

- Simulations in conference rooms without deployment;
- Simulations including the control and command centre;
- Simulations including major field deployment;
- Training sessions with real-life simulations in the field.

These measures enable Stornoway to remain operational and have positioned it as an industry leader in emergency measures management, as the team demonstrated in the provincial mine rescue championship.

2.1.2.7 Mine tailings management

The Renard mine achieved an AA rating for all five indicators in this protocol owing to its comprehensive modified processed kimberlite containment (MPKC) monitoring and management program. Stornoway's systems and processes are well integrated with management decisions and operational functions (Figure 2.8).

In 2019, audits showed that tailings operations were all compliant with regulatory requirements. In addition, the Operation, Maintenance and Surveillance (OMS) Manual for the MPKC facility was also updated in 2019, and a dedicated report on the facility was released.

Tailing Management Policy and Commitments Statement

Stornoway has a policy in place including a statement of its commitment toward tailings management at the modified processed kimberlite containment (MPKC) facility, in keeping with MAC's Tailings Guide. Funded commitments and specific budget item ensure sound management, operation, monitoring and auditing of the tailings containment facility.

Tailings Management System

A tailings management system is in place covering every step in the life cycle of the tailings containment facility (from planning, design and construction, to operations, closure and post-closure). Two annual audits are carried out on the system by an external consultant. The system's procedures and manuals are also updated yearly in line with new industry directives.

The restoration plan for instance was completely updated in June 2018 and is still pending government approval.

Operation, Maintenance and Surveillance (OMS) Manual

SWY has an operation, maintenance and surveillance manual in place for the modified processed kimberlite containment (MPKC) facility, which is updated annually.

OMS activities comply with best practices specified by the Mining Association of Canada (MAC) and include an inspection and operations schedule, operating procedures, detailed deposition plans, maintenance operations and emergency response measures. MPKC management is also guided by a quality assurance and control plan along with a surveillance plan.

Division of Tailings Management Responsibilities and Accountability

SWY has detailed operational procedures in place for managing tailings at the MPKC facility. Specific roles and responsibilities related to accountability, budgeting authority, implementation and reporting as regards tailings management are clearly defined in procedure ENVS 2.4 in the OMS Manual. These responsibilities are subject to rigorous external review as part of two annual audits. Detailed audit reports are submitted to senior management, so as to ensure any gaps, corrective measures or changes are properly tracked.

Annual Review of Tailings Management

Regular reviews of the tailings management system along with its performance are carried out weekly, quarterly and annually. More specifically, a weekly internal review is conducted in the form of inspections and monitoring. The monthly review of the tailings management system is carried out as part of the monthly review of operations and surveillance activities.

Two annual audits (in May and October 2019) confirmed sound management and adequate surveillance of the containment facility. Various recommendations were made and were incorporated into the post-audit action plan, thereby making it possible to gradually improve operational and monitoring aspects of the MPKC facility.

An external biennial auditing system is in place including a review of the effectiveness of tailings management and a report to senior management. To ensure accountability, an action plan is developed in response to audits and inspections by the designer. Audit reports are produced by the design consultant twice a year.

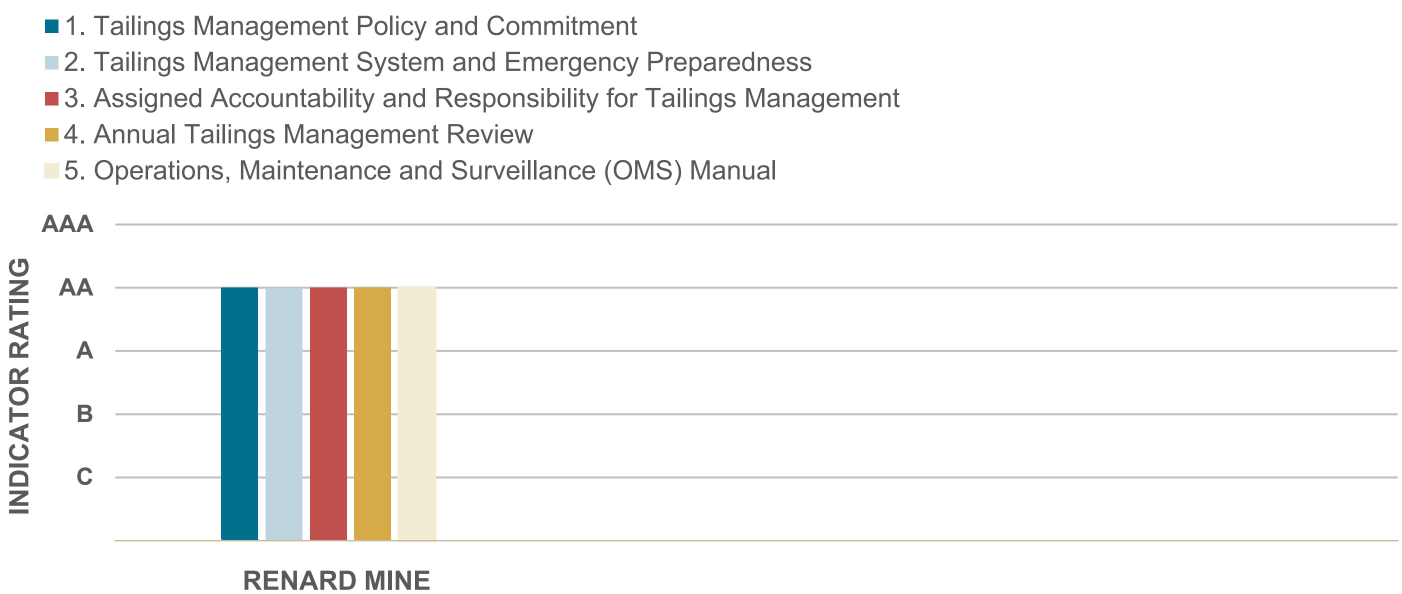


Figure 2.8 Performance indicators for tailings management

2.2 Environmental Surveillance Program

As part of the impact assessment, mitigation measures were developed to prevent and mitigate impacts during the construction and operations phases.

In 2019, surveillance activities ensured that mine operations were carried out in compliance with requirements set out in the 2011 impact assessment (Roche, 2011a). Surveillance activities are continuing so as to track the overall environmental performance of SWY operations.

Surveillance helps anticipate and promote the early detection of environmental issues and allow for a fast response in the event of a system malfunction or a failure of a mitigation measure.

2.2.1 Ecopermitting Procedure

Eco-Permits are an internal SWY procedure to ensure regulatory compliance of work undertaken by contractors or any change to a contractor's operating method. Eco-Permits are mandatory at SWY and must be obtained before carrying out any change that is likely to impact the environment. This includes:

- Work in aquatic environments (e.g., installation of bridges or culverts), ditch excavation, and earthwork of any type;
- Clearing, construction of any type of infrastructure, mining or road works;
- Installation of treatment systems (water-oil separators, or drinking water and wastewater treatment facilities, etc.);
- Infrastructure, equipment or operation that generates liquid, solid or gaseous discharges into the environment;
- Use of a new product.

SWY's Environment Department assesses Eco-Permit applications to ensure that all authorizations have been obtained and that the type of work is compliant with applicable regulations.

When an Eco-Permit is issued to applicants, they are approved to go ahead with the work. The process moreover enables updates to the environmental monitoring program to reflect changes that occur.

Once approved and signed by the Environment Department, Eco-Permits are submitted to the applicant in the form of a document that specifies the requirements as set out in certificates of authorization, guidelines and best practices. Recommendations, alternative work methods and relevant mitigation measures are also outlined therein to ensure better environmental protection.

Compliance with the requirements specified in eco-permits is validated in planned daily inspections by environment technicians. Surveillance forms are included with each eco-permit to ensure systematic verification of compliance with mitigation measures. The status of applications is regularly updated in the Eco-Permit log.

Since 2015, a total of 423 Eco-Permit applications have been submitted for internal assessment to the Environment Department. Figure 2.9 illustrates the distribution of Eco-Permits issued between 2015 and 2019. Applications generally peak in the second (Q2) and third (Q3) quarters i.e., in summer, the best time to undertake outdoor maintenance work at the mine site.

In 2019, 84 Eco-Permit applications were submitted, about 15% more than in 2018. The 2019 Eco-Permits involved various types of work including:

- Development of pit R65;
- Maintenance of and improvements to ditches around mining activities;
- Optimization of ore and materials stockpiles in line with conditions set in the authorizations and mining operations;
- Improvements to drilling products in the underground mine;
- Improvement to maintenance products at the mine camp;
- Maintenance of mine roads;
- Maintenance of liquified natural gas (LNG) facility.

To limit the number of environmental incidents, SWY advocates prevention and the application of mitigation measures at source. These measures, which are determined based on the work to be performed, are specified as conditions in Eco-Permits.

This internal approval process, which goes well beyond regulatory requirements, provided excellent control over the work and compliance with government rules and authorizations throughout the construction phase. It is now well established as part of operations and will remain active throughout the life of the mine.

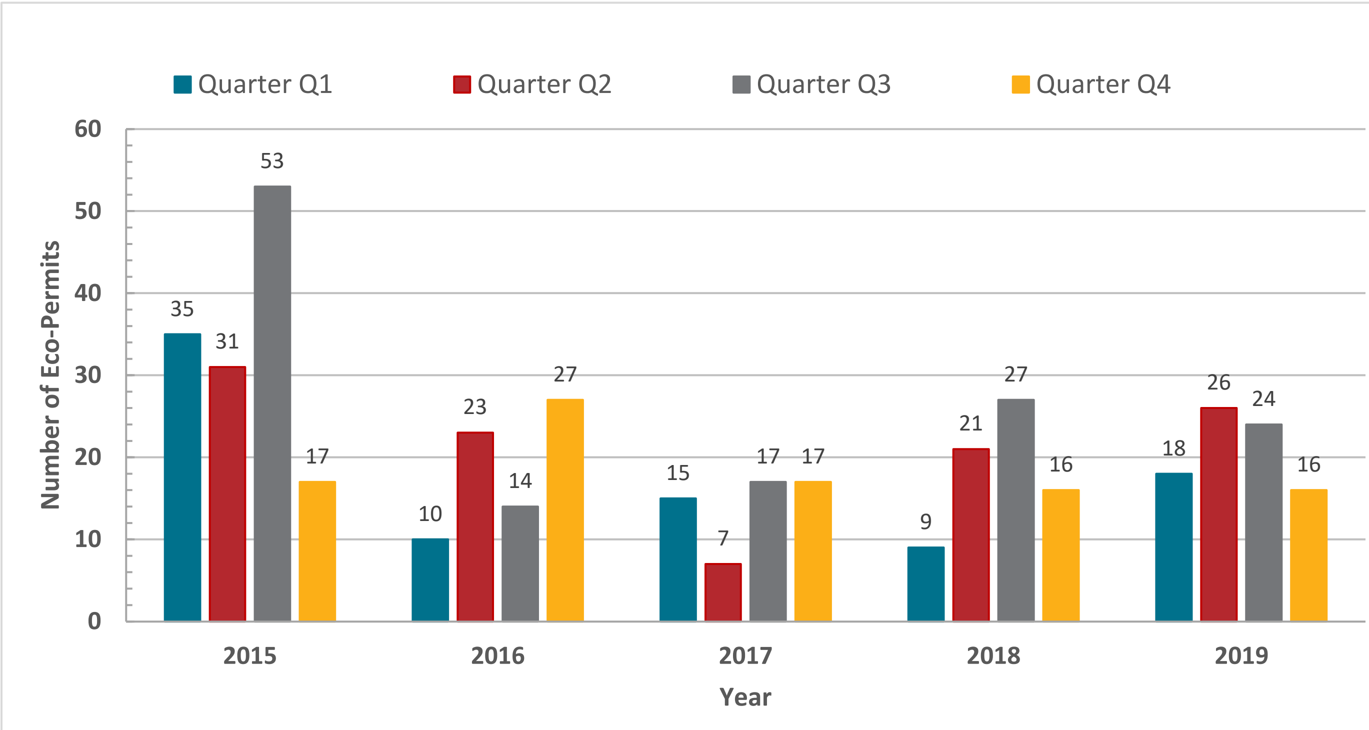


Figure 2.9 Number of Eco-Permits issued per quarter from 2015 to 2019

2.3 Hazardous, Recyclable and Ultimate Materials and Contaminated Soil Management

2.3.1 Hazardous Materials Management

To ensure sound management of hazardous materials at the Renard mine site, rigorous control is applied as part of the procurement process for new products. Material safety data sheets for selected products are analyzed and submitted for approval to the Health and Safety and Environment departments. A system of electronic Hazmat terminals (Photo 2.1) set up to facilitate access to material safety data sheets for hazardous materials on site allows employees to quickly search for or print out a sheet at any time. Product labels can even be printed if products are transferred to other containers.

Since July 2016, mandatory training sessions on the Workplace Hazardous Materials Information System (WHMIS, 2015) have been held for personnel. Sessions were also held in 2019 to ensure all employees have the knowledge and tools needed for the safe use of hazardous materials on the job.

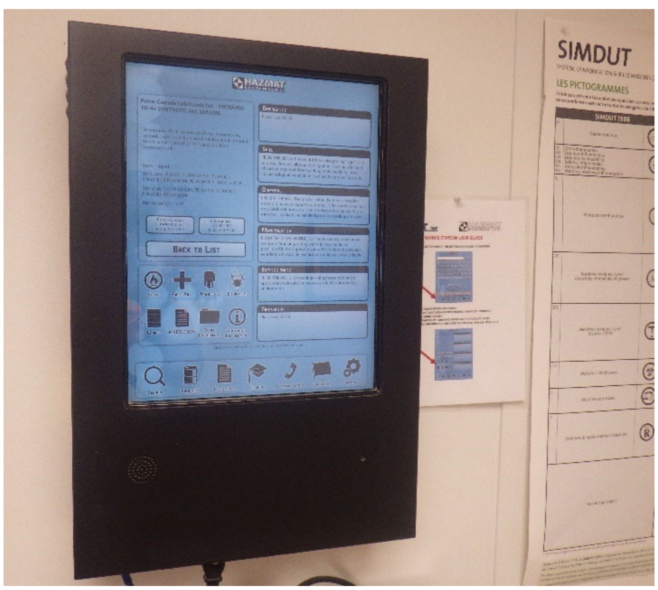


Photo 2.1 Hazmat terminal

2.3.2 Residual, Recycled or Ultimate Waste Management

Operations at the Renard mine generate a variety of solid waste (SW) that is recyclable, repurposed or discarded. These materials are generated by construction activities, operations or as a result of the dismantling and site restoration work.

2.3.2.1 Policy

The solid waste management (SWM) approach put in place by SWY is based on the 3R-RD principle. The first goal is to minimize the amount of solid waste generated; the second is to reuse such materials; and the third, is to maximize the recycling or recovery of any such materials. Solid waste that cannot be recovered is disposed of in the trench landfill site (TLS).

Solid waste at the Renard mine site is separated at source and collected in dedicated containers (Photo 2.2) so that whatever can be re-used is recovered. The primary solid waste disposed of at the TLS is waste with a high organic matter content (kitchen waste, waste bin materials, etc.) and ICI (institutional, commercial and industrial) waste.

Photo 2.2 Source separation of residual materials on site

All solid waste generated at the mine site (including the airstrip and domestic wastewater treatment plant) are allowed to be landfilled, except for waste rock and mine tailings, recyclables, residual hazardous materials and biomedical waste.

To avoid attracting opportunistic wildlife (e.g., bears, foxes and crows) lids were installed on domestic waste bins used on the mine site in 2019. This also helped limit the waste blown away by the wind or disbursed by wildlife.

From the outset of development work on the Renard project, SW management at the mine has involved:

- Transporting metals (ferrous and non-ferrous), waste oil and grease as well as used tires off site to be recycled and reclaimed by external companies;
- Storing uncontaminated (untreated) wood at the TLS and chipping some of it as part of the organic waste

reclamation program for use in progressive site revegetation (Photo 2.3);

- Sorting cafeteria-related SW with a high organic content at source, and placing it in a refrigerated room before transporting it to the TLS located 10 km from the Renard mine;
- Transporting dehydrated sludge produced by the rotary press in the wastewater treatment process to the TLS for disposal;
- Discarding all other ultimate SW that cannot be reclaimed (e.g., construction waste) in the TLS.

A two-phased trial to repurpose waste wood undertaken in summer 2019. Over an 11-day period (August 17-20 and August 25- 31), the activity resulted in the shredding of wood waste into approximately 350 650-kg bales of wood chips (Photo 2.3).

Photo 2.3 Bales of wood chips at the TLS (August 2019)

Three bales of wood chips were sent on August 20, 2019, to the Centre technologique des résidus industriels (CTRI) in Rouyn-Noranda as part of a study to repurpose the baled wood. The study had to be put on hold, however, as a result of the health crisis in early 2020 but will continue later in 2020.

2.3.2.2 SWM monitoring tools

To carefully track SW management at the Renard site, SWY uses a key performance indicator (KPI) expressed in tonnes of processed ore. This indicator has been recorded yearly since 2017.

SWY also plans to track the amount of recycled SW and compare it with the 2015 recovery and reclamation target, which is set at 70% (in tonnes) of recyclable materials by RECYC-QUÉBEC. The goal is to more accurately track SWM using a performance indicator and a government target.

Also, since 2018, the amount of SW has been calculated using material-specific conversion factors (wood, metal, electric wire, tires, etc.) to determine the amount of SW that is recycled and landfilled. SW quantities are now expressed in percentage of tonnes (% of t) instead of cubic metres (m^3), which was used by default until 2017.

This adjustment results in a more accurate weight of SW by type of material, not by container.

2.3.2.3 Overview of solid waste management

Figure 2.10 shows a breakdown of SW generated (in %) in 2019 by category. CRD (construction) waste has decreased since 2018, given that there were no major construction projects in 2019. Household waste and sludge from the drinking water treatment plant (DWTP) (CRD waste) represented 23.67% of SW in 2019, a clear reduction in relation to 2018 (42%). These changes reflect the decrease in the number of people on site in 2019. Ferrous and non-ferrous metals for their part accounted for 40% of the total mass, which is comparable to the rate in 2018. Table 2.3 depicts the quantities of recycled and landfilled solid waste (SW) since 2015, along with the tonnes of ore processed since the start of operations.

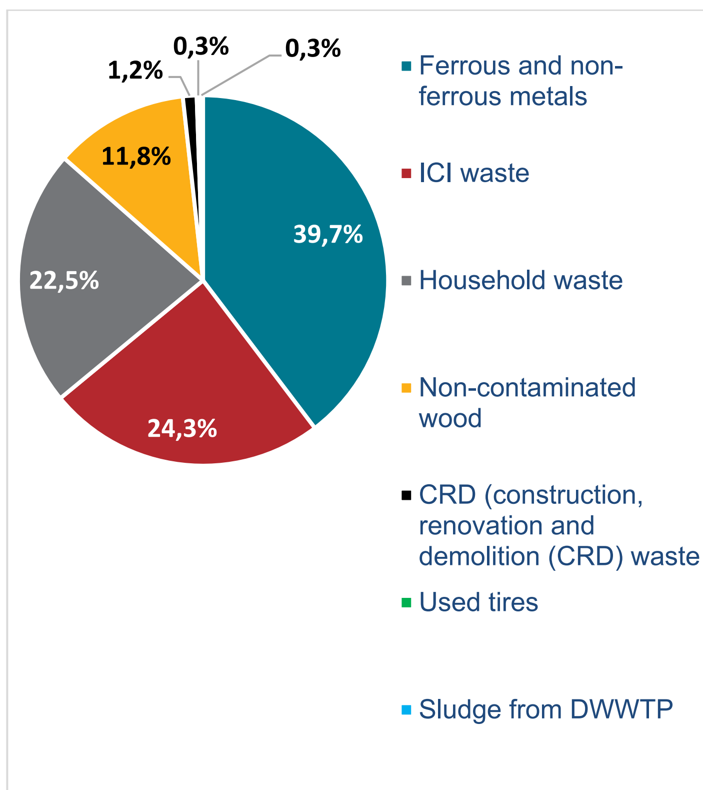


Figure 2.10 Categories of solid waste generated at the Renard mine site in 2019

Table 2.3 Solid waste (SW) sorting processes (in % of tonnes) since 2015

Year	Sorting Process (in tonnes)			
	Recycled SW	Landfilled SW	Total SW	Processed Ore (dry)
2015	796	937	1,733	n/a
2016	911	1,028	1,939	n/a
2017	519	751	1,270	1,990,906
2018	1,152	957	2,109	2,328,300
2019	799	745	1,544	2.556,459
Total (%) in 2019	**51.7**	**48.3**	**100.0**	**-**
Total (%) since 2015	**48.6**	**51.4**	**100.0**	**6,875,665**

n/a: construction period

Since 2015, about 49% of total solid waste at the mine site has been recycled, and 51.4% landfilled. In 2019, no major construction projects were carried out, which is the reason for the significant decrease in total SW in relation to 2018. The 2019 recycling rate (51.7%) was slightly lower than in 2018 (54.6%) but still higher than the 2017 rate (40.9%).

The management measures applied by SWY in 2019 helped maintain the SW recycling rate comparable to 2018, as well as to increase recycling activities since 2015 (Figure 2.11). Note that Recyc-Québec's target for SW recycling is 70%.

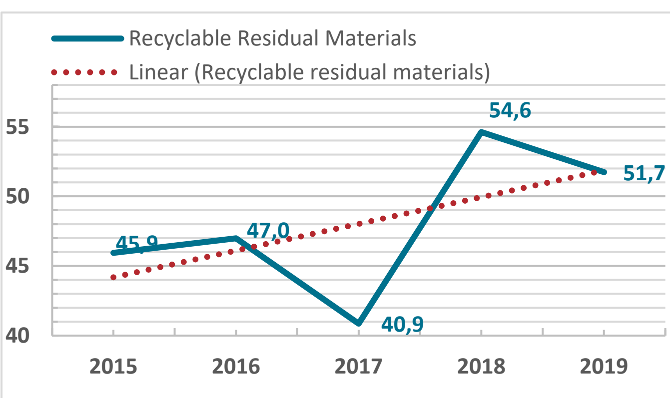


Figure 2.11 Solid waste recycling rates since 2015

The TLS landfilling rate in 2019 (48.3%) is slightly higher than in 2018 (45%) but is still of the same order of magnitude.

2.3.2.4 TLS management

Figure 2.12 shows the amount of SW landfilled at the TLS on a monthly basis in terms of the population at the mine camp in 2019. Overall, the amount of landfilled SW closely reflects the change in numbers of people at the Renard mine, with a maximum landfilling rate in August 2019.

Control of TLS

The TLS is managed in compliance with applicable legislation. TLS management procedures include covering the cells from May to October to minimize the dispersion of waste and prevent odours. An annual report on TLS operations is submitted to the MELCC. The operator at the landfill systematically checks every load of solid waste transported to the landfill to confirm whether it is allowed at the landfill. No waste materials produced by activities other than Renard mine operations are allowed. Only the operator has access to the site and the landfill gate is secured with a lock.

TLS Structure

Trenches are dug as needed to prevent water from coming into contact with the waste. Every fall, a larger trench is excavated to meet requirements over the winter. Overburden is stored at the site for use as surfacing materials (Photo 2.4).

Solid waste placed in the trenches is covered with a layer of soil at least once a week from May to October, as specified in the regulations.

SW management is critical during that period. Higher summer temperatures create bad odours from the site and elsewhere. And the lack of snow cover exposes waste to being dispersed by the wind. Clean-up on the site is done on a regular basis to prevent the dispersion of waste. When solid waste in the trenches has reached the final height (3 m), as specified in the certificate of authorization for the construction and operation of the TLS, a 60-cm layer of soil consisting of impermeable material is placed on the solid waste material and graded to prevent water accumulation

A final layer of topsoil (15 to 30 cm) is then placed on the impermeable material. The cells are covered as they are filled to allow for the progressive rehabilitation of the TLS. In 2019, five cells were in operation, four cells were closed, and two were revegetated. As at December 31, 2019, three cells were open and in operation.

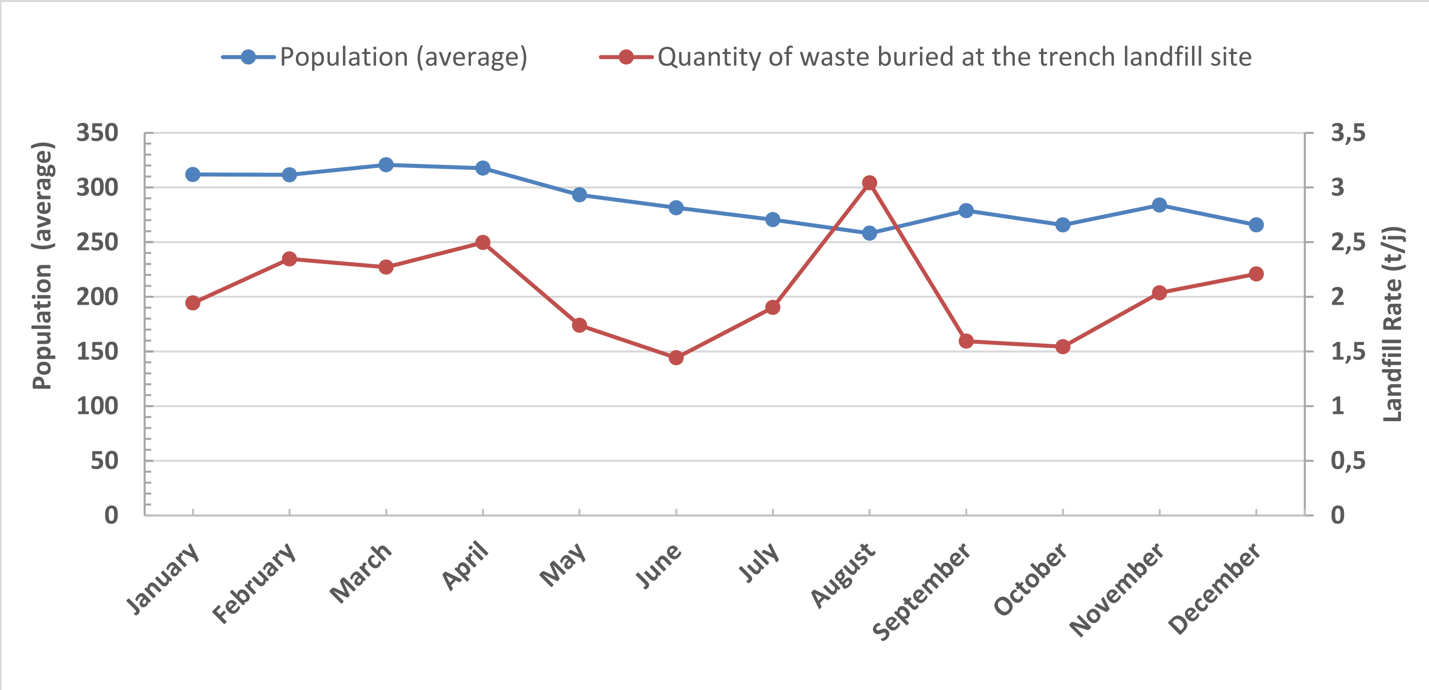


Figure 2.12 Monthly solid waste landfilling rates at the TLS based on the Renard camp population in 2019

Photo 2.4 TLS (October 2019)

Final covers were placed on two cells in 2019, and a total of 2.566 m³ of soil was used. The amount and types of solid waste landfilled at the TLS, the materials used to cover the waste materials and the final cover materials are all logged, and presented in the annual TLS report, which is submitted to the MELCC.

2.3.2.5 Control of residual hazardous materials and the RHM storage area

The main residual hazardous materials (RHM) produced at the Renard mine site are:

- waste oil, used grease, oil-contaminated solids (filters, aerosols, various containers, etc.);
- various solutions (fuel, anti-freeze, detergents, etc.), hazardous acids;
- batteries and biomedical waste.

This waste is recovered, sorted and temporarily stored in the hazardous waste area before being transported off site to be treated, reclaimed or recycled by external specialized firms. A log is kept on site to track the type and quantities of stored materials.

Quantities of RHMs

Table 2.4 indicates the quantity of RHMs shipped off site since 2015, i.e., about 920 t.

Since ore extraction and mining operations require the use of hazardous materials, and since surface activities in pit R65 ceased in April 2019, the quantity of RHMs declined accordingly in 2019. A total of about 224 t of RHMs was shipped off site, which is below the quantity shipped in 2018 (237.1 t).

Table 2.4 Quantities of residual hazardous materials shipped off site and tonnes of dry processed ore since 2015

Year	Process (tonnes)	
	RHM Shipped	Processed Ore (dry)
2015	125.1	n/a
2016	150.3	n/a
2017	183.5	1,990,906
2018	237.1	2,328,300
2019	223.6	2.556,459
Total	**919.6**	**6,875,665**

n/a.: construction year

Breakdown of RHMs

Figure 2.13 shows the breakdown of RHMs shipped off site in 2019 by category. The quantities shipped off site generally decreased in 2019, except for waste oil. Waste oil accounts for close to 56% of total RHMs shipped off site, as compared with 33% in 2018 and 63% in 2017.

The "Other" category includes waste grease, acids, contaminated containers, aerosols, batteries and other substances, which amounted to 9% in 2019 as compared with 21% in 2018. The decrease in this category essentially reflects the shutdown of surface activities in pit R65 as of April 2019.

Biomedical waste (BMW) generated at the Renard mine site is recovered at the nursing infirmary. This waste includes infectious non-anatomical waste (e.g., blood-soiled bandages), and sharp infectious non-anatomical waste (e.g., contaminated needles). In 2019, a total of 20.3 kg of BMW was shipped off site for disposal, as compared with 13.4 kg in 2018.

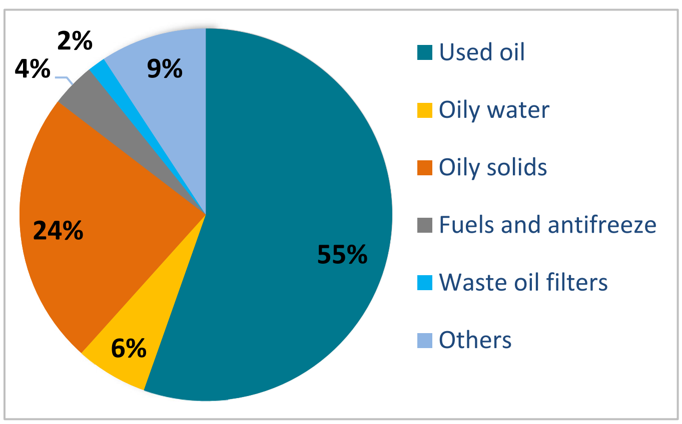


Figure 2.13 Types of residual hazardous materials shipped off site in 2019

2.3.3 Contaminated Soil Management

In 2019, no contaminated soil was placed on the biopile treatment bed. SWY's goal is to ensure the Renard mine is free of contaminated soils.

The treatment bed is therefore no longer in use. Contaminated soils are all shipped to the RSI Environnement treatment center in Saint-Ambroise. The treatment facility will be re-opened in the event a large quantity of soil requires decontamination. In such a case, it would be more cost effective to use the treatment bed than to ship a large number of containers of soil off site for treatment.

In 2019, contaminated soil was all shipped to MELCC-authorized treatment centers. Soil samples were systematically taken prior to shipping to determine the soil's contamination level and ensure it would be accepted by the treatment center (Photo 2.5).

In 2019, a total of 462 tonnes of contaminated soil was shipped to the Saint-Ambroise treatment center for incineration (Photo 2.6).

An average of 0.181 kg of contaminated soil was treated per tonne of processed kimberlite in 2019, as compared with 0.226 kg/t in 2018, a decrease of 19.9%. In relation to the 2017 average of 0.367 kg/t, the treatment of contaminated soil in 2019 decreased by 50.7% in three years.

Photo 2.5 Contaminated soil sampling (January 2019)

Photo 2.6 Transport of contaminated soil (July 2019)

3 Environmental Monitoring Program

The Environmental and Social Monitoring Program (ESMP) is required under Condition 4.1 of the Global Certificate of Authorization (CA) and the Comprehensive Study Report (CSR) issued by the Canadian Environmental Assessment Agency (CEAA, 2013). In addition to promoting early detection of environmental issues, the program allows SWY to uphold commitments made to government authorities and local communities.

The Environmental and Social Monitoring Program is part of an environmental and social management framework based on the ISO 14001:2015 standard. The general objective of the ESMP is to measure, observe and document any natural and project-related change in the environment in relation to baseline conditions, to verify the accuracy of the environmental assessment, and to assess the effectiveness of mitigation measures. These measures will be adjusted in the event of any unanticipated adverse environmental impact and adaptive management of the impact deployed.

3.1 Weather and Climate

Monitoring is designed to measure weather conditions at the mine site, facilitate the interpretation of data from the biophysical environment, and hence differentiate direct project impacts from those related to natural weather variations

The specific objectives of monitoring are to:

- Provide weather information required for mining operations as well as the design and operation of water management facilities, and provide sound management throughout the mine site;
- Validate snow depth and ice thickness at the mine site;
- support the interpretation of air and water quality monitoring results;
- Support the interpretation of hydrological monitoring results.
- There are two weather stations in place at the mine site, one at the airport and the other near Lake Lagopede (Photo 3.1). The water level stations are described in section 3.4.1

To uphold the commitments Stornoway made in the ESIA (Roche, 2011a) and in the Global CA and subsequent updates, these monitoring activities are carried out according to the following schedule:

- Weather and water level data are recorded continuously;
- Data recorded at weather stations are downloaded continuously.

Data collected at the airport are used primarily for aviation purposes. The data collected at the Lake Lagopede station are used for analytical purposes, because this station is closest to mining operations.

The Lake Lagopede weather station records a number of parameters every two minutes, enabling an in-depth analysis of weather conditions at the Renard mine site. These parameters include air temperature, relative humidity, atmospheric pressure, and wind speed and direction.

A precipitation gauge was installed near the weather tower to quantify precipitation in summer and winter (Photo 3.2). A pyranometer was also installed in 2016 to calculate solar radiation near Lake Lagopede. These data are essential to determining evaporation from Lake Lagopede, which is needed for calculating the water balance at the mine site *(*see 3.4.4). SWY shares raw weather data collected every year with the MELCC for input into Quebec's climate monitoring network.

3.1.1 Temperature

Figure 3.1 shows temperature variations observed in 2019 for daily minimum and maximum values. Average temperatures at the Renard mine site in 2019 are comparable with historical averages for the La Grand River (1981-2010) and Bonnard (1981-2010) stations (Table 3.1).

The trends observed at the Renard mine site are consistent with those observed in the rest of the province, i.e., normal seasonal conditions early in the year, above normal conditions in March and July, and below normal temperatures in April, October and November (MELCC, 2019).

3.1.2 Precipitation

Table 3.2 lists monthly precipitation measured at the Renard site in 2019, compared with historical averages at the La Grande River station (1981-2010). Monthly precipitation data is also compared with multi-year monthly averages at the Nitcheqwuon station at km 97, the closest station to the site (Golder 2011a and 2015).

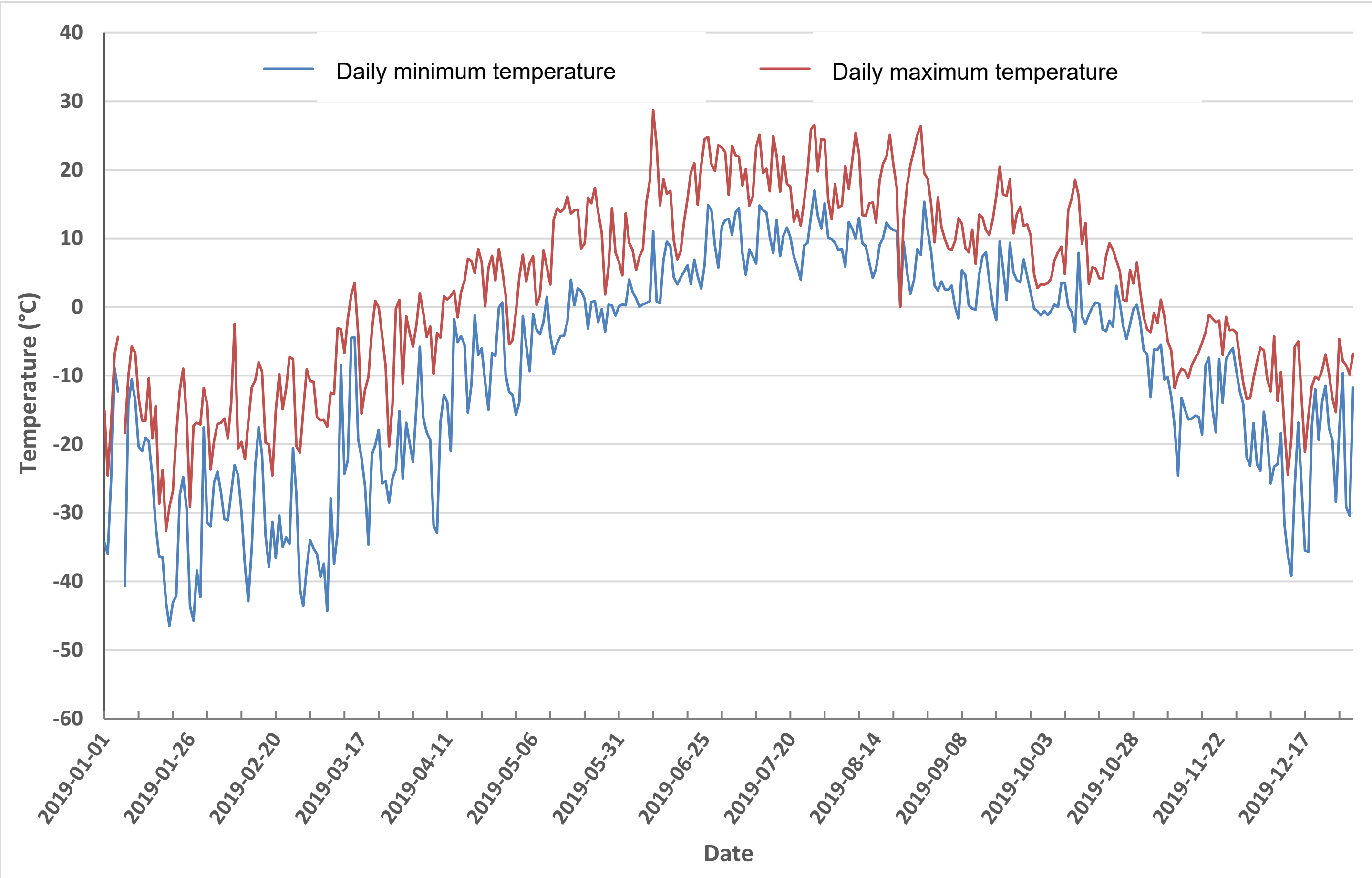


Figure 3.1 Daily minimum and maximum temperatures in 2019

Table 3.1 Monthly temperatures at the mine site in 2019

Month	Renard Mine Site Weather Station		Average Temperatures at Nearby Weather Stations	
	Average (°C) in 2019	Average (°C) in 2019	La Grande Rivière (1981-2010) (°C)	Bonnard (1981-2010) (°C)
January	-22.5	- 24.0	- 23.2	- 20.9
February	-22.1	- 22.9	- 21.6	- 18
March	-15.4	- 8.2	- 14.5	- 11.4
April	-4.7	- 9.6	- 5	- 1.9
May	3.8	0.03	4.3	5.8
June	10.5	9.7	10.8	12
July	15.0	16.3	14.2	14.5
August	13.1	13.3	13.1	13.5
September	7.6	7.8	8.1	8.6
October	3.0	- 2.8	1.7	1.9
November	-8.4	- 8.6	- 6.1	- 6.7
December	-15.8	-14.6	- 16	- 16

Photo 3.1 Weather station near Lake Lagopede

This station is considered to be the most representative of historical weather conditions observed at the Renard mine.

In 2019, precipitation recorded at Renard mine overall remained comparable to historical data, and the same weather patterns were observed, i.e., minimum values in winter and rainy periods from June to September.

Cumulative rainfall measured in 2019 (774 mm) at the mine site remains comparable to cumulative rainfall in 2011, 2015 and 2018, but below values calculated for 2016 (at the same date) and 2017.

Province-wide, the trends observed at the Renard mine site were consistent with those observed in Quebec, whether in February, in spring or in summer in Northern Quebec. Precipitation at the mine site was consistent with that in the rest of the province: there was less precipitation in January 2019, and slower snow melt, but record precipitation between June and September (MELCC, 2020).

Photo 3.2 Precipitation gauge near weather station

3.1.3 Snow and Ice Cover

3.1.3.1 Snow depth and ice thickness

Snow cover and ice thickness were measured monthly during the winter at the mine site. The data were used in water balance calculations for winter 2018-2019. Table 3.3 shows the monthly measurements recorded for Lake Lagopede in winter 2019.

The maximum average snow depth varied since 2016 as follows:

- 37 cm as at March 16, 2016;
- 53 cm as at March 1, 2017;
- 29 cm as at March 8, 2018;
- 41 cm as at March 18, 2019.

Maximum ice thickness, or average measurement of white and black ice combined, has been measured on Lake Lagopede since 2015, and it has been fairly consistent from year to year (Photo 3.3).

Table 3.2 Monthly precipitation measured in 2019

Month	Monthly Precipitation (mm) Measured at La Grande River	Estimated Multi-Year Monthly Averages (mm) at Renard Mine		Monthly Precipitation (mm) Measured at Renard Mine			
	(1981-2010)	(Golder, 2011a)	(Golder, 2015)	2016	2017	2018	2019
January	31	38	36	-	49	45	15
February	22	32	28	-	59	29	71
March	29	39	36	-	12	11	37
April	33	39	34	-	44	24	39
May	39	58	55	-	59	57	63
June	65	89	84	-	91	81	110
July	78	107	105	-	126	198	101
August	91	111	107	-	98	65	101
September	111	100	98	-	59	129	106
October	87	81	79	113	120	72	60
November	68	61	58	43	64	40	34
December	43	61	35	32	40	36	36
Total	**697**	**798**	**755**	**188**	**821**	**787**	**774**

The measurements recorded since 2015 have varied as follows:

- 84 cm as at April 20, 2015;
- 79 cm as at April 2, 2016;
- 84 cm as at April 3, 2017;
- 94 cm as at April 7, 2018;
- 84 cm on April 6 and April 10, 2019.

The 2019 monitoring data showed that maximum ice thickness is consistent from year to year, and that it is comparable to the ice thickness measured in 2015, i.e., prior to the start of operations.

Photo 3.3 Measuring ice thickness on Lake Lagopede (December 14, 2019)

3.1.3.2 Snow accumulation

Total snow accumulation on the ground was also measured near MER1 weather station. In 2019, the first snow fell on November 4, or one month later than in 2018 (October 13). Average snow accumulation by late December 2019 was 66 cm. Maximum snow accumulation of 132 cm was measured on the ground in 2019, which is comparable to the maximum recorded in 2018 (134 cm).

3.1.3.3 Snow density

Since late 2018, snow density has been measured weekly at the Lake Lagopede station throughout the entire period with snow cover. Snow density is measured in cm snow water equivalent (Photo 3.4).

In 2019, the maximum snow density measured was 36 cm, compared with 15 cm in 2018. Snow density measurements combined with snow accumulation measurements are used to calculate the quantity of runoff in the spring thaw.

These data are used in hydrological studies of the north basin of Lake Lagopede (see section 3.4 for further information).

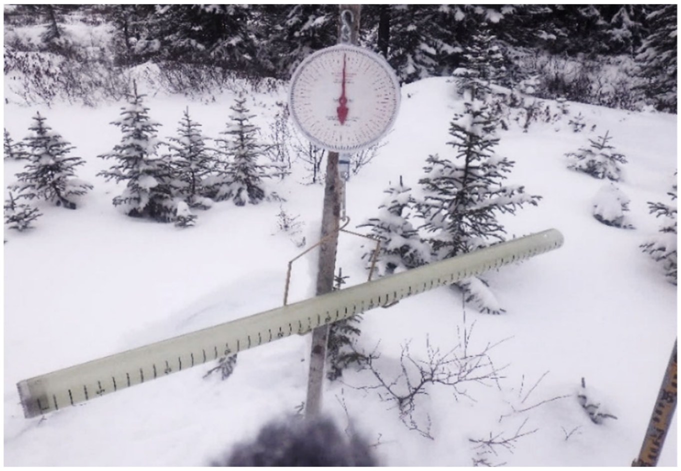


Photo 3.4 Measuring snow density (November 23, 2019)

2.1.1.1 Wind

The weather station (MER1) near Lake Lagopede is also used to develop a wind rose for the mine site and support the interpretation of air quality monitoring data (Photo 3.5).

Prevailing winds (south and southwest) in the mine site region are primarily influenced by the James Bay water masses and locally by the variable relief and the many lakes and rivers. With its two main seasons, winter and summer, and very short transition periods between these two seasons, the dominant climate at the mine site is a cold continental climate. Figures 3.2 to 3.5 show quarterly wind roses for 2019. Table 3.4 provides wind-related information (speed, prevailing winds, and proportion of calm winds) as well as precipitation.

Winds measured at the weather station in winter and spring 2019 were primarily southerlies and westerlies, consisting of 27% and 19% respectively of the winds measured. In summer and fall, prevailing winds are essentially south-south-westerly (20%) with winds varying from the south to north-north-east (20%). Section 3.2.2 describes the effect of the winds on AIR1 to AIR6 measurements used in air quality monitoring.

Table 3.3 Snow depth and ice thickness at AQR69, AQR70 and AQR71 stations on Lake Lagopede in 2019

Sampling Date	Snow and Ice Cover (in cm)				
	Station	Snow	White Ice	Black Ice	Total Ice
2019-01-05	Average at AQR-69-70-71	36	16	16	32
2019-02-07	Average at AQR-69-70-71	20	23	59	82
2019-03-18	Average at AQR-69-70-71	41	45	37	82
2019-04-06 to 2019-04-10	Average at AQR-69-70-71	28	n/a	n/a	84
2019-05-02	Average at AQR-69-70-71	13	n/a	n/a	83

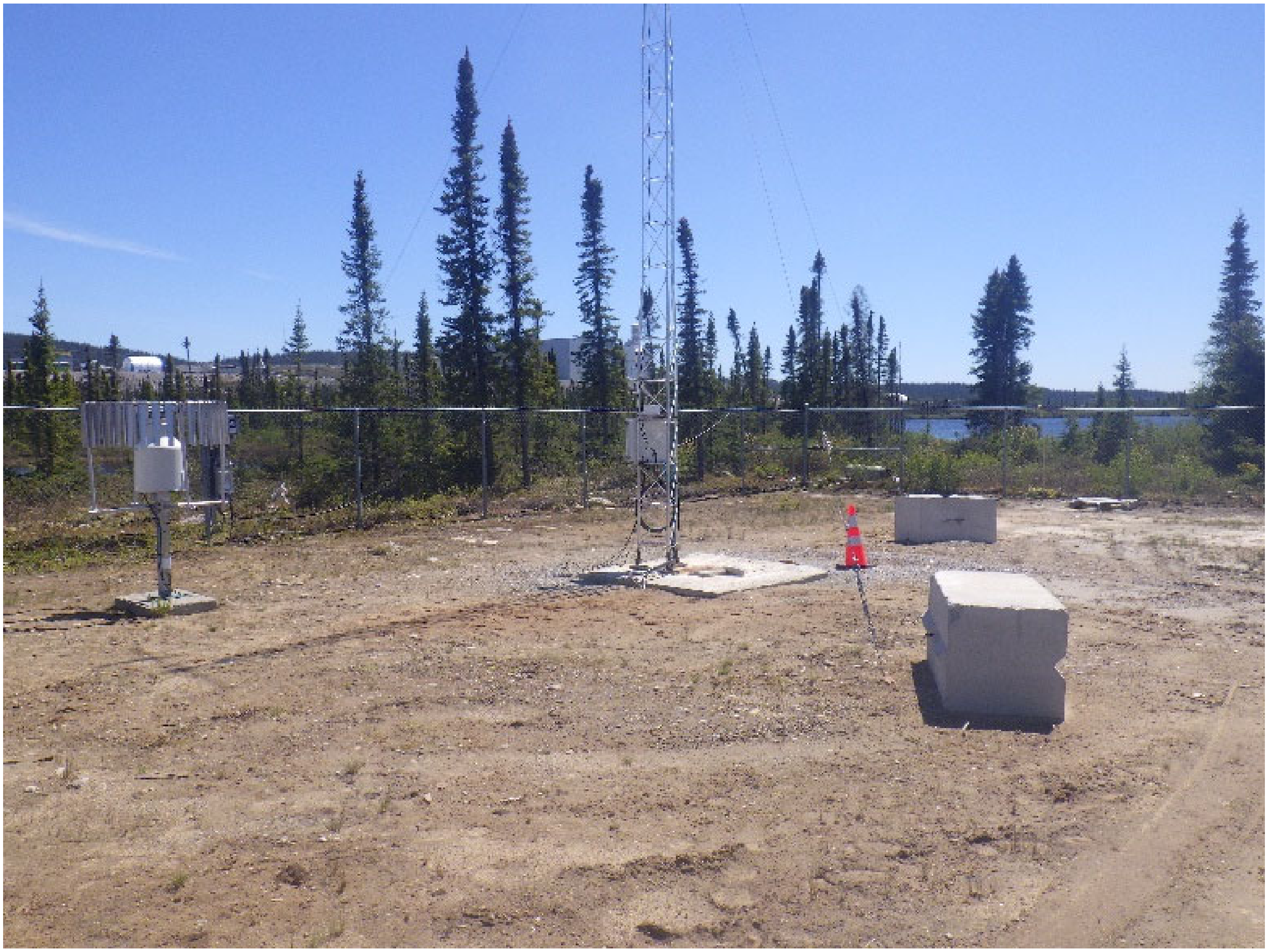


Photo 3.5 MER1 weather station (une 2019)

Table 3.4 Weather conditions during air quality monitoring campaign in 2019

Season	Average Wind Speed (km/h)	Prevailing Winds	Calm Winds	Average Daily Precipitation (mm/d)	Stations Downwind
Winter Dec. 21, 2018 – March 20, 2019	9.5	South and West	27%	1.5	AIR4, AIR5, AIR6
Spring March 20, 2019 – June 21, 2019	11.1	South to West	19%	2.0	AIR4, AIR5, AIR6
Summer June 21, 2019 – Sept. 23, 2019	10.8	South. South-South-West	20%	3.4	AIR4, AIR5
Fall Sept. 23, 2019 – Dec. 22, 2019	10.3	South. North-North-East	20%	1.5	AIR1, AIR4, AIR5

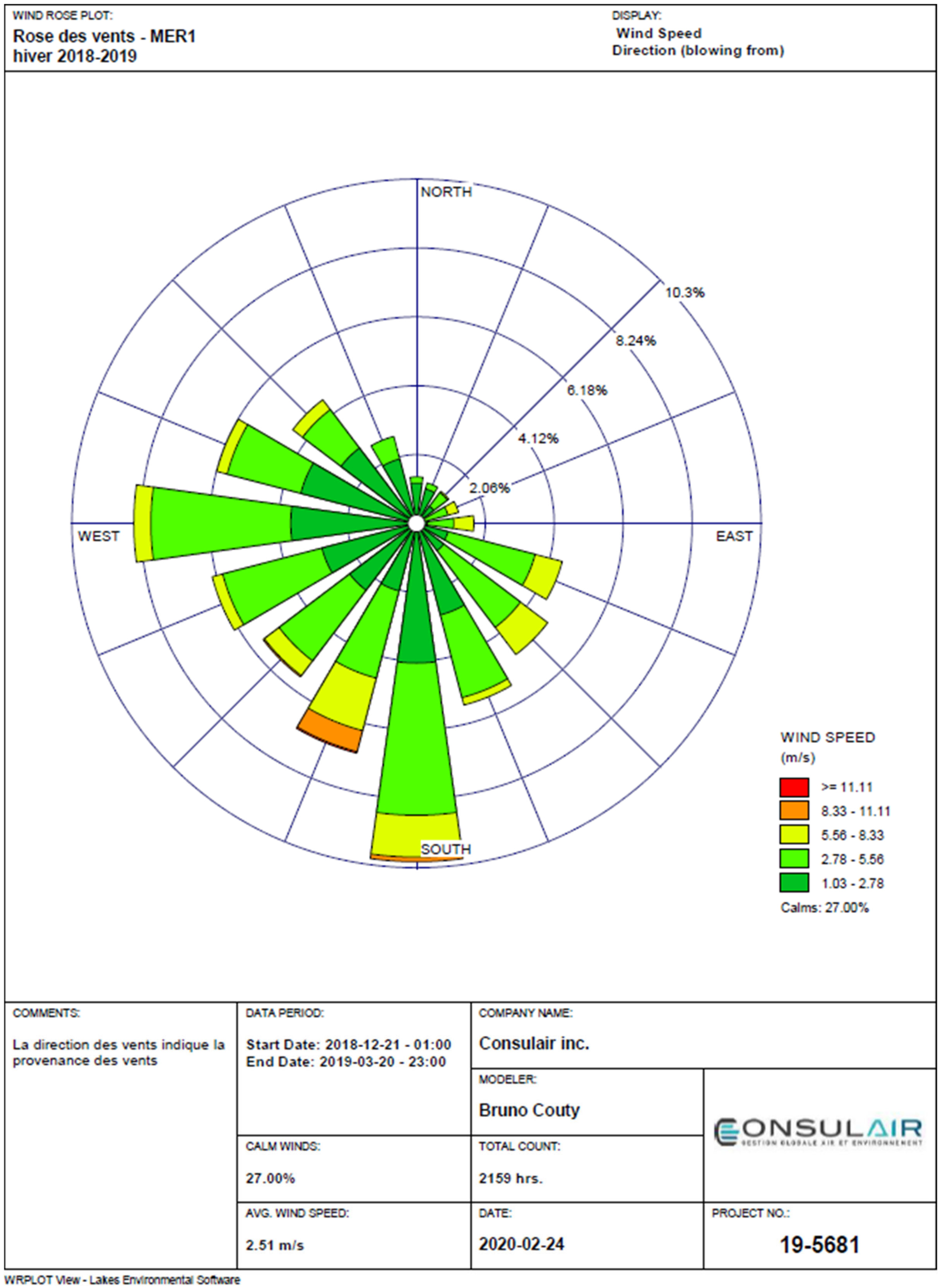


Figure 3.2 Wind rose at Renard mine for first quarter in 2019

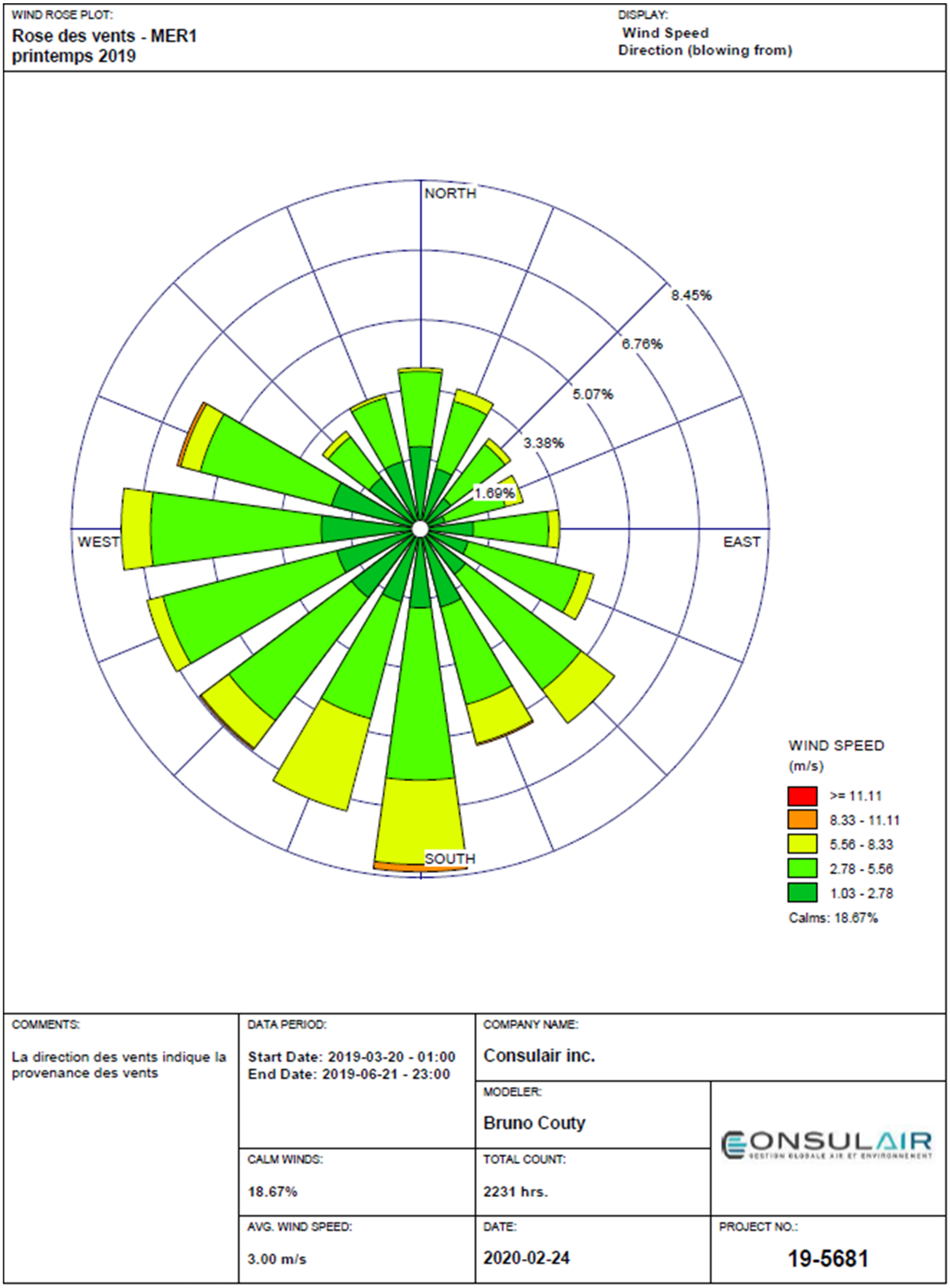


Figure 3.3 Wind rose at Renard mine for second quarter in 2019.

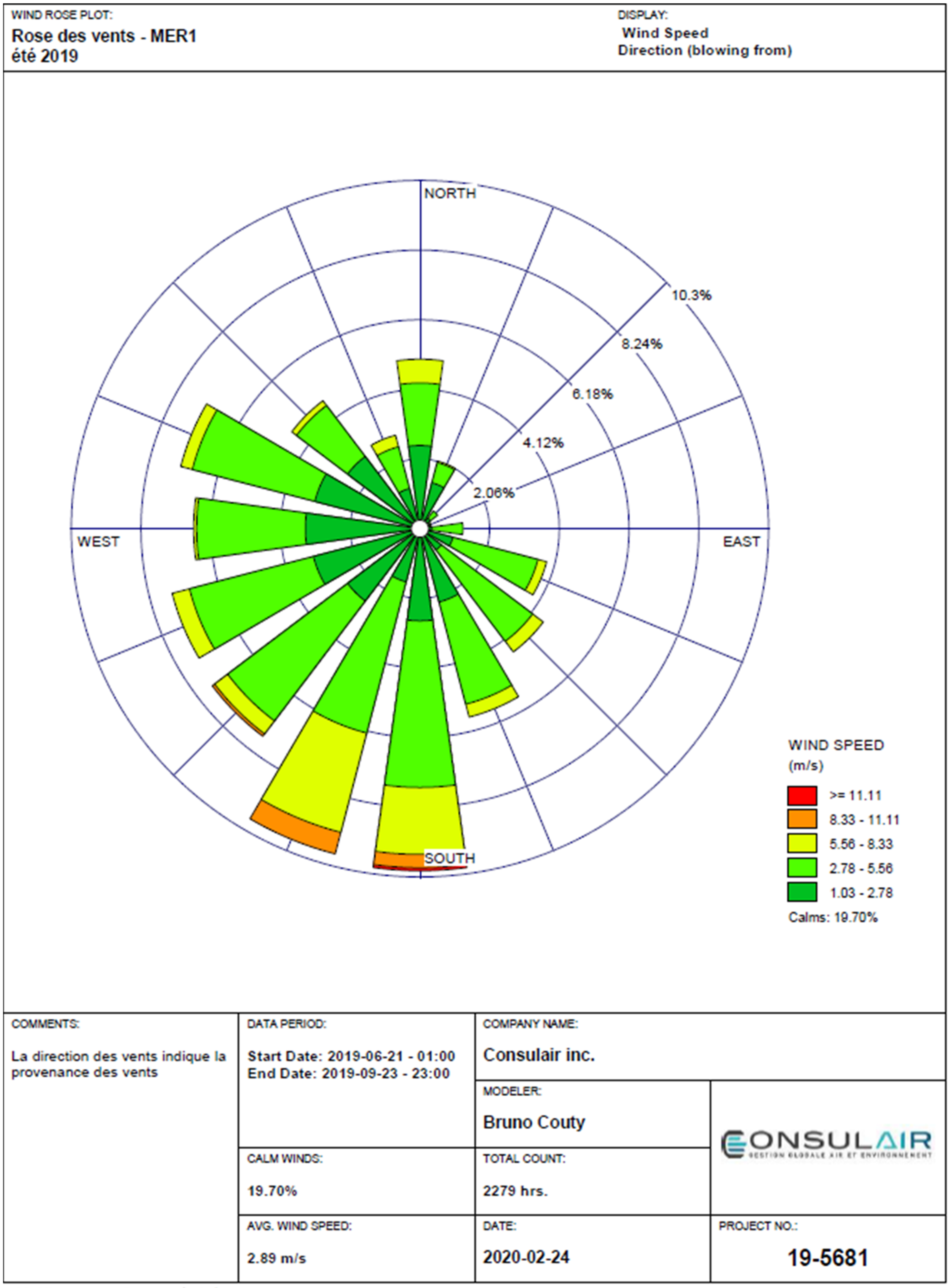


Figure 3.4 Wind rose at Renard mine for third quarter in 2019.

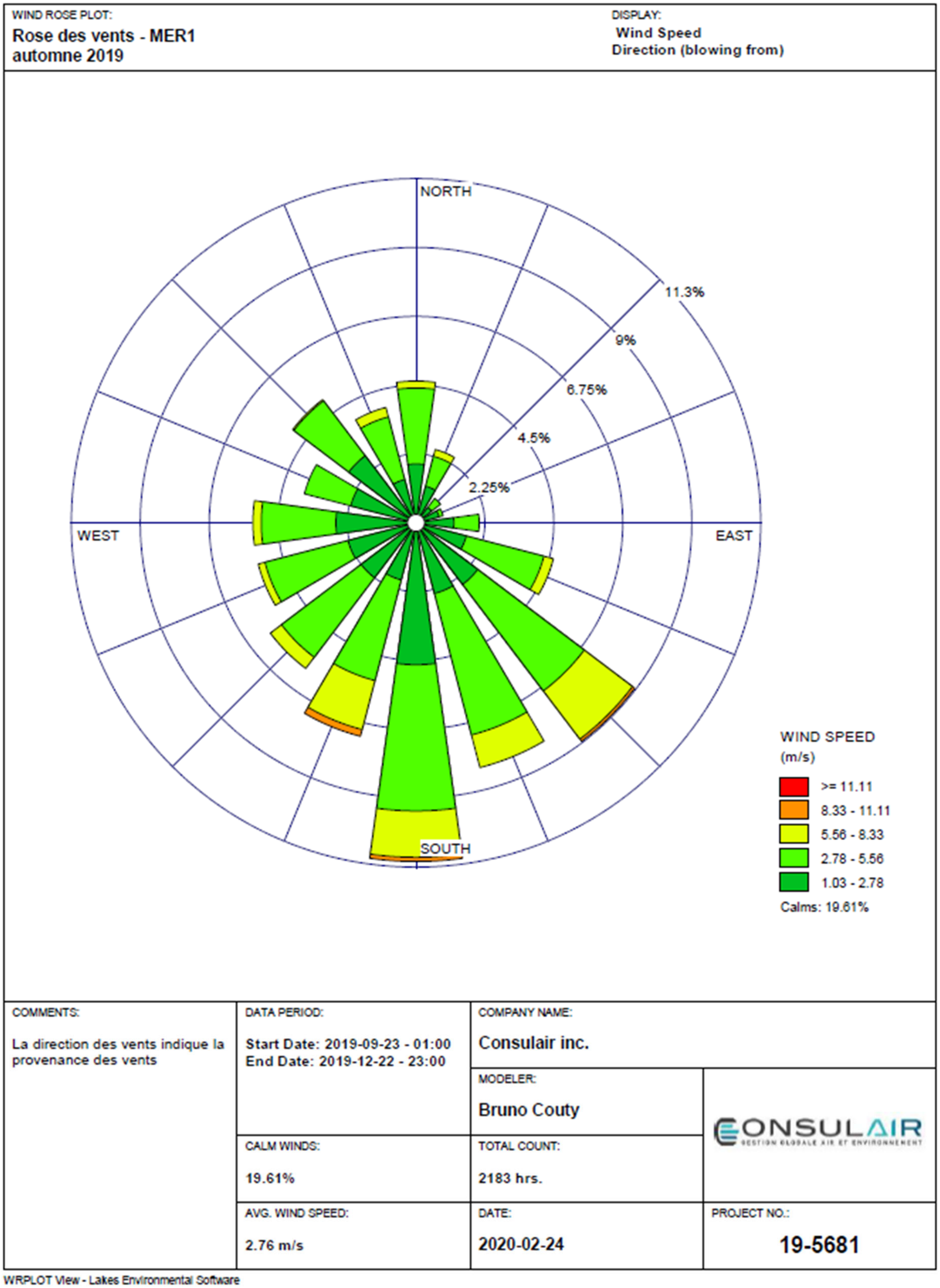


Figure 3.5 Wind rose at Renard mine for fourth quarter in 2019.

3.2 Air Quality and Atmospheric Emissions

3.2.1 Air Scrubber Management

To control air contaminant emissions at source during the construction of the ore processing plant, four dust collectors (PEP-3-4-5-6) were installed above the point emission sources, i.e., the ore crushing, grinding and sorting equipment, when the ore processing plant was built. The dust collectors and scrubbers were brought online in July 2016.

A dust collector maintenance program was set up to ensure the performance and smooth operation of the equipment. The dust collectors are maintained by personnel from the ore processing plant.

Since 2016, SWY has had an air quality monitoring program in place (section 3.2.2). This program is designed to demonstrate and validate the effectiveness of the air scrubbing equipment installed at the mine site.

3.2.1.1 Dust collector monitoring

To obtain the depollution attestation defining new atmospheric emission requirements, SWY improved its dust collector monitoring and maintenance program in 2019 with respect to the frequency of inspections required by the MELCC (Table III-1 in Appendix II).

Inspections of dust collectors (PEP-3, 4, 6) and cyclones are done weekly (as compared with every 14 days previously) by ore processing plant operators who also maintain the logs for this equipment. In addition, the ore processing plant conducts monthly inspections and maintains a log for the PEP-5 scrubber.

In addition, dust collectors with a capacity of more than 17,000 m³, as well as the wet dust collector installed at the ore processing plant, are equipped with passive leak detectors. This continuous leak detection system is connected to the control system, in compliance with CAR requirements (Q-2, r. 4.1) for a continuous device for detecting leaks or system failures.

Weekly inspections as well as monthly preventive maintenance are carried out on the cyclones installed at the ore processing plant. During such inspections in 2018, no anomalies, no reports, and no dust emissions were observed or recorded from the air scrubbing equipment.

3.2.1.2 Diffuse emission monitoring

As part of the depollution attestation, regular inspections of the tailings ponds, waste rock piles and ore stockpiles were also carried out by the environment technician to detect diffuse emissions. The goal was to detect the presence of any visible particles more than two metres away from the sites.

In 2019, the site inspection form was updated to record the observation of dust emissions. Four additional stations were in fact added to the form, i.e., the stations at pits R2, R3 and R65, as well as the station at the unloading silo. No dust emissions were observed during any of the inspections in 2019. Inspection frequency is specified in Table III-1 and the points to be checked are listed in Table III-2 in Appendix II (PED-1,2,3,4,5,6,7,8,9,10) and (PT-1, 7).

3.2.2 Air Quality Monitoring

Ambient air quality and atmospheric emissions are monitored to confirm contaminant concentrations measured in the ambient are compliant with the standards set out in the Clean Air Regulation (CAR, Q-2, r.4.1) as well as with source emissions standards indicated in the same regulation.

Air quality monitoring is performed in accordance with the quality assurance and control guidelines set by the National Air Pollution Surveillance Network (NAPSN). The monitoring focuses on five components:

- Meteorological measurements (see section 3.1);
- Hydrometeorological measurements (see section 3.4);
- Ambient air contaminant concentration and dustfall measurements;
- Measurement of contaminant concentrations from point emission sources;
- Evaluation of the amount of fuel and natural gas required for mine operations (cf. section 3.2.3).

3.2.2.1 Equipment

The primary goal of ambient air quality monitoring is to ensure the equipment used has the features and performance capacity to comply with requirements set out in the Clean Air Regulation (CAR) as well as with the air quality targets defined in the ESMP (Stornoway, 2019). The monitoring equipment used include:

- Gauges, to determine monthly dustfall rates;
- Passive SO_2 and NO_2, samplers, to validate whether emissions of these two contaminants comply with the

average annual concentration standards set out in the CAR;

- A high volume (Hi-Vol) air sampler (TE-5170V), which draws in ambient air and collects total suspended solids (TSS);
- A high volume (Hi-Vol) air sampler (TE-6070-2.5V), which takes in fine particulates from the ambient air ($PM_{2.5}$).

3.2.2.2 Sampling stations

Air quality monitoring is carried out at six ambient air monitoring stations installed within and on the perimeter of the mine site (photos 3.6 to 3.11), including a control station and five stations exposed to mine activities (Map 3.1). AIR1 and AIR3, on the property limits, are the only stations subject to CAR standards.

AIR1 and AIR3

Control station AIR1, which is upwind of the mine site in relation to the direction of the prevailing winds (northwest/southeast), serves to establish local background levels, or baseline values for total suspended solids (TSS, fine particulates ($PM_{2.5}$), metals, SO_2, NO_2, and dustfall.

AIR3 is located generally downwind of the mine in relation to the prevailing winds (northwest /southeast). A high-volume air sampler (TE-6070-2.5V) for $PM_{2.5}$ was installed there in November 2017 at the top of the telecommunications mountain where it is exposed to the prevailing winds. Data from this station in combination with PM2.5 measurements from station AIR1 are used to assess the impact of the mine on ambient air quality at the mine property limits.

AIR2

The first of the exposed stations, AIR2, provides specific observations. It is located in the middle of mining operations, between pit R2-R3 and the accommodation complex. The CAR air quality standards, which apply strictly to property limits, are not applicable to this station. AIR2 is used strictly to monitor exposure of workers in the middle of the mine site and track emissions of TSP, metals, SO_2, NO_2 and dustfall near mining operations.

AIR4 and AIR5

Two other stations, AIR4 and AIR5, were also installed to measure dustfall from non-point sources (for example, pit R65) on Lake Lagopede (AIR4) and Lake F3298 (AIR6) (from for example the MPKC facility).

These measurements are used to compare annual ambient air quality results with the results of the air dispersion model (AERMOD) from non-point sources on Lake Lagopede and Lake F3298.

AIR6

Finally, an additional station (AIR6) was set up west of the modified processed kimberlite containment (MPKC) facility. Data collected from this station are used to determine concentration levels of contaminants potentially generated by mining operations in areas where ambient nitrogen dioxide (NO_2) concentrations were estimated in the contaminant dispersion model to be the highest.

3.2.2.3 Meteorological conditions

Wind speed and direction as well as precipitation are meteorological data that have a significant impact on air quality, specifically on the monitoring of total suspended solids (TSS). These data are collected at the permanent weather station MER1 located near the air quality monitoring station AIR4.

2.1.1.1 2019 Results

Air quality monitoring was undertaken from January 1 to December 31, 2019, at stations AIR1, AIR3, AIR4, AIR5 and AIR6.

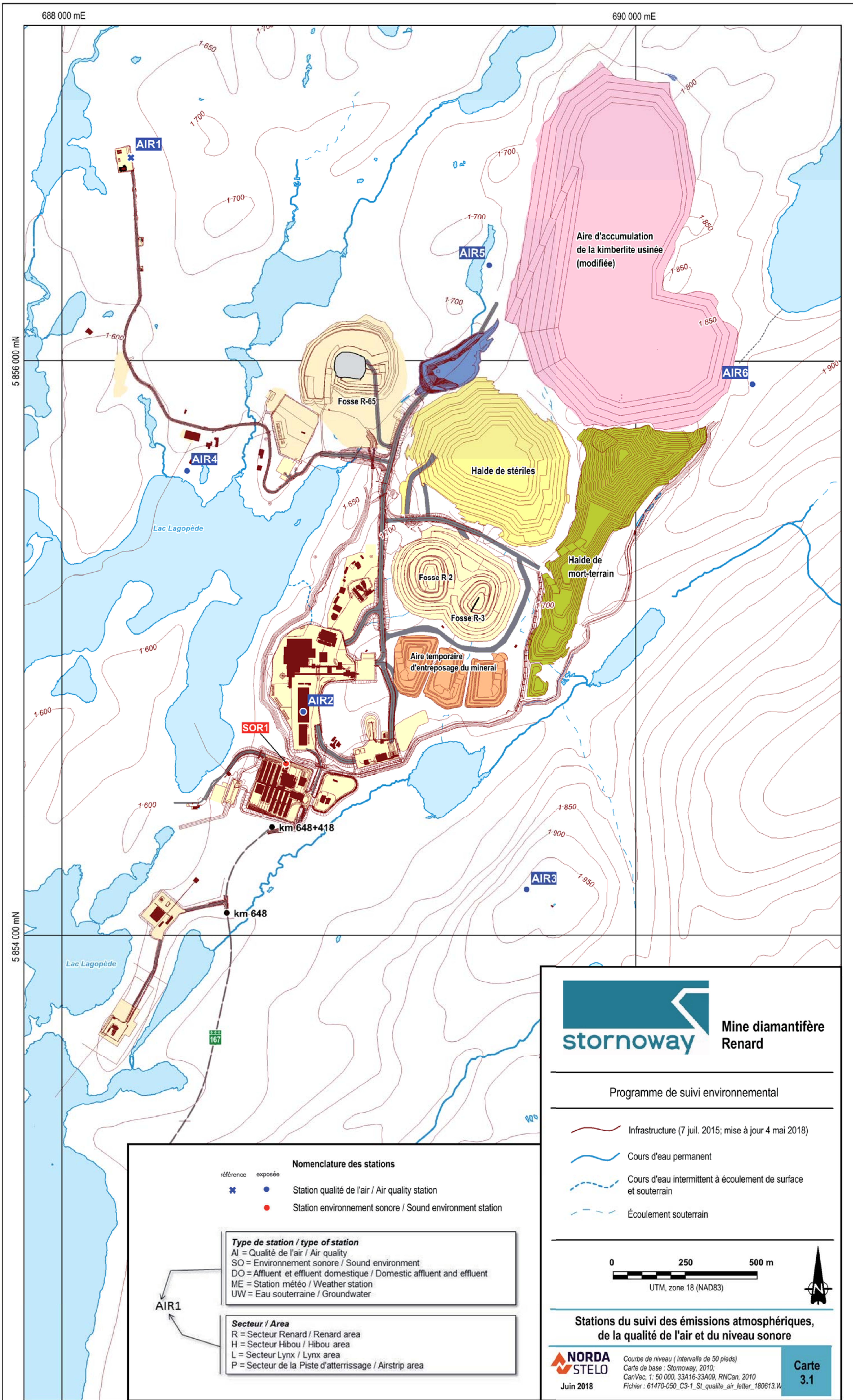
Meteorological Conditions

Meteorological data from station MER1 were used to develop the four seasonal wind roses for 2019 shown in figures 3.2 to 3.5 in Section 3.1. According to the wind roses, stations AIR4 and AIR5 are located downwind of the mine site.

For the first time since air quality monitoring was launched, the position of stations AIR1 and AIR3 seem to have reversed. According to meteorological data measured in the field in 2019, station AIR1 is downwind and station AIR3 is upwind of the mine site in relation to the prevailing winds. Initially, the meteorological data modelled for the 2011 impact assessment placed these two stations respectively upwind (AIR1) and downwind (AIR3) of the mine site. Other stations are also found downwind of the Renard mine depending on the season, such as AIR6 in winter and spring.

TSP and $PM_{2.5}$

Total suspended solids (TSS) and $PM_{2.5}$ particulates were sampled 61 times from January to December 2019.


688 000 mE
690 000 mE
5 856 000 mN
5 854 000 mN
AIR1
AIR2
AIR3
AIR4
AIR5
AIR6
SOR1
Aire d'accumulation
de la kimberlite usinée
(modifiée)
Fosse R-65
Halde de stériles
Halde de
mort-terrain
Fosse R-2
Fosse R-3
Aire temporaire
d'entreposage du minerai
Lac Lagopède
km 648+418
km 648
167
1 600
1 650
1 700
1 800
1 850
1 900
1 950
Nomenclature des stations
référence
exposée
Station qualité de l'air / Air quality station
Station environnement sonore / Sound environment station
Type de station / type of station
AI = Qualité de l'air / Air quality
SO = Environnement sonore / Sound environment
DO = Affluent et effluent domestique / Domestic affluent and effluent
ME = Station météo / Weather station
UW = Eau souterraine / Groundwater
AIR1
Secteur / Area
R = Secteur Renard / Renard area
H = Secteur Hibou / Hibou area
L = Secteur Lynx / Lynx area
P = Secteur de la Piste d'atterrissage / Airstrip area
stornoway
Mine diamantifère
Renard
Programme de suivi environnemental
Infrastructure (7 juil. 2015; mise à jour 4 mai 2018)
Cours d'eau permanent
Cours d'eau intermittent à écoulement de surface
et souterrain
Écoulement souterrain
0
250
500 m
UTM, zone 18 (NAD83)
N
Stations du suivi des émissions atmosphériques,
de la qualité de l'air et du niveau sonore
NORDA
STELO
Juin 2018
Courbe de niveau (intervalle de 50 pieds)
Carte de base : Stornoway, 2010;
CanVec, 1: 50 000, 33A16-33A09, RNCan, 2010
Fichier : 61470-050_C3-1_St_qualite_air_letter_180613.W
Carte
3.1

TSP and $PM_{2.5}$ concentrations were in compliance with applicable CAR standards (TSP: 120 g/m^3; PM2.5: 30 g/m^3 over 24h) in all the field measurement campaigns in 2019. Using measurements from all the seasons combined, average TSP concentrations at station AIR1 are higher than those from station AIR3, which is consistent with the prevailing winds observed at the property limit (AIR1) in 2019 (Consulair, 2020).

At station AIR2, located in the very middle of mining operations, the average TSP concentration observed in 2019 (25 g/m^3) was clearly lower than the averages measured in 2018 (40 g/m^3) and 2017 (55 g/m^3). This concentration is well within the ambient air quality standard applicable at the property limit (120 g/m^3 over 24 h), and has been since 2017, despite the fact that these standards do not apply to this station. These results therefore show a sustained improvement in air quality since 2017 and a marked improvement in 2019, when surface mining operations came to a close.

The concentrations of fine particulates $PM_{2.5}$ measured at the property limits (AIR1 and AIR3) are compliant with the CAR standard across all the sampling and are comparable in each of the seasons in 2019 (Consulair, 2020). The TSP and $PM_{2.5}$ results in the 2019 monitoring therefore indicate that mining activities have no impact on air quality at the property limits (AIR1 and AIR3).

Metals

The metal concentrations that were measured (24 h concentrations) or calculated (annual average concentrations) at the property limits as well as at specific observation station AIR2, were all in compliance with applicable daily and annual CAR standards.

Moreover, since there is no current total chromium standard, additional analyses for trivalent and hexavalent chromium are performed whenever a value exceeds the more restrictive hexavalent chromium standard (0.004 g/m^3).

In 2019, average total chromium concentration was 100% less than the applicable CAR standards, including the most restrictive hexavalent chromium standard. No further analysis was therefore needed to confirm compliance with the standard.

SO_2 and NO_2 Concentrations

Table 3.5 provides annual concentrations for nitrogen dioxide (NO_2) and sulphur dioxide (SO_2) measured at the property limits since 2017. In 2019, the concentrations measured at the stations, including AIR2, were clearly below CAR standards (NO_2: 54.8 ppb; SO_2: 19.8 ppb).

Table 3.5 Annual NO_2 and SO_2 concentrations from 2017 to 2019

Station	Annual Average		
NO_2 (ppb) Standard: 54.8	2017	2018	2019
AIR1	0.6	0.4	0.2
AIR3	0.8	0.6	0.7
AIR6	1.0	0.5	0.4
SO2 (ppb) Standard: 19.8	2017	2018	2019
AIR1	0.2	< 0.2	< 0.2
AIR3	0.2	< 0.2	< 0.2
AIR6	0.2	< 0.2	< 0.2

Dustfall

Table 3.6 presents dustfall rates measured at the five stations (AIR1, AIR3, AIR4, AIR5 and AIR6). Although there is currently no applicable standard for this parameter, the values are compared with the reference standard of 7.5 t/km^2/30 days set out in RQA (Q-2, r.38 – standard which has since been repealed).

In 2019, dustfall remained well within the RQA reference standard, as observed in 2017 and 2018 (Consulair, 2020).

Station AIR5 had the highest annual average in 2019, as in 2017 and 2018 (without the influence of the forest fires). But it still remained well within the RQA standard. Note that AIR5 was downwind of the prevailing winds at the Renard mine in all seasons in 2019, which is consistent with the maximum value recorded at the station.

Table 3.6 Average dustfall

Dustfall (Standard: 7.5 tonnes / km^2 / 30 days)			
Station	Annual Average		
	2017	2018	2019
AIR1	2.3	3.6*	1.0
AIR3	2.4	1.4	1.4
AIR4	1.9	1.2	0.9
AIR5	3.9	2.9	2.0
AIR6	2.6	1.1	0.8

* value including the influence of forest fires in June 2018
value without the June value: 0.7 t/km^2/30 days

To conclude, the parameters measured in 2019 as part of the ambient air quality monitoring program were all in compliance with applicable CAR standards at the Renard mine property limits.

3.2.3 Atmospheric and Greenhouse (GHG) Emissions

In keeping with the emissions reporting requirement under the National Pollutant Release Inventory (NPRI) and the Quebec Atmospheric Emissions Inventory (IQÉA), atmospheric emissions from mining operations were calculated at the Renard diamond mine in 2017 and 2018.

These emission calculations include greenhouse gases (GHG) as well as pollutants likely to be released by mining operations. The environmental impact assessment estimated that total annual GHG emissions from equipment at the Renard mine would be in the order of 75,000 t (CO2 eq.) [metric tons of CO2 equivalent] (Roche, 2011a).

Under the Regulation respecting Mandatory Reporting of Certain Emissions of Contaminants into the Atmosphere (RDOCECA), when annual GHG emissions for stationary equipment exceed 25,000 t (CO2 eq.) an audit report on emissions must be produced.

3.2.3.1 2018 GHG report

Since GHG emissions from stationary equipment exceeded 25,000 mt (CO_2 eq.), an external audit report was produced.

In response to this audit, Stornoway submitted a report on the total quantity of GHG emissions. The audited and revised total quantity of GHG emissions in 2018 amounted to 66,127 t (CO_2 eq.), hence a difference of less than 9,200 t in relation to estimates in the 2011 impact assessment (Roche, 2011a - section 6.3.3.2).

In the case of stationary equipment, SWY has favoured the use of LNG (liquefied natural gas) rather than diesel fuel in mine operations since 2014. This change in fuel meant that a reduced mass of GHG emissions, assessed at 45,000 mt (CO_2 eq.), was generated by stationary equipment (SWY, 2014). In 2018, once the report was reviewed by the MELCC, the measured and validated GHG emissions from stationary equipment at the Renard mine amounted to 44,793 t (CO_2 eq.). GHG emissions from mobile equipment in 2018 amounted to 21,336 t (CO_2 eq.).

3.2.3.2 2019 GHG Report

In 2019, a greenhouse gas emissions report was prepared and submitted to government authorities in 2020. Since GHG emissions from stationary equipment exceeded 25,000 mt (CO_2 eq.) in 2019, an external emissions audit report was produced.

The 2019 report on GHG emissions along with the standard unit for SWY operations was approved by the external auditor. In 2019, the total quantity of GHG emissions on the Renard mine site amounted to 73,657 t (CO_2 eq.), which is below forecasts indicated in the 2011 impact assessment (Roche, 2011a). GHG emissions from stationary equipment amounted to 49,840 t (CO_2 eq.), whereas GHG emissions generated by the use of mobile equipment were 23,726 t (CO_2 eq.).

2.1.1.1 Performance indicator for GHG emissions – 2017-2019 report

In addition to monitoring GHG emissions, in 2017 the Renard mine registered on the Carbon Market, a cap-and-trade system for greenhouse gases.

Under this system, the Renard mine opted to use tonnes of processed kimberlite expressed as dry matter as a standard unit. This meant Stornoway could establish a performance indicator expressed in quantities of GHG emitted per tonne of processed kimberlite annually. Externally audited stationary GHG emissions, as reported for the performance indicator between 2017 and 2019, are indicated in Table 3.7.

Table 3.7 Change in stationary GHG emissions as reported for the standard unit since 2016

Year	GHG (kg) per Tonne of Processed Ore	Stationary GHG Emissions (t. eq.CO_2)	Processed Ore (tonnes)
2017	19.72	39,268,	1,991,000
2018	19.09	44,464,	2,328,000
2019	19.49	49,840	2,556,459

Between 2018 and 2019, there was a slight increase of 2% in the GHGs emitted per standard unit for stationary equipment on the mine site. This variation can be explained by the temporary increase in electric power needed to develop level 450 in the underground mine throughout 2019.

It should be noted that results reported in the 2019 report are comparable to those reported in the 2018 report. It is more reflective of the shutdown of surface operations, and hence the reduced use of mobile equipment on the surface of the mine as of April 2019.

Photo 3.6 AIR1 sampling station (September 2019)

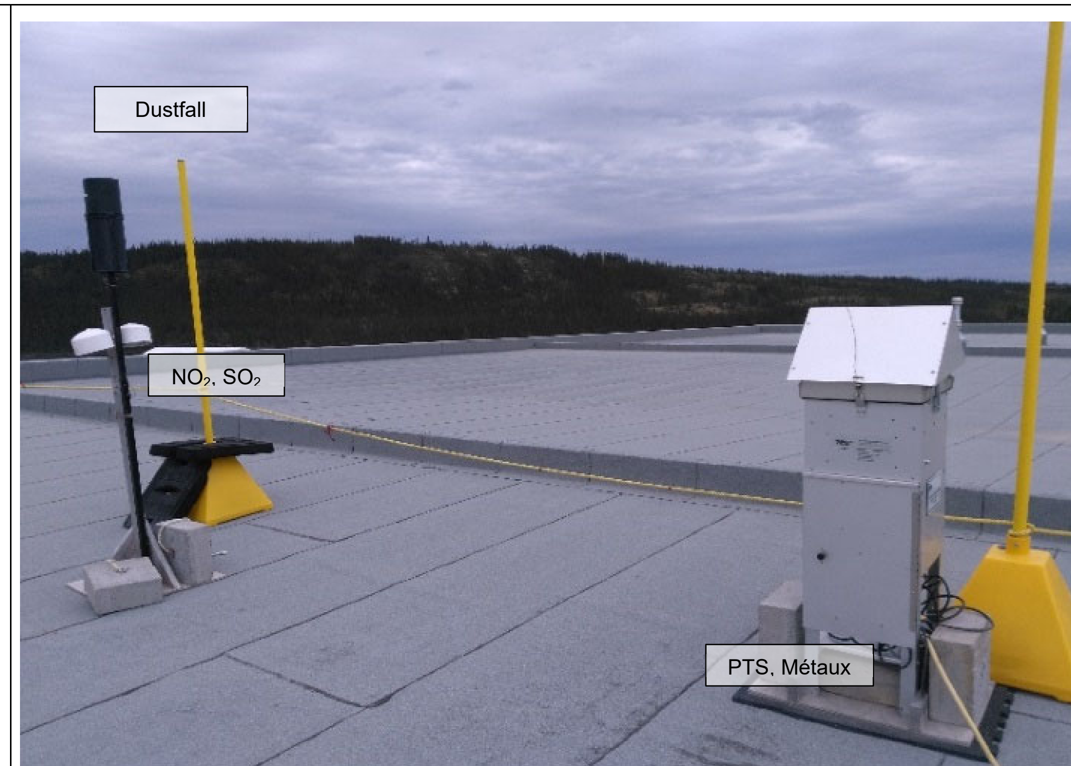


Photo 3.7 AIR2 sampling station (June 2018)

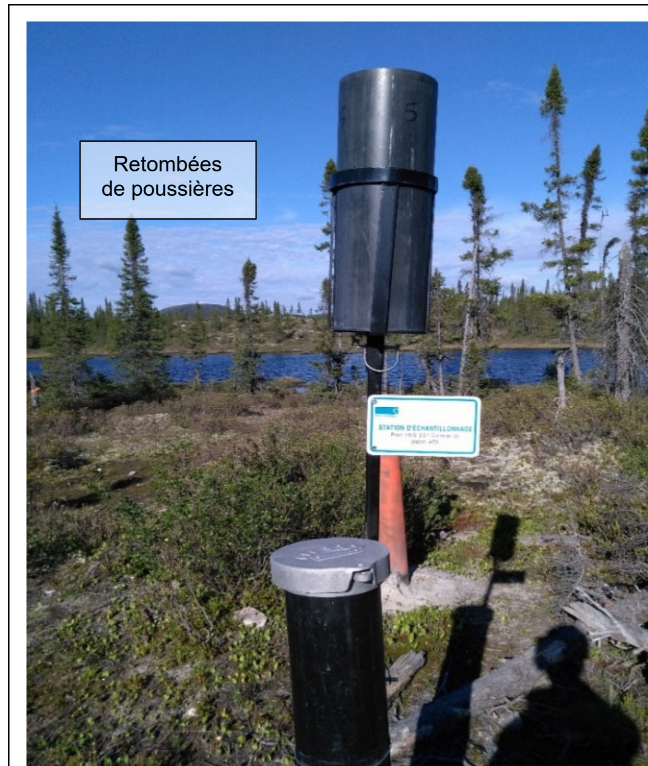


Photo 3.8 AIR5 sampling station (June 2018)

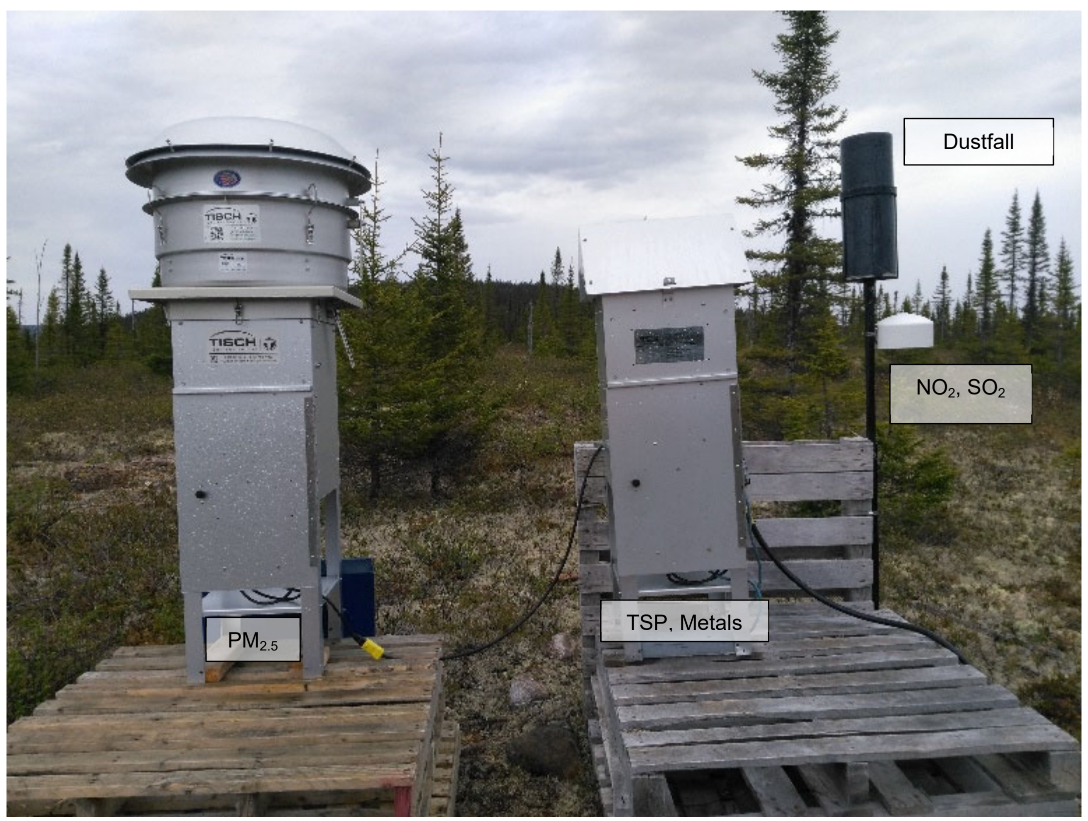


Photo 3.9 AIR3 sampling station (June 2018)

Photo 3.10 AIR4 sampling station (June 2018)

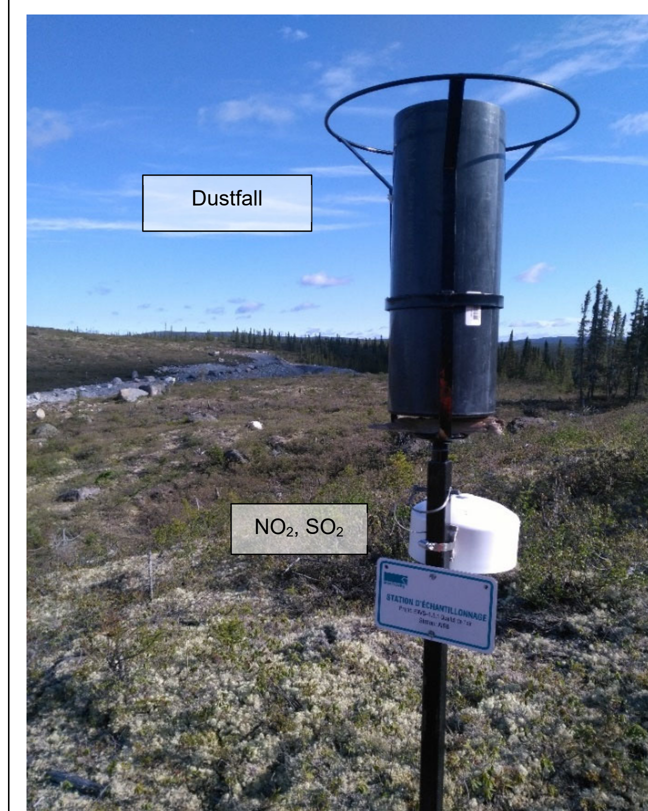


Photo 3.11 AIR4 sampling station (June 2018)

3.3 Noise and Vibration Levels

In compliance with Directive 019, Stornoway made a commitment to the MELCC to monitor noise and vibration levels during construction and operation phases at the mine. Noise limits are set at 55 dBA during the day and 50 dBA at night. However, the objectives set by SWY in the environmental impact assessment were 45 dBA during the day and 40 dBA at night. The allowable limit of 12.7 mm/s is set for vibrations and 128 dBL for threshold air pressure, under Directive 019.

The objective of this monitoring is to track changes in noise levels attributable to mining operations and measure vibrations during blasting activities so as to validate the mitigation measures in place and apply any necessary corrective measures. Noise level monitoring will also help identify noise sources that are likely to be a source of annoyance or disturbance for workers.

3.3.1 Noise Levels

3.3.1.1 Method

The method used to assess noise levels is set out in the Memorandum of Instruction 98-01 ("handling of noise-related complaints and requirements imposed on noise-producing companies") (NI9801) site (Yockell, 2020).

As specified in memorandum NI9801, noise level surveys must be conducted in sensitive areas near operations. In the case of the Renard mine, only the sector containing the accommodation and service complex area is considered to have the potential to be disturbed and therefore constitutes a sensitive area. A measuring point was selected north of the accommodation complex. Map 3.2 illustrates the location of the measuring point.

Short (1 h) and long (24 h) acoustic surveys were carried out within the only sensitive area on the mine site, namely the accommodation and service complex area (Map 3.2). This sensitive area is considered to be a housing area within an industrial zone.

Photo 3.12 illustrates the calibration of the sonometer used to conduct the noise surveys. It is positioned between the sensitive area and the main mining activities that are likely to impact noise levels for workers.

To qualify noise generated by mine operations alone and owing to the significance of other human activities throughout the site, field observations were carried out for two or three one-hour periods during the surveys.

In 2019, back-up alarms were logged, along with the length of time they sounded. As in prior acoustic monitoring, a backup penalty of +5 dBA was applied owing to the significant number of back up alarms.

Photo 3.12 Calibration of sonometer used in acoustic monitoring surveys

3.3.1.2 2019 results

Survey period and conditions

In 2019, four acoustic surveys (24-hour readings) were carried out in the operations phase:

- Survey 1: from Thursday, June 13 at 12 p.m. to Friday, June 14 at 12 p.m.;
- Survey 2: from Friday, July 12 at 11 a.m. to Saturday, July 13 at 11 a.m.;
- Survey 3: from Thursday, August 8 at 3:20 p.m. to Friday, August 9 at 3:20 p.m.
- Survey 4: from Sunday, September 29 at 10:30 a.m. to Monday, September 30 at 10:30 a.m.

During the surveys winds were below 20 km/h, relative humidity was less than 90%, air temperature varied between 0 and 24°C, and there was no precipitation.

These sampling conditions mean that the measurements taken in 2019 were acceptable for comparison purposes with the NI9801 standard.

Surveys

Noise levels surveyed in 2019 were of the same order of magnitude as those in 2017 and 2018 (Yockell, 2020). Noise levels were generally higher than the NI9801 standard. On average, deviations from the daytime standard (55 dBA) were about +5 dBA, and exceedances of +9 dBA were observed above the night-time value limit (50 dBA). There were however no complaints filed by workers in 2019.

Objectives set by Stornoway

Noise levels exceeded Stornoway's night-time objective of 40 dBA and 45 dBA daytime objective including the +5 dBA penalty, and the average deviation recorded from the standard was +8.9 dBA.

This deviation however is of the same order of magnitude as in 2018 (8.5 dBA), 2017 (8.4 dBA) and 2016 (8.5 dBA), indicating that noise levels have remained stable throughout the mine site from year to year.

Surveys at the Plant and the Crusher during Operations

Since 2017, various monitoring has been carried out to determine the origin of noise generated by various mining infrastructure. As in 2017 and 2018, a survey was conducted in 2019 when the mine was in normal operation, as well as when the crusher was not in operation.

The 2019 results indicate that on the one hand the crushing system and mine operations have no significant impact on fluctuating noise levels observed; and on the other hand, that noise levels surveyed during mine operations and when the crusher is shut down are comparable.

2020 Monitoring

Although the 2019 noise monitoring results remain comparable with results from previous years, SWY shall maintain restrictive targets and will continue to monitor back-up alarms and conduct noise surveys during shutdowns with a view to controlling and reducing the propagation of noise emissions throughout the mine site.

Noise surveys will be carried out, taking site-specific weather constraints into consideration, to cover other types of mining operations and gain a better understanding of the impact of each activity.

3.3.2 Vibrations

3.3.2.1 Measuring protocol

Vibration triggered by blasting operations continued to be monitored in 2019. A seismograph coupled with a microphone was used to measure excess air pressure during various blasting operations (Map 3.3). The vibration sensor was installed in compliance with best practices for recording noise from blasting (Yockell, 2020).

To make adjustments to the monitoring of mining operations, P2 located near pit R2 in 2018 was removed in 2019 because the pit was no long in operation. In 2019, the seismograph was placed in two locations, at P1 near pit R65 for blasting operations at that pit, and P2 (Photo 3.13) near the cafeteria (Map 3.3).

Photo 3.13 New site for recording vibrations near the accommodation complex

In late 2018, Stornoway put recording equipment in place at P2 near the accommodation complex.

This procedure represents a significant improvement for monitoring blasting operations because it provides a more accurate representation of vibration levels and air pressure values at a sensitive area, namely the accommodation complex (Yockell, 2020).

3.3.2.2 Authorized limit values

According to Directive 019 on the mining industry, Stornoway is not required to put in place a system for monitoring ground vibration and air pressure associated with blasting activities at the mine. This restriction applies only if impacted (sensitive) areas are not on the operator's property. In this case, the only sensitive point is the workers' camp, which is owned by Stornoway.

The operator however is committed to complying with industry best practices with regard to controlling nuisances associated with blasting-related vibration and air pressure. Based on Directive 019, therefore, the values applicable to the workers' camp are 12.7 mm/s for vibration ground speed, and 128 dBL for the threshold of maximum air pressure.

3.3.2.3 2019 surveys

Pit R65

In 2019, measurements were taken from January 1 to April 4 at P1 and from July 7 to 17 at P2. A total of 23 valid recordings were used to characterize blasting-related vibration and air pressure rates.

Vibration levels measured near the R65 blasting point (P1) were generally lower than 12.7 mm/s, whereas air pressure levels varied from 98 to 146 dBL. Only seven vibration levels and five air pressure values exceeded established limits.

Accommodation Complex

In 2019, two surveys were carried out at P2. No values exceeding limit thresholds in the case of the vibration rate and the air pressure levels were recorded at P2.

The surveys conducted in 2019 at P2 bear out the assumption made in 2017 and validated in 2018 that vibration and air pressure rates are compliant with applicable standards at the mine site, and more specifically the accommodation complex.

3.3.2.4 2020 monitoring

Noise and vibration level monitoring will continue in 2020.

Carte / Map
3.2

stornoway
DIAMOND CORPORATION
PROJET RENARD

SOUND IMPACT STUDY

Localisation the sound assessment point

● Sound assessment point

▨ Residential complex

N

Scale = 1 : 4000

NOTE : This plan has not been prepared by a land surveyor and therefore should not be considered as such.

Préparé par:

Yockell
ASSOCIÉS INC.

Projet : 21511075

February 2020

Carte / Map
3.3

stornoway
DIAMOND CORPORATION
PROJET RENARD

SOUND IMPACT STUDY

Seismograph Location

● Seismograph Location

N

Scale = 1 : 4000

NOTE : This plan has not been prepared by a land surveyor and therefore should not be considered as such.

Prepared by:

Yockell
ASSOCIÉS INC.

Projet : 21511075

February 2020

3.4 Hydrological Regime

Water from Lake Lagopede is used during mining operations to supply the accommodation complex, and services area as well as mining operations with drinking water. Downstream from the drinking water intake, treated mine water is discharged into the north basin of the lake and treated domestic wastewater is released into the south basin.

Monitoring the hydrological regime facilitates the interpretation of environmental monitoring data and differentiates the direct impact of the project from impacts associated with natural weather and hydrological variations in the area.

Finally, hydrological regime data are used to validate water quality predictions in the plume dispersion modelling of mine and domestic effluent in Lake Lagopede, as outlined in the impact assessment (Roche, 2011a). The monitoring has also enhanced our understanding of water flow conditions during winter flow at riffle A-A'.

In 2019, the monitoring of the Lake Lagopede hydrological regime was carried out in three phases, including a winter (low flow) campaign, a spring campaign targeting peak flow in Lake Lagopede, and a summer campaign to survey low water levels during summer low-flow periods (Tetra Tech, 2020a).

3.4.1 Water Levels at Water Level Stations and Estimated Flows

To monitor the hydrological regime of streams and the water levels in nearby lakes, four water level stations were installed to measure levels on an hourly basis at strategic locations in the Lake Lagopede watershed, i.e., the north basin of Lake Lagopede, Lake F3294, Lake F3296 and Lake F3300 (Map 3.4).

These stations, which were installed in 2011, are used to improve the quality and temporal scope of flow data for the main tributaries of Lake Lagopede. The four water level stations are equipped with telemetry instrumentation enabling remote control of the station and the uploading of water level and current speed data.

Although data recorded at these four stations can now be accessed remotely, the stations are all maintained in each of the campaigns carried out by an external consultant (Photo 3.14). They are also visited monthly by SWY's environment technician to check their physical condition.

Photo 3.14 Inspection of water level station on Lake F3300 in spring 2019

3.4.1.1 Water levels

Data collected in 2019 show that recession for lakes F3296 and F33300 began at the start of the spring campaign (May 20 to 27, 2019). This seems to indicate that peak flow in 2019 occurred in about mid May, i.e., during a period that was comparable with the same period in the years from 2011 to 2016.

The spring flood in Lake F3294, the main tributary of Lake Lagopede, was measured on May 21, while the spring flood in Lake Lagopede was measured on May 24 at 2 p.m. The 2019 spring flood is comparable to the 2018 spring flood (June 3), although in 2018 it was a little later compared with the historical data recorded from 2011 to 2016 (mid April to mid May).

The highest peak flows in Lake F3294 (492.05 m) and Lake Lagopede (484.10 m) are similar to historical flow levels (Table 3.8). The water level in the North basin of Lake Lagopede during the 2019 spring flood is slightly lower than in 2018.

The 2019 flood level is among the lowest peak flows recorded since the water level stations were installed in Lake Lagopede. This observation can be correlated with the decline in cumulative precipitation (774 mm) and in total snow accumulation (66 cm) in 2019 (for more information refer to section 3.1).

Table 3.8 Water levels during spring flood in lakes Lagopede and F3294 since 2011

Year	Maximum Recorded Water Level (m)	
	Lake Lagopede	Lake F3294
2011	484.24	492.09
2012	484.08	492.16
2013	484.24	492.14
2014	484.44	492.26
2015	483.83	491.93
2016	484.06	491.91
2017	484.20	492.11
2018	484.35	492.34
2019	484.10	492.05

3.4.1.2 Discharge rating curves

Water levels recorded at the four water level stations are linked to flow measurements taken in the hydrological monitoring campaigns to establish a discharge curve along with estimated flowrate for each water level. Water flow time series for each station are shown in Figure 3.6.

In 2019, the discharge curves were updated with data from 2010 to 2019, particularly data collected during the 2019 spring flood (Photo 3.15).

Photo 3.15 Evaluation of water flow at F3294 station – spring sampling campaign (May 22, 2019)

The data collected in spring 2019 were used to measure peak flows at station F3294 and the Lake Lagopede station (riffles A-A' and C-C') and high-water levels for stations F3296 and F3300 (Tetra Tech, 2020a).

This new data for the three stations installed on the main tributaries of Lake Lagopede (lakes F3294, F3296 and F3300) helped improve the upper (flood) parts of the discharge curves by reducing the uncertainty level associated with converting water level series into flow data.

The discharge curves for the three stations now include more than 20 points each and the Lake Lagopede station has about 15 points. This more extensive range of flows linked to water levels has enhance our understanding of the hydrology of Lake Lagopede.

3.4.1.3 Lake F3298's hydraulic renewal time

In the first phase of monitoring in 2016, only one flow value was calculated for the outflow of Lake F3298 in October 2016. The water level and flow measurements were the lowest recorded since the spring flood in 2016. The flow value is not therefore representative of average annual flow conditions in the Lake F3298 outflow. The hydraulic renewal time for Lake F3298 could not be determined so as to compare it with estimated renewal time under natural conditions, i.e., before the surface area of its small drainage basin was reduced as part of the development of the mine (Norda Stelo, 2017a).

A study was therefore launched in spring 2019 to investigate the water renewal time for Lake F3298. Water level measurements taken at the water level station (HOBO probe) installed in Lake F3298 in October 2016 were used to calculate water flows at the outlet under different hydrological conditions (Map 3.4). This study will continue in 2020.

The probe installed in Lake F3298 will be raised in spring 2020 as soon as the lake is free of ice so as to collect water level and current speed data recorded in 2019 and 2020.

A discharge rating curve can be calculated using these data, and hence an estimate determined of the hydraulic renewal time for Lake F3298. These calculations will be more representative of existing environmental conditions than calculations to date. Water levels and flows could also be compared with 2012 modelling values (Golder, 2012).

2.1.1.1 Status of hydrological regime in 2019

Comparing recent water level and flow data (from 2015) from the start of mining operations with data from the reference period (2010-2014) revealed no clear upward or downward trend at the Lake Lagopede station. To date therefore there has been no measurable impact of mining activities on the hydrological regime of Lake Lagopede.

Chemin: \\golder.gds\gal\Montreal\SIG\CAD\PROJETS\STORNOWAY\PRODUCTION\1896274\2000\ | Nom du fichier: 1896274-2000-05.dwg | Dernière édition par: iarroub Date: 2019-03-06 Heure:9:06:43 | Imprimé par: IArroub Date: 2019-03-06 Heure:9:21:48

LÉGENDE

- STATION LIMNIMÉTRIQUE
- PROFILS TEMPÉRATURE, CONDUCTIVITÉ, VITESSE ET DIRECTION DU COURANT
- PROFILS TEMPÉRATURE, CONDUCTIVITÉ, pH, OXYGÈNE DISSOUS ET VITESSE ET DIRECTION DU COURANT
- MESURES DE DÉBIT
- ÉMISSAIRE PERFORÉ (EFFLUENT DE L'USINE DE TRAITEMENT DES EAUX USÉES MINIÈRES
- CONDUITE DE L'EFFLUENT DE L'USINE DE TRAITEMENT DES EAUX DU CAMP

NOTE(S)

- SYSTÈME DE COORDONNÉES : UTM NAD83, ZONE 18
- IMAGE AÉRIENNE (GOOGLE EARTH, 2017)

0 250 500

1:10 000 MÈTRES

Carte / Map 3.4

CLIENT
LES DIAMANTS STORNOWAY (CANADA) INC.

PROJET
MINE RENARD - RELEVÉS HYDROLOGIQUES 2018

CONSULTANT
GOLDER

AAAA-MM-JJ	2019-03-06
DESSINÉ	ED
PROJETÉ	AT
RÉVISÉ	AG
APPROUVÉ	YB

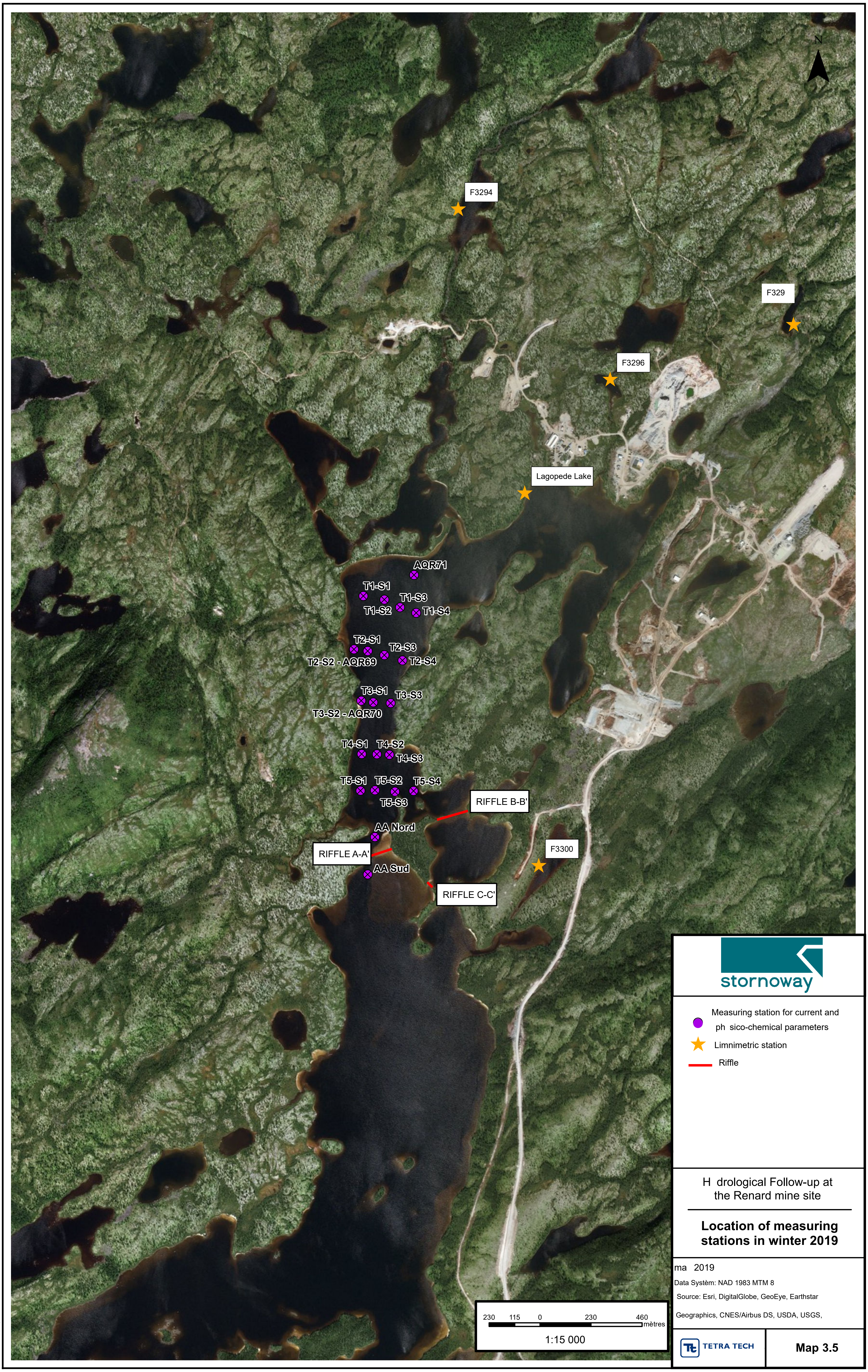
TITRE **LOCALISATION DES STATIONS LIMNIMÉTRIQUES, DES SEUILS A-A' ET B-B' ET DES POINTS DE MESURE - CAMPAGNE ÉTÉ 2018**

N° PROJET	PHASE	RÉV.	FIGURE
1896274	2000	0	5

SI LA MESURE NE CORRESPOND PAS À L'ÉCHELLE, LA TAILLE DE LA FEUILLE A ÉTÉ MODIFIÉ. ANSI B

25 mm

0



N
F3294
F329
F3296
Lagopede Lake
AQR71
T1-S1
T1-S2
T1-S3
T1-S4
T2-S1
T2-S2 - AQR69
T2-S3
T2-S4
T3-S1
T3-S2 - AQR70
T3-S3
T4-S1
T4-S2
T4-S3
T5-S1
T5-S2
T5-S3
T5-S4
RIFFLE B-B'
AA Nord
RIFFLE A-A'
AA Sud
RIFFLE C-C'
F3300
stornoway
Measuring station for current and ph sico-chemical parameters
Limnimetric station
Riffle
H drological Follow-up at the Renard mine site
Location of measuring stations in winter 2019
ma 2019
Data Systèm: NAD 1983 MTM 8
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS,
230 115 0 230 460
mètres
1:15 000
TETRA TECH
Map 3.5

3.4.2 Winter Flow Monitoring at A-A' and B-B' Riffles

The various mine effluent dispersion modelling studies revealed a seasonal restriction to flow at A-A' riffle, a shoal between the north and south basins in Lake Lagopede, especially during the winter low-flow period (Map 3.5). This is caused by the shallow water in this part of the lake along with the thick ice cover observed in the area.

To confirm the actual existence of this vertical restriction in the field, ice thickness, water depth and water flow measurements have been recorded during the winter low-flow period at riffles A-A' and B-B' since 2013 (Photo 3.16) (Roche, 2013b).

3.4.2.1 Riffle A-A'

Ice Thickness

Ice thickness at riffle A-A' was measured on April 7, 2019, and it was 0.2 m on average, with a maximum thickness of 0.46 m (Figure 3.6).

Flow cross-section

In winter 2019, the flow cross-section at A-A' was about 16 m wide and the depth at the deepest part of the cross-section was 0.94 m (Photo 3.16), which is similar to what was surveyed in 2018 (17 m wide and 1 m deep).

Photo 3.16 Survey at riffle A-A' (winter 2019)

The ice cover did not obstruct the entire flow cross-section, which represented 29% of the total flow cross-section at riffle A-A' when the measurements were taken (Figure 3.7). Since a section with water flow was observed at riffle A-A' in all the winter monitoring campaigns and no increase in water level was observed during the winter months, it can be confirmed that there is permanent water flow at riffle A-A'.

Flow rate

Sixteen water flow measurements were taken at riffle A-A' on April 8, 2019. As observed in previous winter campaigns, however, the low lake turbidity and current velocities recorded at riffle A-A' during the winter low-flow period (the most severe low-flow period in the year) reduce the accuracy and reliability of measurements taken at this location (Tetra Tech, 2020a).

Average flow at A-A' was estimated using water levels and the discharge rating curve for the Lake Lagopede water level station (Figure 3.8). The estimated flow was therefore 0.325 m^3/s, which is of the same order of magnitude as flow rates measured in 2015 (0.573 m^3/s), 2016 and 2017 (0.50 m^3/s) and in 2018 (0.270 m^3/s).

The flow rates measured at riffle A-A' since 2013 are provided in Table 3.9. The estimated flow rate in 2019 is similar to the 2013 flow rate, before mining operations were launched. Table 3.9 includes for comparative purposes a characterization of riffle A-A' in summer or the open-water period in 2015.

Table 3.9 Characterization of riffle A-A'

Date	Time (HNE)	Flow Measurement (m^3/s)
2013-03-26	13:10:00	0.35
2015-08-07	16:18:00	2.375
2016-02-23	15:30:00	0.50
2016-10-06	n/a	1.248
Roche – water balance Qmin10years	n/a	0.33
2016-10-06	13:00:00	1.172
2017-03-30	10:31:44	0.50
2017-09-12	15:11:00	0.63
2018-03-30	13:30:00	0.27
2018-09-16	10:35:00	1.248
2019-04-08	n/a	*0.325

* Estimated using water level and discharge rating curve data from the Lake Lagopede water level station (Tetra Tech, 2019)

Conclusion

In summary, ice thickness measurements, estimated flows (estimated flow rate of 0.325 m3/s) for the winter low-flow period (observable flow) and bathymetric readings at riffle A-A' in 2019 indicate that riffle A-A' poses no vertical restriction to water flow in the winter low-flow period.

These data are consistent with data from previous years (2016-2017) recorded respectively by Englobe (2016) and SNC Lavalin (2017), as well as with findings from 2018 monitoring. Neither does this riffle create a barrier to flow in the summer low-flow period, since a 100-m wide flow cross-section was observed along with a depth of 1.1 m and a flow rate of 1.2 m3/s in the summer campaign in August 2019.

The conclusions drawn from these observations are considered to be applicable to low-flow periods in Lake Lagopede in general, not just in 2019. The measurements were in fact taken when water levels in Lake Lagopede were the lowest in 2019, but also the lowest levels recorded in winter low-flow periods since 2010 at the Lake Lagopede station (Tetra Tech, 2020a).

3.4.2.2 Riffle B-B'

Ice Thickness

In winter 2019, ice thickness at B-B' riffle varied between 0.21 and 0.5 m, which is comparable to A-A' riffle. The ice reached the bottom, which meant that no seepage was observed in any of the 130-m surveys (Figure 3.9).

Flow

At riffle B-B', no flow cross-sections were detected, since the riffle was frozen its entire depth and width at all the survey points. Since no section with water flow was observed at B-B' riffle during the winter monitoring campaigns, it can be confirmed that there is no water flow at riffle B-B' in the winter low-flow period. Other observations in 2019 confirmed that water flow by way of the B-B' riffle is very limited in fact almost nonexistent during certain periods of the year as in the summer low-flow period.

3.4.2.3 Riffle C-C'

After analyses and discussions with the consultant, it was decided to measure flow in 2019 at the C-C' riffle rather than B-B' riffle (Tetra Tech, 2020a). Since all the water that flows across B-B' riffle also flows across C-C' riffle, and the latter is not as wide (± 30 m) as B-B' (± 140 m), the flow area is smaller. At the C-C' riffle the depths of the water column are greater, which means more measurements and more accurate measurements can be obtained. As anticipated, in spring and summer 2019, the flow cross-section at C-C' riffle was about 30-m wide and had an average depth between 1.35 m in spring and 0.3 m in summer (Tetra Tech, 2020a). Flow velocities varied between 2.03 m³/s in spring and an average flow that was almost nil in summer (Tetra Tech, 2020a).

3.4.3 Monitoring Flow in Lake Lagopede

Mine effluent dispersion modelling in 2011 (Environnement Illimité, 2011) and an update to the modelling in 2017 (Englobe, 2017) revealed the presence of two restrictions to mixing and water flow in Lake Lagopede:

- a seasonal horizontal barrier formed by natural thermal stratifications called winter and summer *thermoclines* which prevent the uniform mixing of effluent in the water column; and
- a vertical barrier at A-A' riffle, which would prevent mine effluent from flowing southward in Lake Lagopede under certain conditions.

Seasonal mixing alternates and enables effluent to mix throughout the entire water column, thereby ensuring effluent flow beyond A-A' riffle (Englobe, 2017).

The objectives of this monitoring are to confirm our understanding of the hydrological regime in the north and south basins of Lake Lagopede, along with modelling assumptions for mine effluent dispersion. Since 2015 a number of surveys (current velocity and direction, temperature and conductivity) have therefore been conducted as part of hydrological monitoring campaigns on the water column of Lake Lagopede's north basin. These surveys continued in 2019. The location of the 2019 monitoring stations is illustrated on Map 3.5.

3.4.3.1 Current velocity and direction

As observed in the 2015 to 2018 campaigns (Englobe, 2015 and 2016; SNC, 2017b; SWY, 2018a and 2019), flow velocities recorded in 2019 in Lake Lagopede's north basin are very low, varying between 0 and 0.1 m/s. Current velocities recorded since 2015 are comparable to those recorded in September 2011, which varied between 0.01 and 0.05 m/s (Englobe, 2015).

The current generally flows in a southerly direction in the north basin of the lake, and southwest immediately upstream and downstream of A-A' riffle (Tetra Tech, 2020a), a shoal that separates the north and south basins of Lake Lagopede. In response to the 2019 surveys, it was decided that current velocity measurements, even continuous measurements, were limited overall in enhancing our understanding of the behaviour of effluent in the receiving environment (Tetra Tech, 2020a).

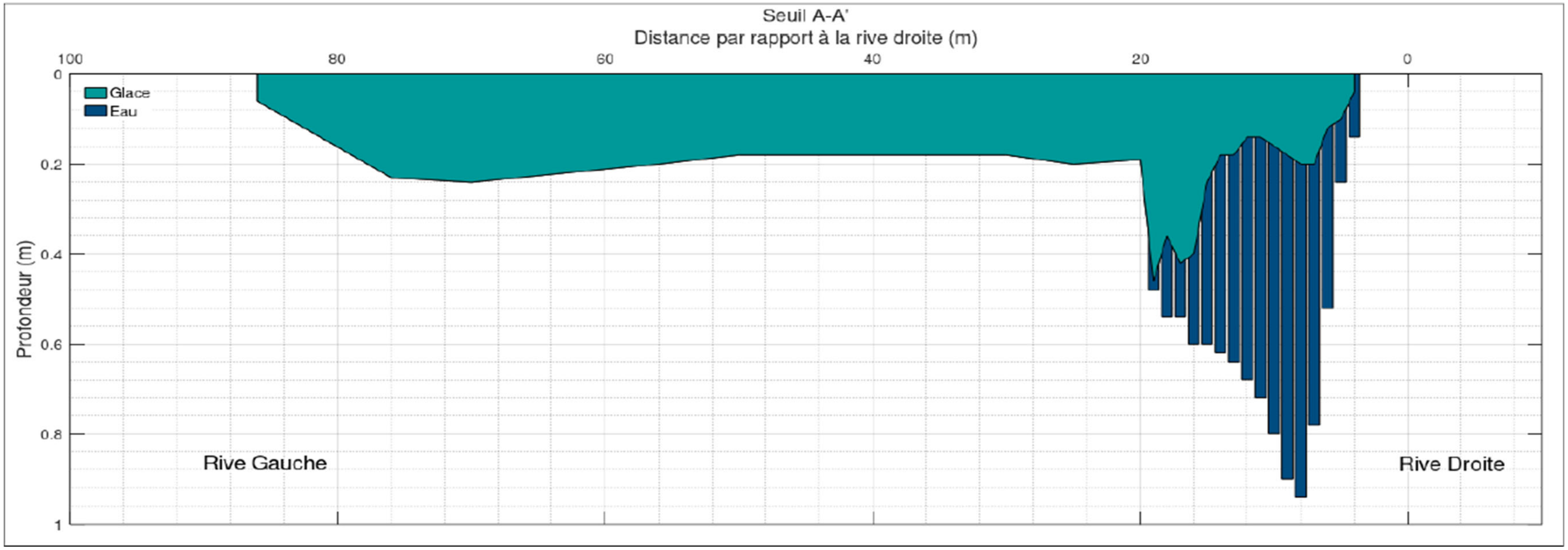


Figure 3.6 Bathymetry and ice thickness at A-A' riffle

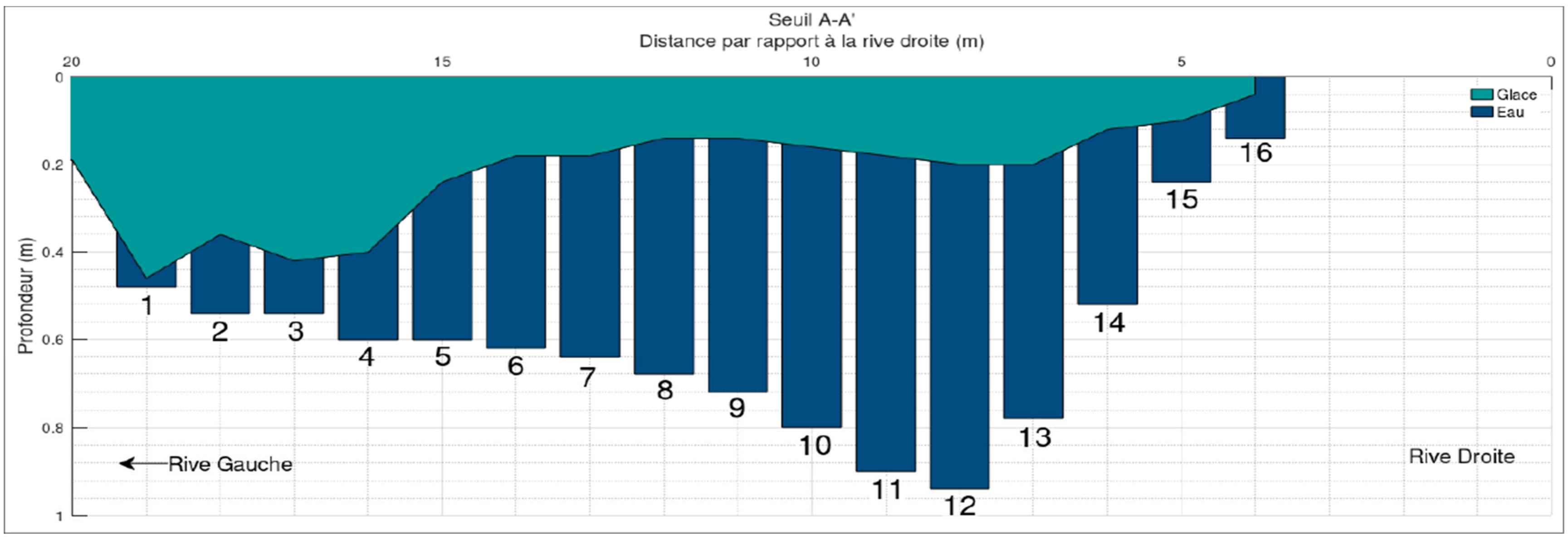


Figure 3.7 Ice strategraphy and bathymetry – focussing on the section with water flow at A-A' riffle

3.4.3.2 Temperature and conductivity in the north basin of Lake Lagopede

Temperature and conductivity are considered to be good indicators of the presence and mixing of mine effluent in the waters of Lake Lagopede. In the spring and fall, temperature changes in the water column could be an indicator of seasonal mixing or stratification (thermoclines) of the water layers. The conductivity of mine effluent measured at the mine wastewater treatment plant (MWWTP) is greater than conductivity in Lake Lagopede. It can therefore be indicative of effluent behaviour in seasonal mixing and thermoclines in Lake Lagopede.

Monthly Vertical Profiles

According to the mine effluent plume dispersion modelling (Englobe, 2017), seasonal thermoclines and high conductivity under these thermoclines are observed alternating with seasonal mixing at three specific stations in Lake Lagopede:

- AQR69 located at the deepest point in the north basin of Lake Lagopede, i.e., just over 20 m deep;
- AQR70 downstream of the effluent diffuser; and
- AQR71 just upstream of the effluent diffuser.

Since September 2015, SWY has conducted vertical temperature and conductivity profiles monthly at these three stations located in the mine effluent dispersion plume. These monthly vertical profiles continued in 2019 at these three stations.

With regards to conductivity, field efforts were deployed in the summer campaign to measure conductivity directly at specified locations and variable depths in Lake Lagopede so as to map out the mine effluent dispersion plume directly in Lake Lagopede (Tetra Tech, 2020a).

Continuous Temperature Profiles

In 2016, in addition to the monthly temperature profiles, which provide a physical-chemical portrait of the water at a given time, SWY decided to install a line of thermographs (at one-metre intervals) in the deepest area of the conductivity north basin (AQR69) of Lake Lagopede. These thermographs record water temperature on a daily basis, thereby making it feasible to detect weekly variations in temperature throughout the water column, specifically during seasonal mixing.

2019 Data

With regard to the 2019 monitoring, only monthly vertical temperature and conductivity profiles at AQR69 station are shown (figures 3.10 and 3.11). Being the deepest station, AQR69 provides a better picture of the extent of the winter and summer thermoclines as well as the effects of seasonal mixing on the dispersion of effluent 20 m deep in the north basin of the lake.

Continuous temperature profiles for station AQR69 are shown in Figure 3.12. In spring 2019, it should be noted that the continuous temperature profiles were interrupted owing to a data loss, and some thermographs were replaced in mid-June 2019 (vertical blue line).

Fall 2019 data were retrieved only in the spring 2020 and will be presented with the 2020 hydrological monitoring.

2.1.1.1 Effluent dispersion in the north basin

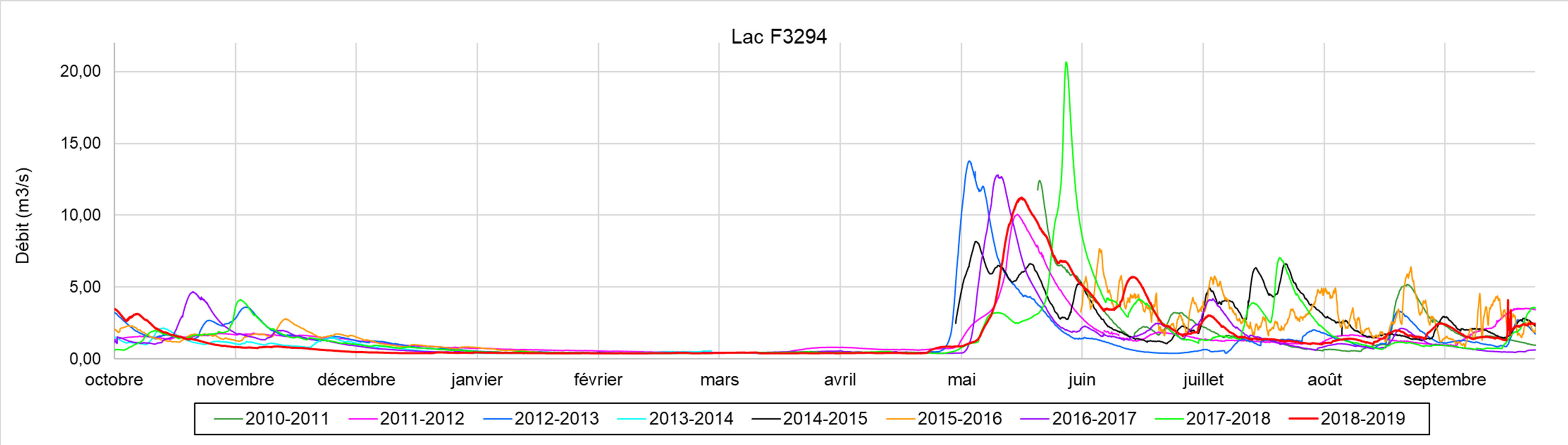
In 2019, seasonal mixing and thermoclines alternated (Figure 3.10) while a marked increase in conductivity was observed in both winter and summer under each seasonal thermocline (Figure 3.11) in the deepest area of Lake Lagopede. Map 3.6 shows variations in conductivity recorded throughout Lake Lagopede in 2019.

In winter, a thermal inversion gradually occurred between the surface (cold water at 0°C) and the bottom (warm water at 3.5°C) of the water column, whereas a poorly defined winter thermocline formed from December to May, 2 to 4 m deep.

Conductivity remained low from the surface down to 5 m under the ice cover and increased considerably under the winter thermocline (from 6 to 15 m deep). This seems to suggest that the thermocline acts as a horizontal barrier, preventing the dispersion of effluent in the water column, as predicted in the 2017 modelling.

In spring, December's thermal inversion disappeared between May and June 2019 and was replaced with a new thermal stratification: water warmed up on the surface and cooled down near the bottom. This thermal reversal is also visible on the continuous temperature profiles (Figure 3.12) and occurs in conjunction with a marked increase in conductivity in June as of 7 m deep.

Although spring temperatures and conductivity are never uniform, compared with what has been observed since spring 2016, the thermal reversal triggered a very brief mixing of the waters in spring 2019.



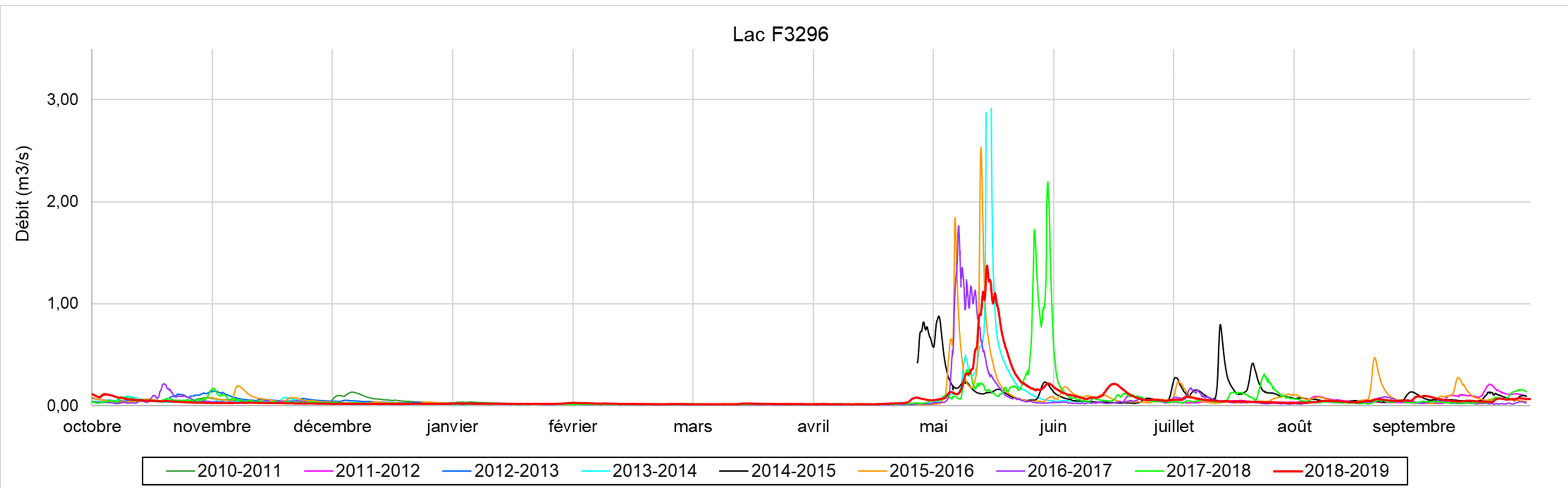
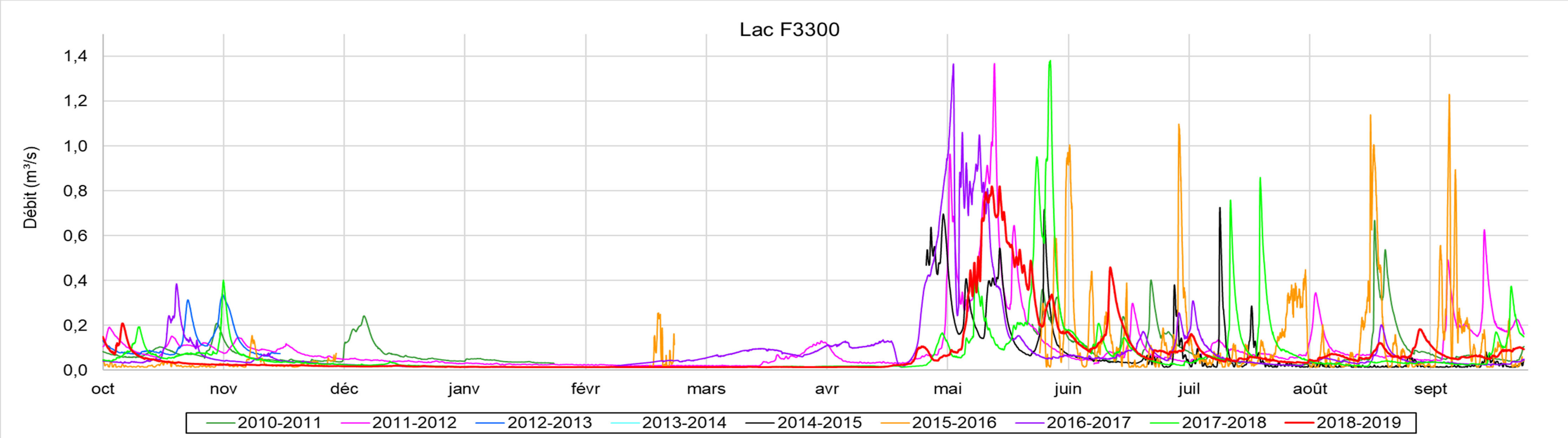


Figure 3.8 Time series of water discharges based on water level readings at F3294, F3296, F3300 and Lagopede stations



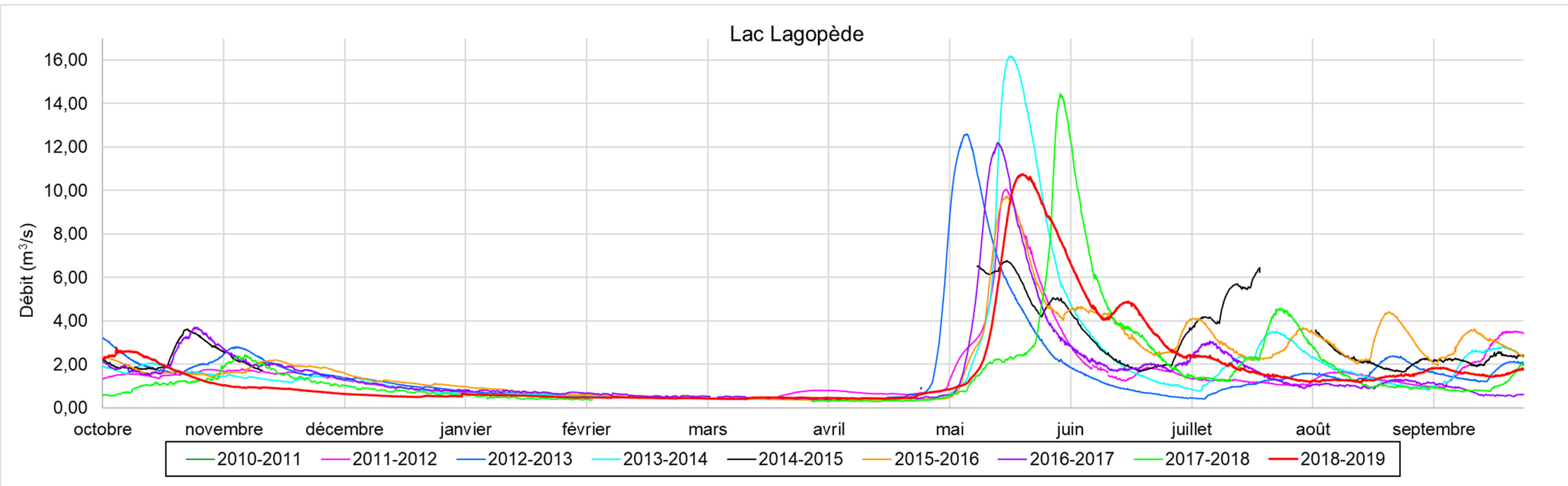


Figure 3.8 (*cont'd*) **Time series for water discharges based on water level readings at F3294, F3296, F3300 and Lagopede stations**

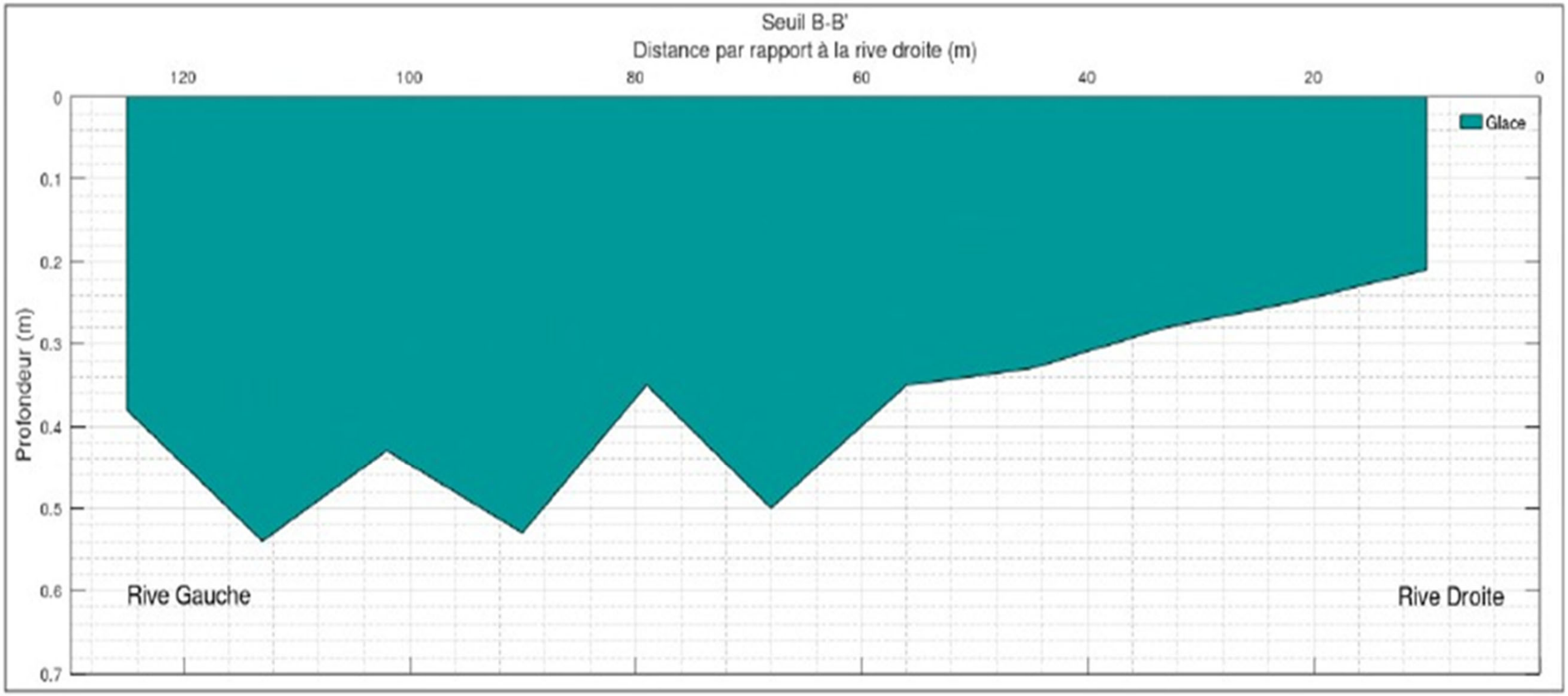


Figure 3.9 Bathymetry and ice thickness at B-B' riffle

In summer, the thermal inversion disappears without any apparent thermal stratification. In July and August, a clearly defined double thermocline forms at 6 m and 15 m deep, and conductivity rises suddenly at these same depths, from the two thermoclines.

In September, a new temperature gradient is settling, although not uniformly throughout the entire water column, especially below 14 m deep. The bottom summer thermocline is maintained at 15 m, which results in a marked increase in conductivity between 15 and 16 m deep (red dotted line). These variations point to an accumulation of effluent in the water layers.

In October, the deep summer thermocline (15 m) disappears in the water column, and conductivity falls suddenly. These variations in temperature and conductivity mark the start of fall mixing in the deepest part of the lake, mainly between 0 and 16 m deep. Temperature and conductivity become completely uniform throughout the water column in November (figures 3.10 and 3.11). This phenomenon points to the dispersion of mine effluent throughout the water column in the fall, as predicted in the 2017 modelling.

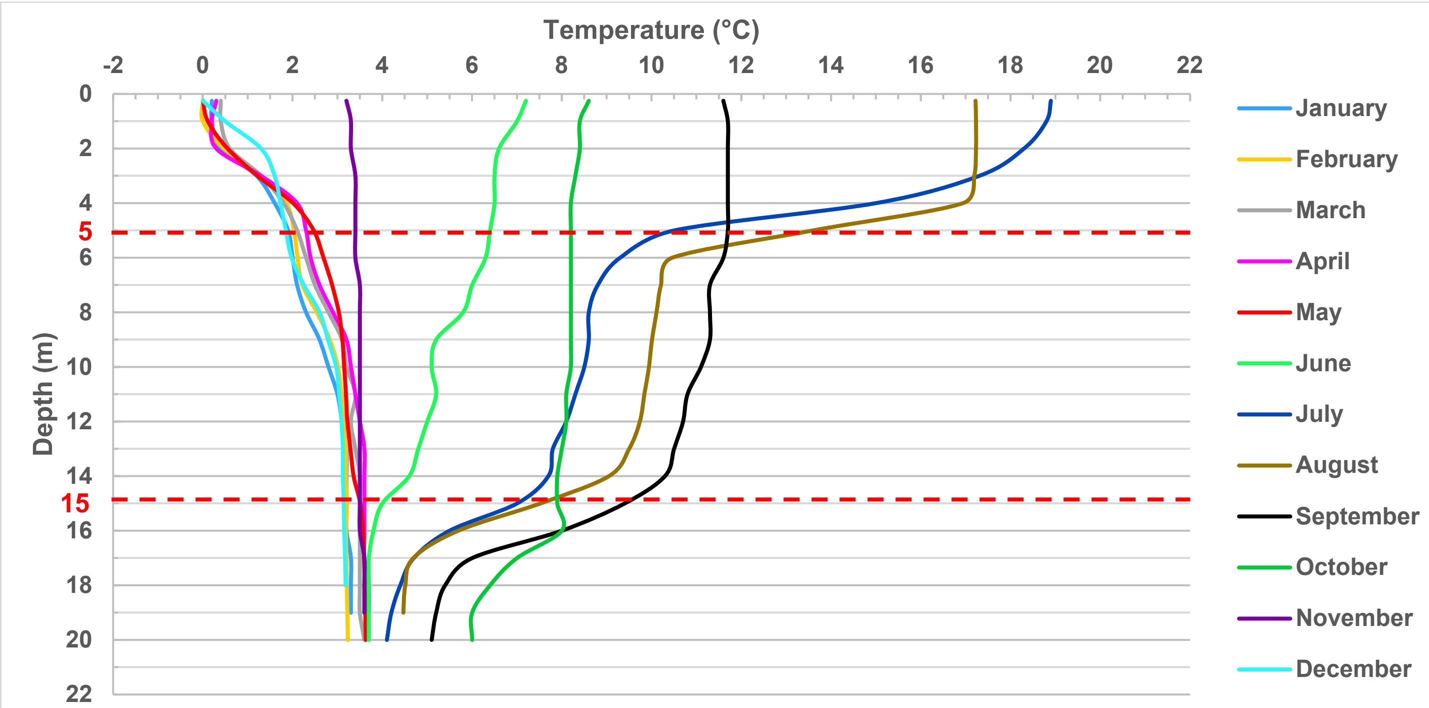


Figure 3.10 Vertical monthly temperature profile at station AQR69 in 2019

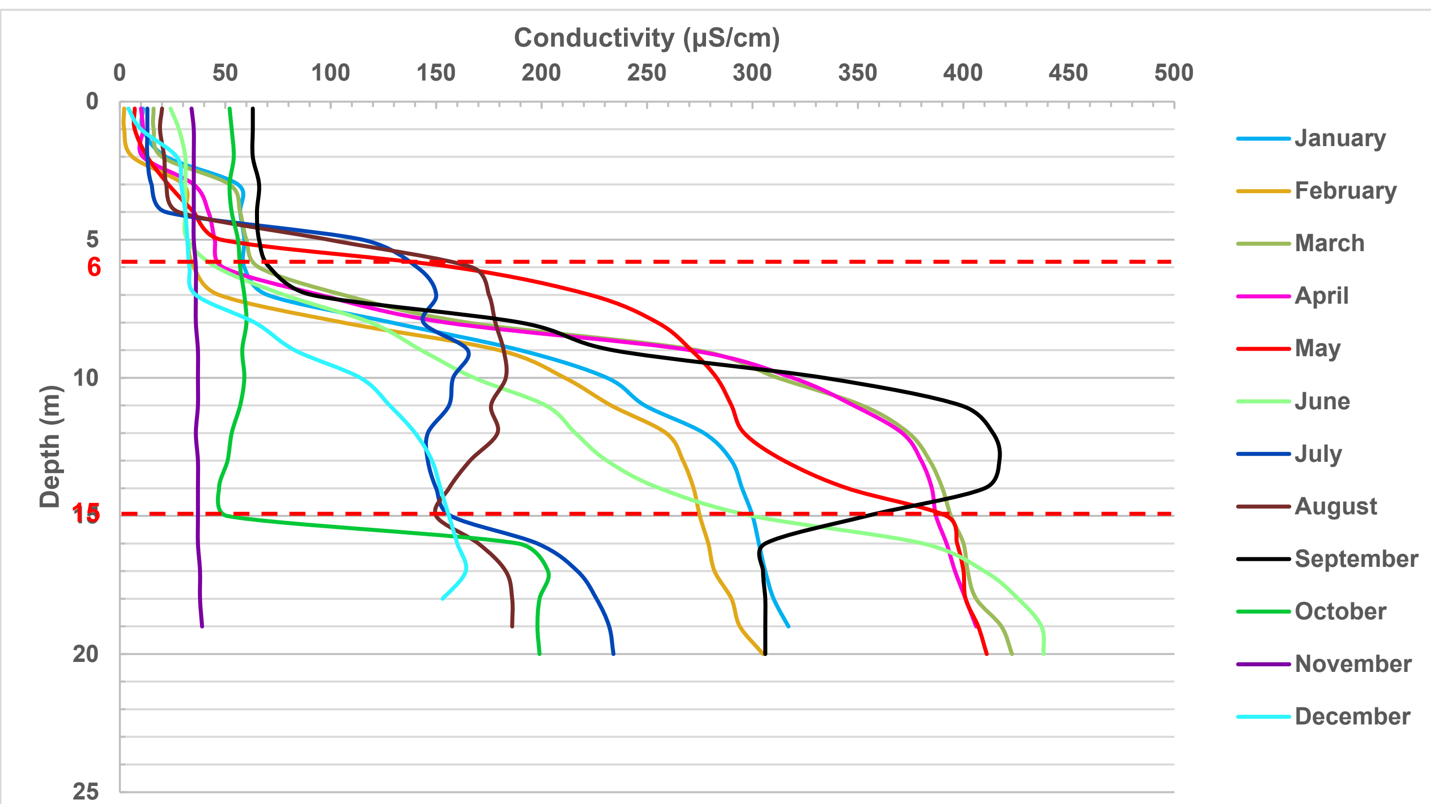


Figure 3.11 Vertical monthly conductivity profile at station AQR69 in 2019
(Horizontal lines represent the double thermocline observed in July and August 2019.)

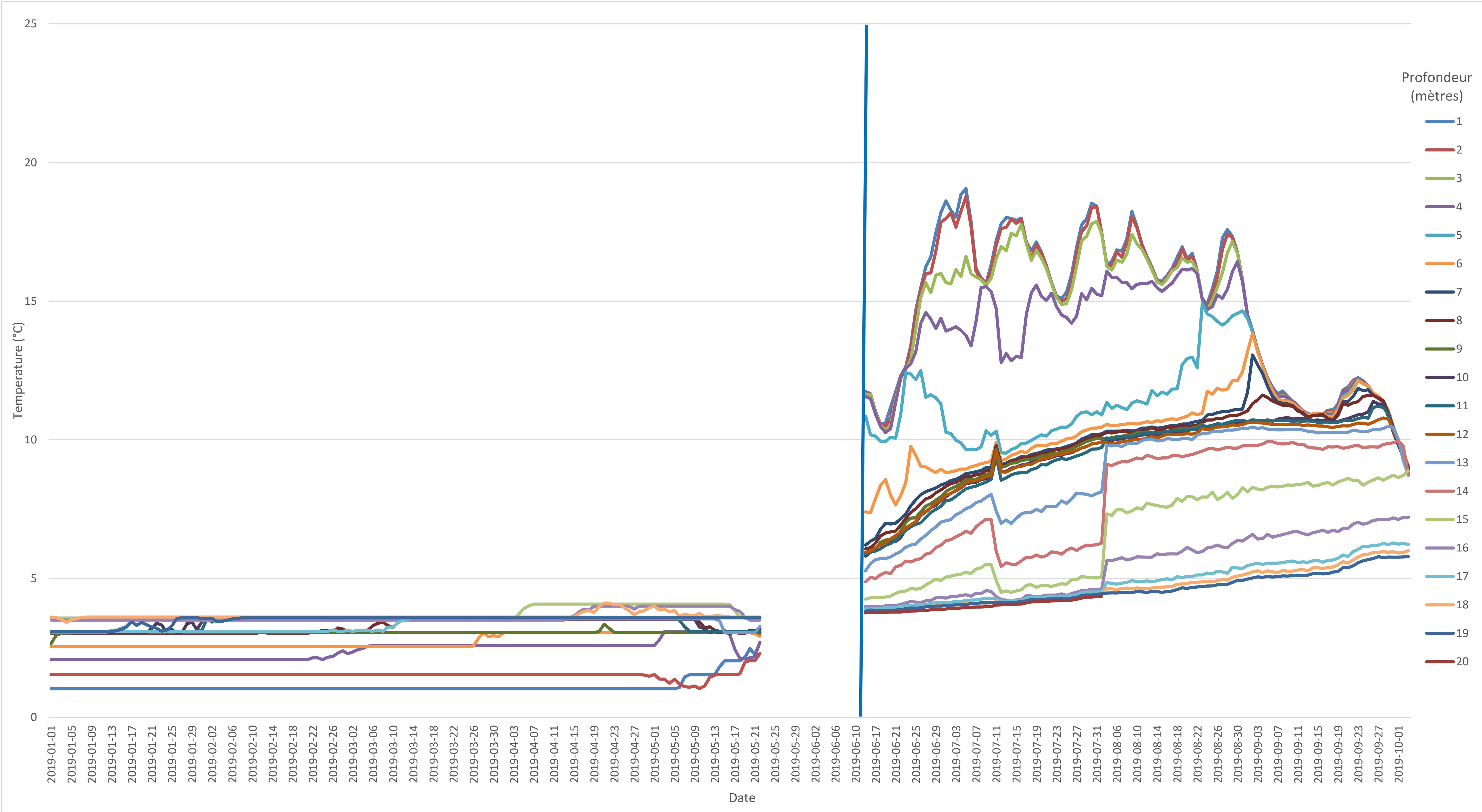


Figure 3.12 Variation in temperatures measured continuously based on depth (from 1 to 20 m) at station AQR69 in 2019

(The blue vertical line represents the time the thermographs were replaced.)

stornoway

Limnimetric station

Conductiv measure

Riffle

Conductivit one greater than 1 S
cm depth m

Hydrological Follow-up at the Renard Mine Site - Winter 2019

Conductivity map of Lagopede Lake

Feb.

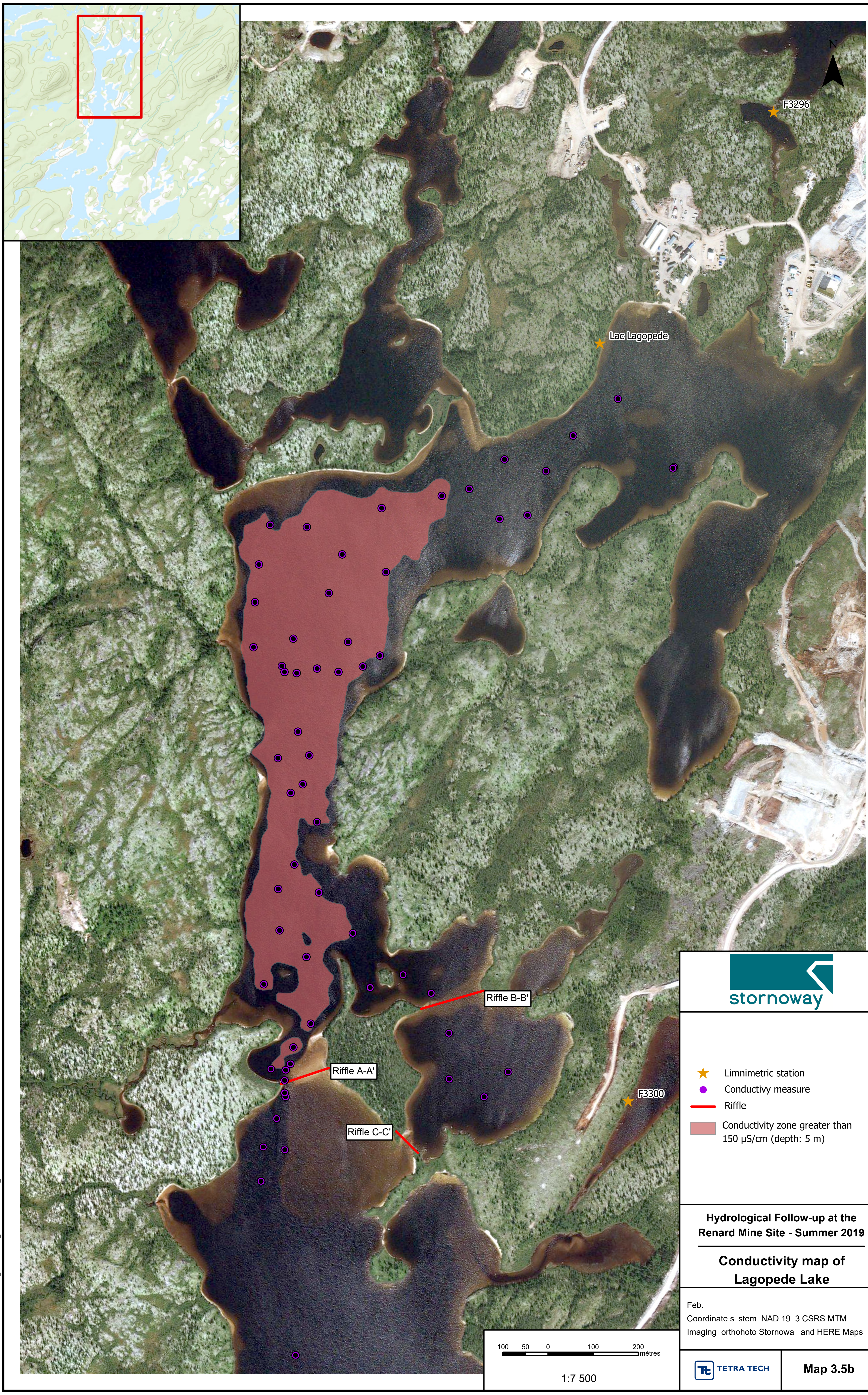
Coordinate s stem NAD 19 3 CSRS MTM

Imaging orthohoto Stornowa and HERE Maps

TETRA TECH

Map 3.5a

P:\39791TT\DOC-PROJ\60\60CRO\ArcGIS_Pro\39791TT_20190822\39791TT_20200129.aprx



stornoway

Limnimetric station

Conductivy measure

Riffle

Conductivity zone greater than 150 µS/cm (depth: 5 m)

Hydrological Follow-up at the Renard Mine Site - Summer 2019

Conductivity map of Lagopede Lake

Feb.

Coordinate s stem NAD 19 3 CSRS MTM

Imaging orthohoto Stornowa and HERE Maps

TETRA TECH

Map 3.5b

P:\39791TT\DOC-PROJ\60\60\60CRO\ArcGIS_Pro\39791TT_20190822\39791TT_20200129.aprx

stornoway

Limnimetric station
Conductivy measure
Riffle
Conductivity zone greater than 150µS/cm (depth: 5m)

Hydrological Follow-up at the Renard Mine Site - Summer 2019

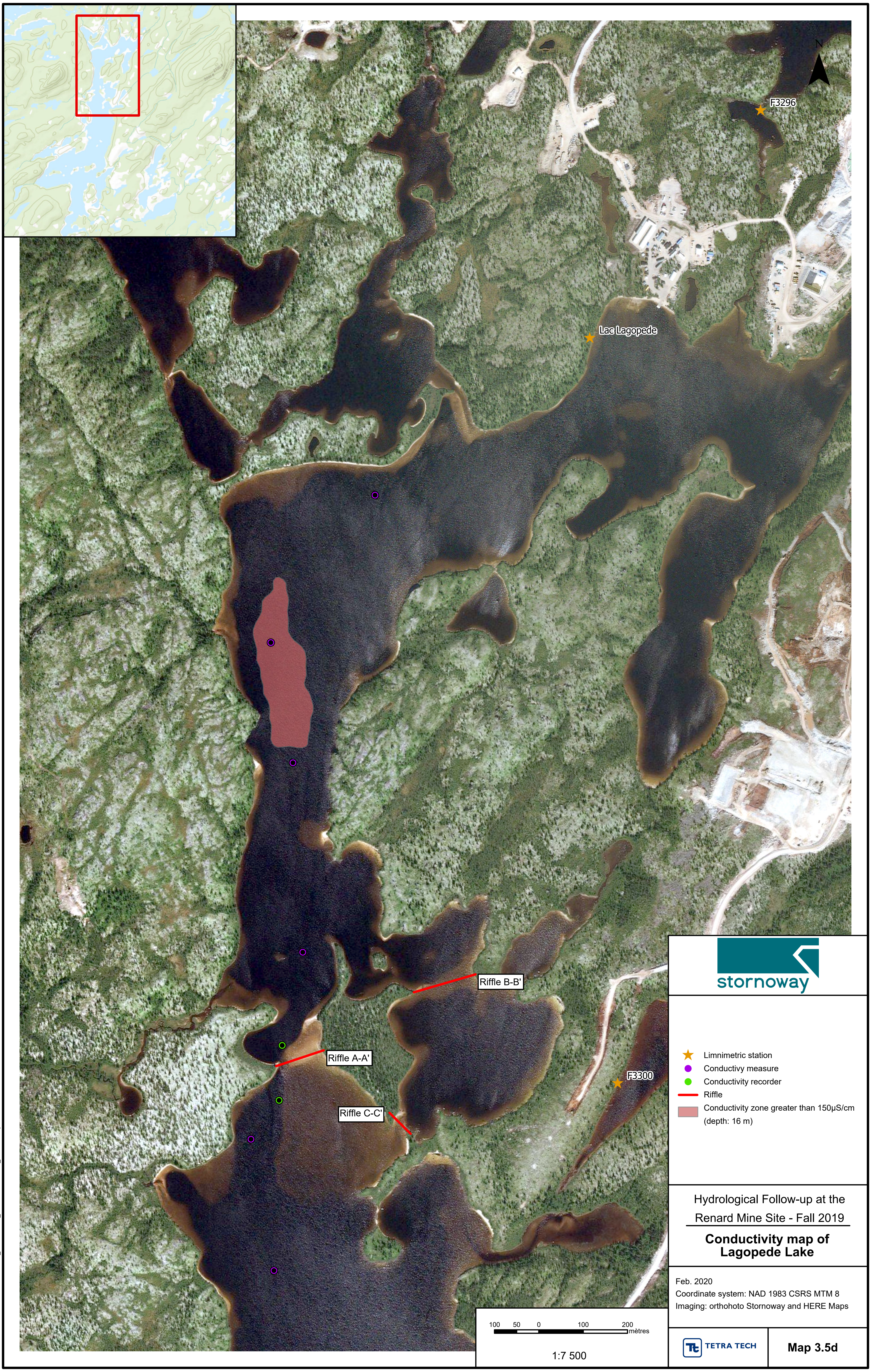
Conductivity map of Lagopede Lake

Feb. 2020
Coordinate system: NAD 1983 CSRS MTM 8
Imaging: orthohoto Stornoway and HERE Maps

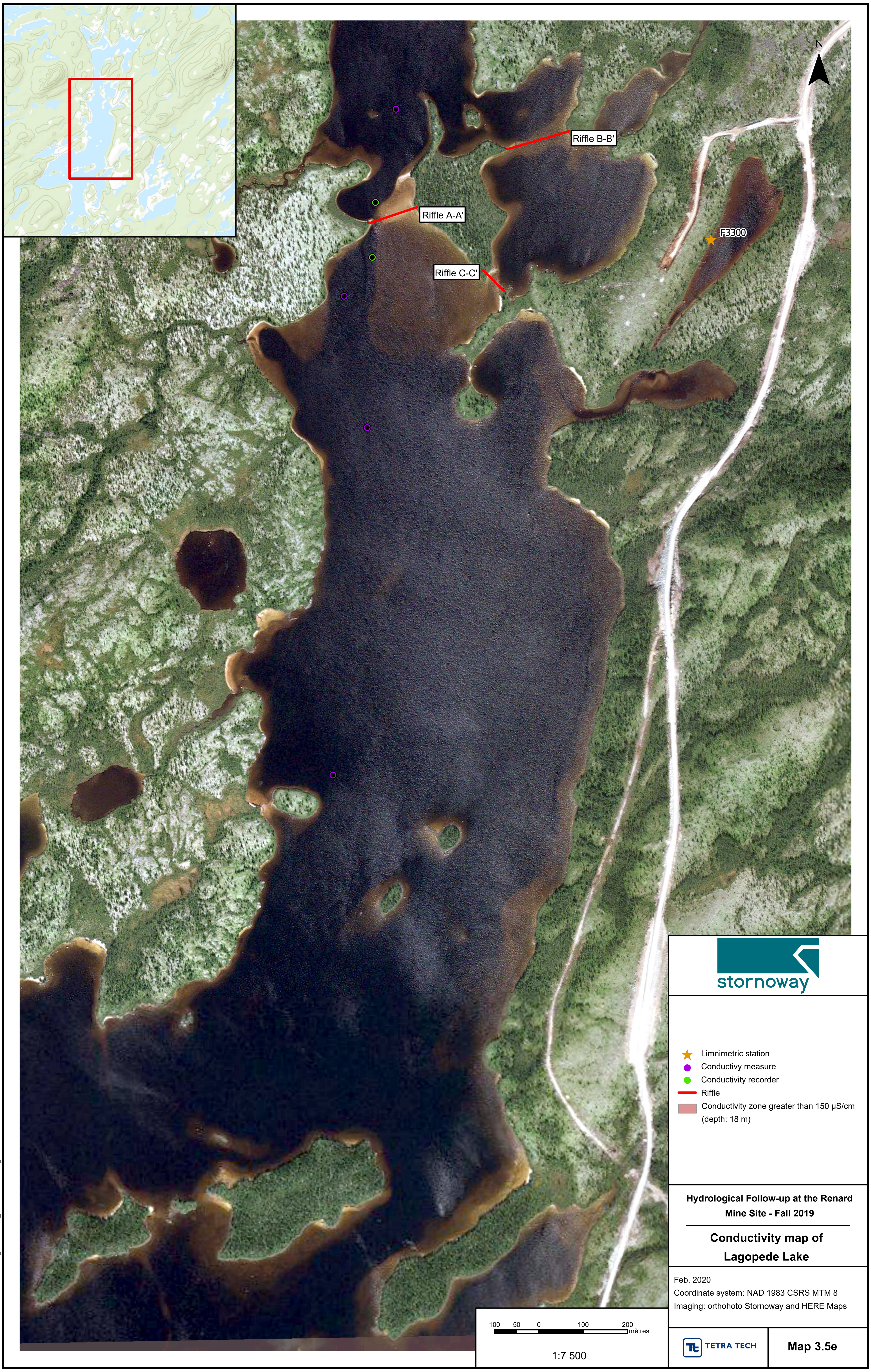
TETRA TECH

Map 3.5c

P:\39791TT\DOC-PROJ\60\60CRO\ArcGIS_Pro\39791TT_20190822\39791TT_20200129.aprx



P:\39791TT\DOC-PROJ\60\60CRO\ArcGIS_Pro\39791TT_20190822\39791TT_20200129.aprx



Hydrological Follow-up at the Renard Mine Site - Fall 2019

Conductivity map of Lagopede Lake

Feb. 2020
Coordinate system: NAD 1983 CSRS MTM 8
Imaging: orthohoto Stornoway and HERE Maps

TETRA TECH

Map 3.5e

P:\39791TT\DOC-PROJ\60\60CRO\ArcGIS_Pro\39791TT_20190822\39791TT_20200129.aprx

3.4.3.3 Effluent dispersion in the south basin (A-A' riffle)

The effluent dispersion modelling in 2017 (Englobe, 2017) assumed that a vertical barrier to mine effluent dispersion was created by A-A' riffle, and that this shoal separating the two main basins (north and south) in Lake Lagopede would prevent mine effluent from flowing from the north basin to the south basin.

To confirm the actual existence of this vertical restriction in the field, vertical conductivity profiles were carried out in 2019 at and south of A-A' riffle to verify whether effluent flowed south from A-A' riffle according to the season (Map 3.7).

Two conductivity recorders were installed on either side of the riffle in summer and fall 2019. They were placed 2 m under the surface, i.e., below the summer thermocline, to ensure that readings were taken in the water layer that flows at A-A' riffle.

Conductivity values upstream and downstream from the riffle generally followed the same variations (Figure 3.13).

The general trend was a gradual increase in conductivity, specifically in late spring, and early fall, just after the winter and summer thermoclines disappeared.

These observations seem to support the assumption regarding spring and fall mixing dynamics following the disappearance of the thermoclines. In the presence of the thermocline, mine effluent accumulates below the thermocline and does not seem to flow at A-A' riffle owing to this thermal stratification. Water that flows downstream at A-A' riffle is from the surface water layer alone above the thermocline.

During mixing, water that flows downstream from A-A' riffle has conductivity values similar to those in the north basin of Lake Lagopede, an indication that water masses are starting to mix and mine effluent, which is uniformly diluted in the water column, flows without any horizontal or vertical barrier to the south basin of Lake Lagopede.

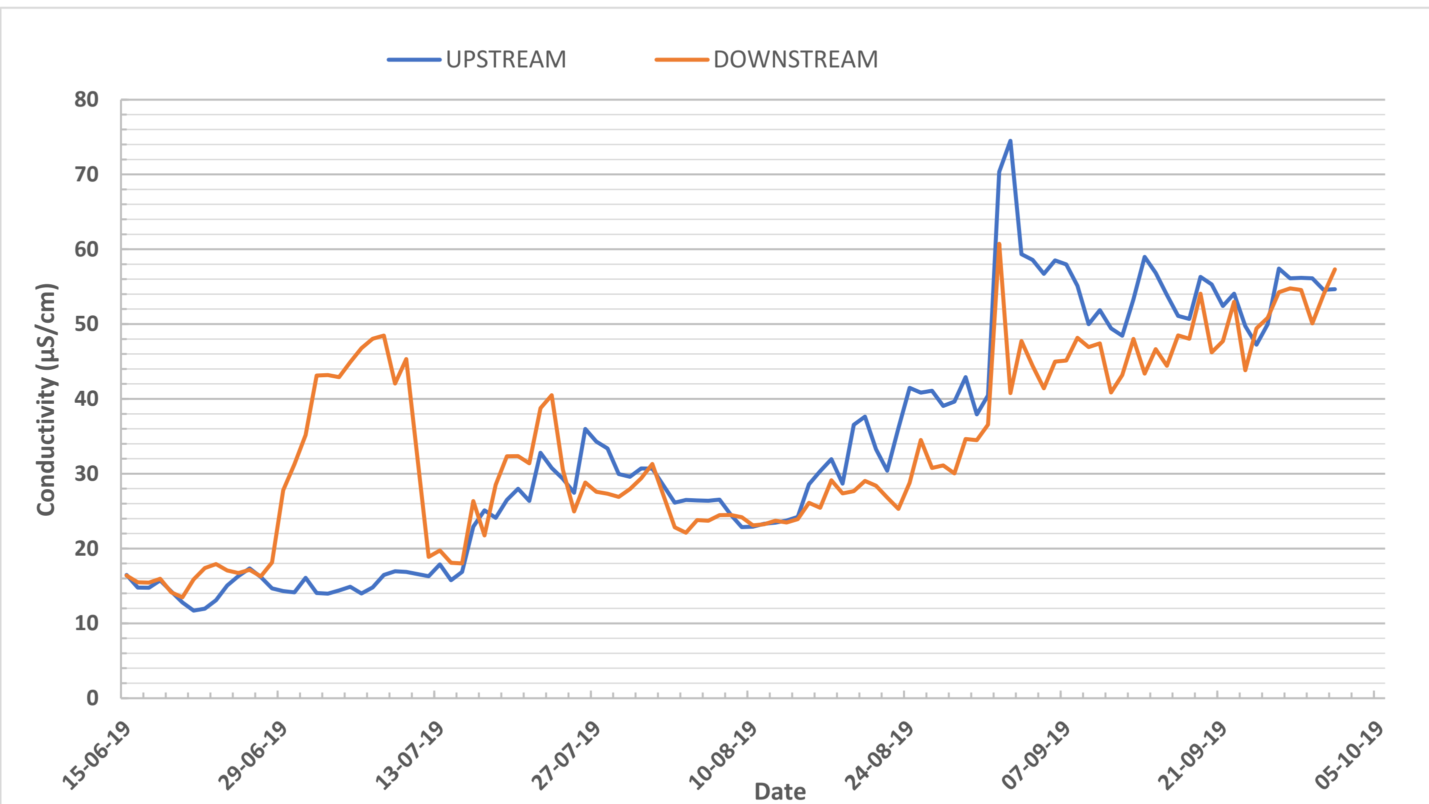


Figure 3.13 Conductivity measured on either side of A-A' riffle using mobile probes in 2019

3.4.4 Water Balance for Lake Lagopede

Hydrological regime data combined with data from the weather station on the shore of the north basin of Lake Lagopede were used in 2017 to establish the first water balance for this part of the lake. It covers the north basin exclusively and was determined using water losses and inflows for Lake Lagopede (Tetra Tech, 2020a).

Water losses include:

- evaporation;
- freshwater withdrawals for mine requirements;
- discharge into the south basin of Lake Lagopede.

Water inflows include:

- precipitation;
- runoff;
- dewatering water;
- treated mine water discharges.

The overall water balance was updated in 2019. The 2019 water balance results indicate a very small variation in water volume on the order of 7,804 m³, about 0.01% of the water stored in the north basin of Lake Lagopede in 2019, which can be considered negligible (Tetra Tech, 2020a).

In addition, the balance of inflows and outflows for the lake in 2019 was stable, with a difference on the order of 0.21%, the same order of magnitude as the 0.16% difference in 2018.

The results of the 2019 water balance therefore demonstrate the reliability of the water level measuring stations and the strong correlation between measured water levels and flows calculated for the entire range of the discharge rating curves in 2019 (Tetra Tech, 2020a).

Finally, almost all the inflows (90%) and all the outflows are measured directly, a method that results in an accurate water balance, since the measurement of lake inflows match the measurement of lake outflows.

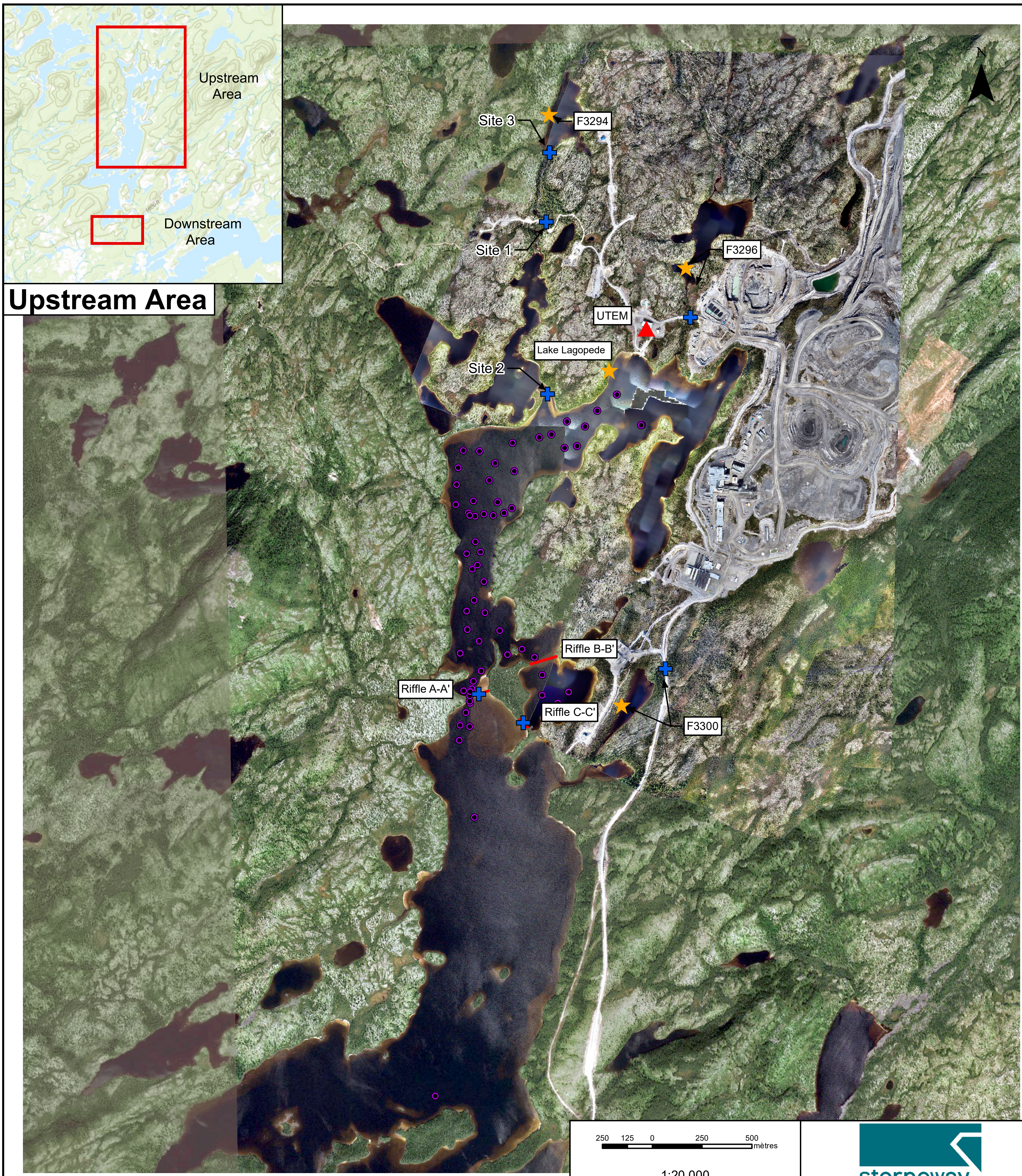
3.4.5 2020 Monitoring

The many additional temperature and conductivity surveys carried out in 2019 served to validate the various effluent dispersion modelling assumptions and confirm complete effluent dynamics in Lake Lagopede as forecast in the 2017 modelling (Englobe, 2017).

Characterizing effluent dynamics remains a significant technical challenge, for which a number of surveys come into play. Hydrological monitoring will continue in 2020 to confirm the stability of effluent dynamics over time.

A review of all available data could be undertaken to determine the relevance of current monitoring, along with other changes or additions to the monitoring protocol, in our efforts to enhance our understanding of the hydrological regime.

Upstream Area

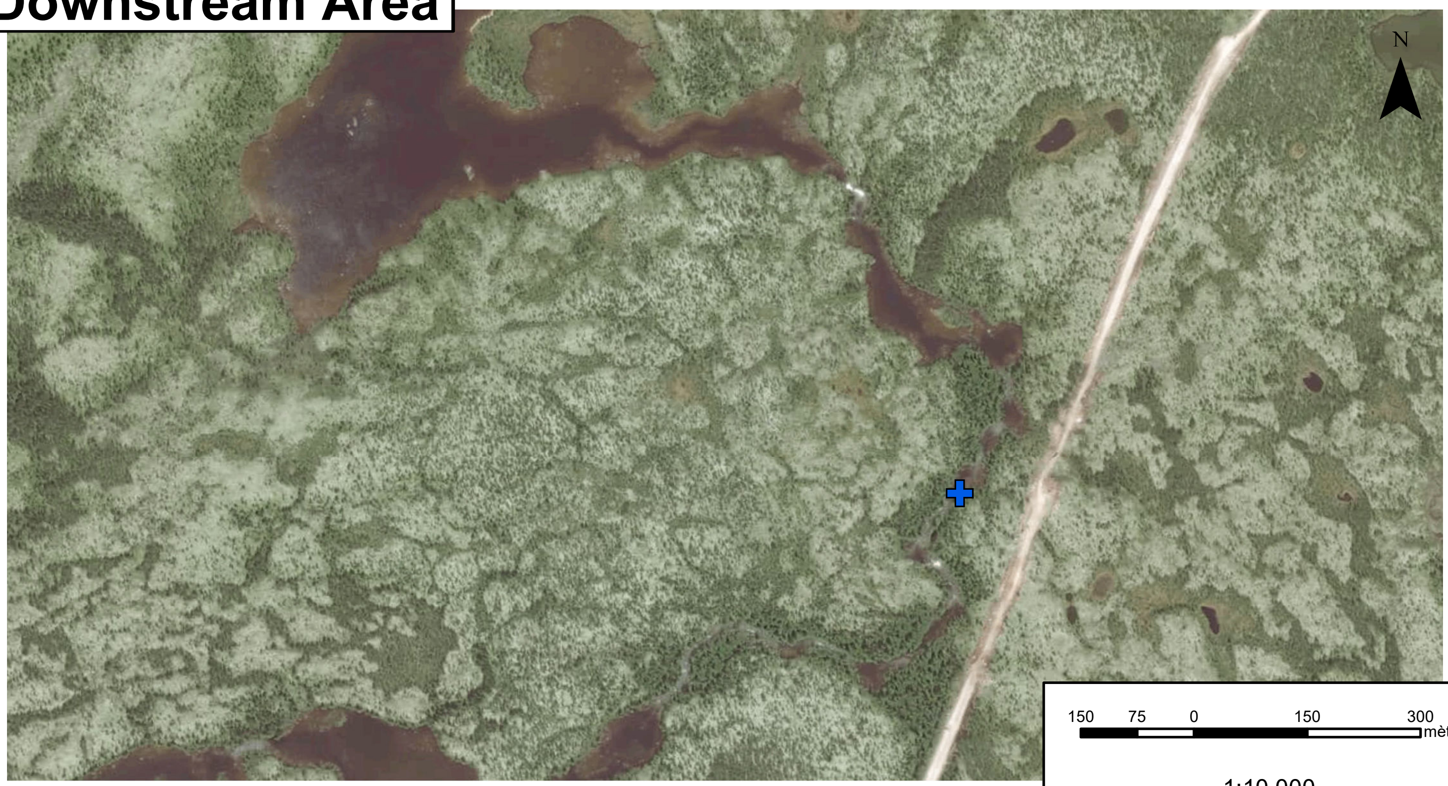


250 125 0 250 500 mètres

1:20 000

stornoway

Downstream Area



150 75 0 150 300 mètres

1:10 000

- Gauging station
- Conductivity measurement
- UTEM
- Limnimetric station
- Riffle

Hydrological Follow-up at the Renard Mine Site - Summer 2019

Location of measuring stations

august 2019

Coordinate system : NAD 1983 MTM 8

Imaging : Orthophoto Stornoway and HERE Maps

TETRA TECH

Map 3.7

3.5 Drinking Water Quality

3.5.1 Drinking Water Consumption

In 2019, 38,956 m³ of drinking water from Renard mine's water treatment plant was distributed to the mine site, with a 100% availability rate.

3.5.1.1 Monthly distribution

Figure 3.14 illustrates the quantity of water distributed (in m^3), the average number of workers at the mine site, and average consumption of drinking water on site (in litres/day/person).

In 2019, monthly consumption of drinking water at the camp varied between 337 and 449 litres/day/person, or an average of 372 litres/day/person over the year, a slight increase of 5% in relation to 2018. The reason for the slight increase was the installation of a drinking water system at level 290 in the underground mine in June 2019.

Water consumption peaked in August 2019, while the camp occupation rate decreased, and water distribution remained constant.

These variations in drinking water consumption are not attributable to individual water consumption on the site, but rather to technical adjustments, i.e., purges and pipe breakages, in the underground drinking water system.

Water treatment technicians also cleaned out the drinking water tanks on April 9 and 10, 2019.

3.5.1.2 Daily distribution

An analysis of daily distribution helps detect abnormal peaks in consumption linked to system failures or leaks in the distribution system, or water wastage. Depending on the situation, maintenance teams are immediately informed and rapidly mobilized to correct any anomalies.

In 2019, average daily distribution amounted to 107 m^3/day, or about 9% less than in 2018 (118 m^3/day).

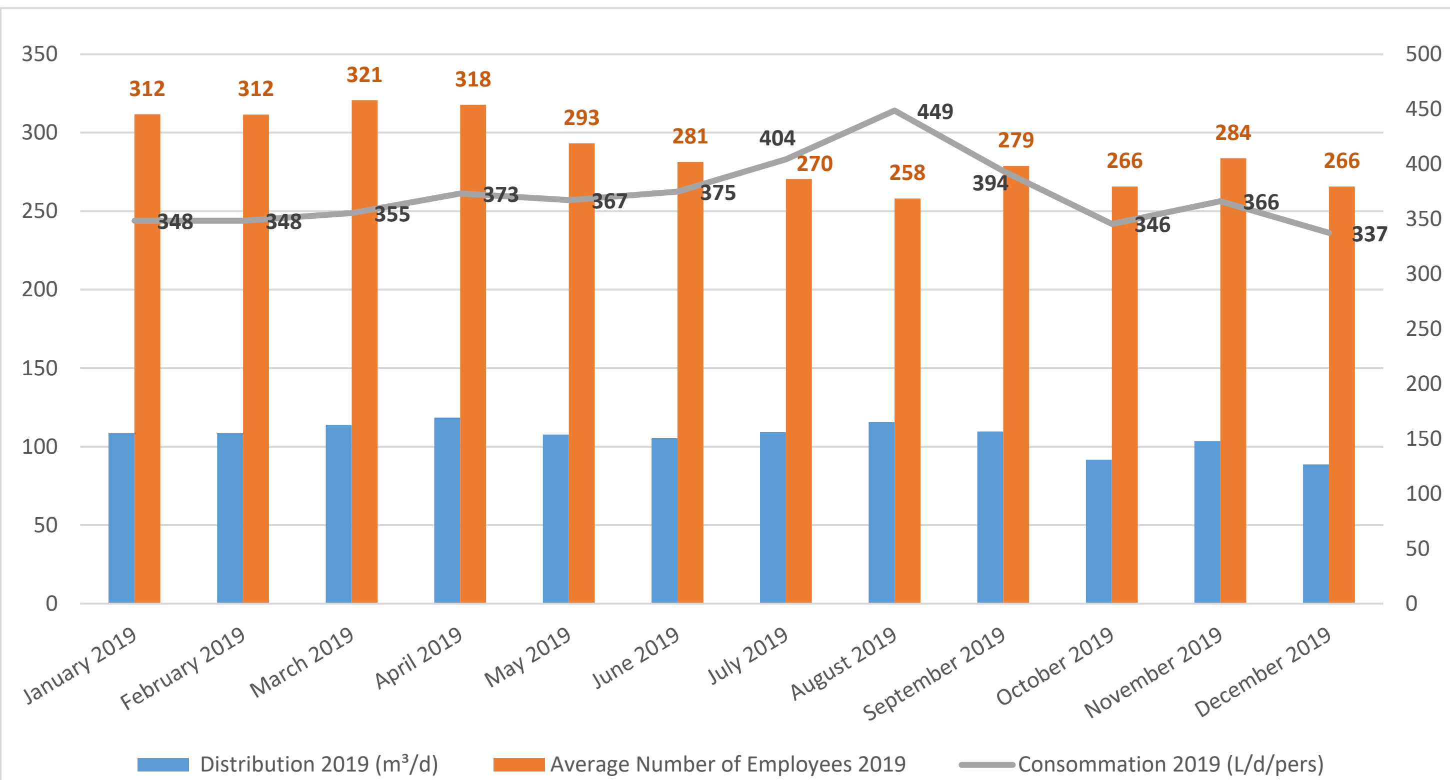


Figure 3.14 Consumption and distribution of drinking water at the Renard mine site in 2019

3.5.1.3 Awareness campaign

With a view to encouraging responsible use of water, in 2016 SWY launched a worker awareness campaign to make them aware of the essential nature of water for humans and the environment, and to decrease bottled water consumption at the mine site.

New employees are informed upon their arrival on site of the efforts made to produce and distribute quality water on the mine site, and the importance of using this natural resource wisely.

In this regard, additional efforts were deployed to conserve water in 2019. One significant change was in the underground mine where a drinking water system was installed. Awareness posters were on display at strategic locations throughout the mine site, for example in the cafeteria.

A study was also undertaken on the feasibility of replacing water bottles with refillable water bottles. It is currently under review by management. The “zero water bottle” challenge was continued in 2019 among administrative employees. In the short term, following the success of this initiative, the plan is to launch the challenge within other departments.

3.5.2 Drinking Water Quality Monitoring

The Regulation respecting the Quality of Drinking Water (RQEP) does not impose any type of monitoring program on companies. SWY has however voluntarily opted in the interests of transparency to set up a drinking water quality monitoring program in line with RQEP requirements, and the Regulation respecting Occupational Health and Safety (RSST).

Test results in 2019 were in compliance with RQEP standards. Table 3.10 shows average concentrations for the various parameters tested in 2019 as part of the Drinking Water Quality Monitoring Program along with annual sampling values from July. To date, no boiling water or drinking water avoidance advisories have been issued by water treatment technicians since the water treatment plant was commissioned, since water quality has consistently met drinking water consumption criteria. The water treatment plant’s water tanks were in fact cleaned on April 9 and 10, 2019.

3.5.2.1 Trihalomethane (THM) concentrations

An increase in trihalomethane (THM) concentrations was observed at the end of the distribution system in 2019. THM, a by-product of water chlorination, is formed when free residual chlorine reacts with natural organic substances present in water, for example, contact with the biofilm that forms on pipe walls over time.

In 2019, the annual mean concentration of THM was 39 µg/l and remained well below the RQEP standard (80 µg/l), although it did increase in relation to 2018 (22 µg/l).

As a preventive measure, and in compliance with the action plan SWY put in place in 2018, a number of actions were taken in 2019 to eliminate potential sources of THM precursors, specifically dissolved organic carbon.

Water treatment technicians gave the water tanks a thorough cleaning in April 2019. In addition, the distribution system was purged in June 2019.

To identify and validate the sources of THM, drinking water samples were taken in December 2019 at four stations:

- drinking water treatment plant (EPR1);
- accommodation complex (EPR3);
- dryhouse (EPR4);
- core shack (EPR11).

The test results indicate that THM concentrations are below RQEP standards (80 µg/l). Note that drinking water in the core shack is not used on a regular basis because the core shack is not frequently used. In addition, the drinking water station is at the end of the system.

These two factors may result in premature wear on the pipes and lead to increased THM concentrations.

In 2020, SWY will make an effort to use the EPR11 drinking water station on a more regular basis.

3.5.2.2 Bacteriological control

No test results indicated the presence of micro-organisms used as indicators of faecal contamination (e.g., E. coli), or total coliforms, in that values were all nil or below the detection limit.

3.5.2.3 Water disinfection

In 2019, the residual chlorine concentration was always maintained above the required limit of 0.3 mg/L at the outlet to the plant, thereby ensuring optimal disinfection. The mean chlorine concentration in 2019 was 0.53 mg/L.

3.5.2.4 Facilities maintenance

To ensure the durability and efficient operation of equipment at the water treatment plant, preventive maintenance is carried out on a regular basis by operators, mechanics and electricians. The membranes in the two nanofiltration units are washed on a monthly basis to preserve the physical integrity of the filtration system and its service life.

An equipment maintenance log has been in use since 2015 to record relevant information regarding any corrective action taken to address problem situations.

Table 3.10 Drinking water quality analyses in relation to Appendix 1 of the RQEP'S drinking water quality standards

PARAMETERS	UNITS	RQEP	Mean Concentration	Maximum Value	Annual Sampling
Inorganic Substances					
Antimony (Sb)	mg/L	0.006	--	--	<0.001
Arsenic (As)	mg/L	0.010	--	--	<0.001
Barium (Ba)	mg/L	1.0	--	--	0.002
Boron (B)	mg/L	5.0	--	--	<0.04
Cadmium (Cd)	mg/L	0.005	--	--	<0.0005
Free residual chlorine	mg/L	0.3(1)	0.53	1.15	0.48
Chromium (Cr)	mg/L	0.050	--	--	<0.001
Copper (Cu)	mg/L	1.0	--	--	0.006/0.004
Cyanides (CN^-)	mg/L	0.20	--	--	<0,003
Fluorides (F^-)	mg/L	1.50	--	--	2.96
Nitrites + nitrates (in N)	mg/L	10.0	1.47	4.13	4.13
Nitrites (in N)	mg/L	1.0	0.995	3.95	3.95
Mercury (Hg)	mg/L	0.001	--	--	<0.0001
pH	pH units	6.5 to 8.5	6.88	7.79	6.81
Lead (Pb)	mg/L	0.010	--	--	<0.001/<0.001
Selenium (Se)	mg/L	0.010	--	--	<0.001
Turbidity	UTN	0.2	0.07	0.22	0.2
Uranium (U)	mg/L	0.020	--	--	<0.0005
Organic Substances					
Total trihalomethanes (THM)	µg/l	80(2)	37.8	49.7	39
Bacteriological					
Atypical bacteria	UFC/100 ml	200	<1	<1	<1
Total coliforms	UFC/100 ml	10	<1	<1	<1
Escherichia coli	UFC/100 ml	0	<1	<1	<1

(1) Minimum value, at outlet of the treatment plant
(2) Maximum average concentration over four quarters

3.6 Surface Water and Sediment Quality

3.6.1 Background

Stornoway (Canada) Inc. committed to monitoring surface water and sediment quality as part of the Renard diamond mine project. This monitoring is also required under condition 4.1 of the Global Certificate of Authorization issued on December 4, 2012, by the MELCC (MDDEFP, 2012), and the monitoring guidelines set out in the CEAA's comprehensive study report (CSR).

Modelling was also performed by Environnement Illimité (2011) as part of the ESIA to determine effluent dispersion and dilution patterns in Lake Lagopede. These modelling results were updated in 2017 to include the addition of dewatering water as an intermediate effluent in 2018 (cf. section 3.13.1).

The modelling assumed that mine effluent could concentrate below a thermocline, defined as a layer of warmer surface water above a layer of cooler water. Thermoclines restrict the dispersion of the plume throughout the entire water column.

Seasonal mixing of the water however causes the effluent to disperse uniformly throughout the water column between the spring flood and the summer low-flow period (July) up to the end of fall (October) every year, thereby significantly lessening the accumulation phenomenon.

3.6.2 Objectives

The primary objective of the surface water and sediment quality monitoring program is to characterize the state of the receiving environment during and after the project construction implementation phases, as well as changes in relation to baseline conditions established in the EBS for the Renard mine (Roche, 2011b).

More specifically, the objectives of the water quality monitoring program are to ensure compliance with the monitoring guidelines and directives set out in Appendix 10 of the CEAA's CSR (2013), namely to:

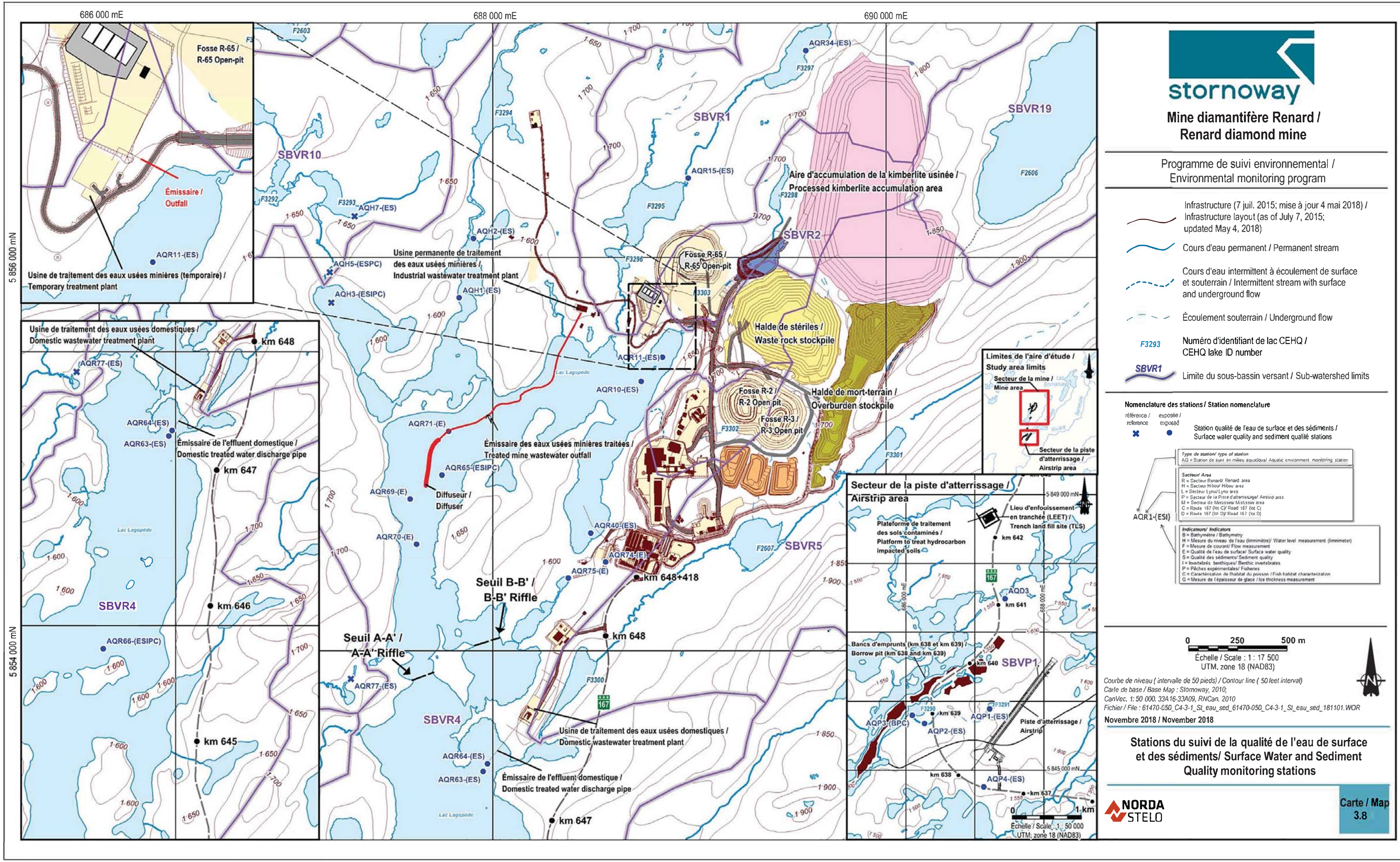
- document changes in water and sediment quality in the receiving environment;
- prevent changes in Lake Lagopede's trophic level with respect to excessive nutrients (e.g., total suspended solids or phosphorus);
- track thermal stratification in the water column which impacts the accumulation of effluent in the receiving environment, particularly in Lake Lagopede;
- evaluate the effectiveness of design and mitigation measures put in place to minimize the project's impact on the water system;
- track the performance of the domestic and mine water management system as well as the ore and tailings infrastructure;
- monitor any changes to mining operations or to other project components that are likely to impact water or sediment quality;
- collect measurements on environmental variables used to interpret benthos and fish monitoring and surveillance results;
- put preventive and corrective measures in place in accordance with monitoring results.

3.6.3 Sampling Area and Period

To accomplish these objectives, a network of water (W) and sediment (S) quality monitoring stations have been sampled since 2015 on the Renard mine site (exposed areas), as well as on the periphery of mining facilities (control areas) (Map 3.8). Sites on the lake include two monitoring stations, one on the surface and another on the bottom of the lake, whereas streams have a single station.

The positions for the stations were selected as part of the 2011 impact assessment and validated in the monitoring program on the basis of potential sources of contaminants. The network covers the hydrographic network in the study area including control areas that are not influenced by mining activities.

In compliance with the schedule outline in the ESMP (Norda Stelo, 2016), the sampling campaigns are carried out according to seasonal hydrological periods so as to correlate concentrations found in the water and sediment with the winter and summer low-flow periods, and the spring and autumn floods. Surface water sampling is therefore carried out in March, June and July, and sediment sampling in October.


stornoway
Mine diamantifère Renard /
Renard diamond mine
Programme de suivi environnemental /
Environmental monitoring program
Infrastructure (7 juil. 2015; mise à jour 4 mai 2018) / Infrastructure layout (as of July 7, 2015; updated May 4, 2018)
Cours d'eau permanent / Permanent stream
Cours d'eau intermittent à écoulement de surface et souterrain / Intermittent stream with surface and underground flow
Écoulement souterrain / Underground flow
F3293
Numéro d'identifiant de lac CEHQ / CEHQ lake ID number
SBVR1
Limite du sous-bassin versant / Sub-watershed limits
Nomenclature des stations / Station nomenclature
référence / reference
exposée / exposed
Station qualité de l'eau de surface et des sédiments / Surface water quality and sediment quality stations
AQR1-(ESI)
Limites de l'aire d'étude / Study area limits
Secteur de la mine / Mine area
Secteur de la piste d'atterrissage / Airstrip area
0 250 500 m
Échelle / Scale : 1 : 17 500
UTM, zone 18 (NAD83)
Courbe de niveau (intervalle de 50 pieds) / Contour line (50 feet interval)
Carte de base / Base Map : Stornoway, 2010;
CanVec, 1:50 000, 33A16-33A09, RNCan, 2010
Fichier / File : 61470-050_C4-3-1_SI_eau_sed_61470-050_C4-3-1_SI_eau_sed_181101.WOR
Novembre 2018 / November 2018
Stations du suivi de la qualité de l'eau de surface et des sédiments/ Surface Water and Sediment Quality monitoring stations
NORDA STELO
Carte / Map
3.8
686 000 mE
688 000 mE
690 000 mE
5 856 000 mN
5 854 000 mN
Fosse R-65 / R-65 Open-pit
Émissaire / Outfall
AQR11-(ES)
Usine de traitement des eaux usées minières (temporaire) / Temporary treatment plant
Usine de traitement des eaux usées domestiques / Domestic wastewater treatment plant
AQR77-(ES)
AQR64-(ES)
AQR63-(ES)
Émissaire de l'effluent domestique / Domestic treated water discharge pipe
km 648
km 647
km 646
km 645
SBVR4
AQR66-(ESIPC)
SBVR10
SBVR1
SBVR19
SBVR2
SBVR5
AQR34-(ES)
AQR15-(ES)
AQH7-(ES)
AQH2-(ES)
AQH5-(ESPC)
AQH3-(ESIPC)
AQH1-(ES)
Usine permanente de traitement des eaux usées minières / Industrial wastewater treatment plant
Aire d'accumulation de la kimberlite usinée / Processed kimberlite accumulation area
Halde de stériles / Waste rock stockpile
Fosse R-2 / R-2 Open pit
Fosse R-3 / R-3 Open pit
Halde de mort-terrain / Overburden stockpile
AQR10-(ES)
AQR71-(E)
Émissaire des eaux usées minières traitées / Treated mine wastewater outfall
AQR65-(ESIPC)
AQR69-(E)
Diffuseur / Diffuser
AQR70-(E)
AQR40-(ES)
AQR74-(E)
AQR75-(E)
km 648+418
Seuil B-B' / B-B' Riffle
Seuil A-A' / A-A' Riffle
Lac Lagopède
Secteur de la piste d'atterrissage / Airstrip area
Plateforme de traitement des sols contaminés / Platform to treat hydrocarbon impacted soils
Lieu d'enfouissement en tranchée (LEET) / Trench land fill site (TLS)
km 642
AQD3
km 641
Bancs d'emprunts (km 638 et km 639) / Borrow pit (km 638 and km 639)
km 640
SBVP1
km 639
AQP1-(ES)
AQP3-(BPC)
AQP2-(ES)
Piste d'atterrissage / Airstrip
km 638
AQP4-(ES)
km 637
0 1 km
Échelle / Scale : 1 : 50 000
UTM, zone 18 (NAD83)

3.6.4 Surface Water Quality

3.6.4.1 2019 Schedule

In 2019, four surface water sampling campaigns were carried out in the lakes and streams in the mine and airstrip areas. The March, June and July campaigns were in the mine area, and included 17 sampling sites.

In October, the entire sampling network included the airstrip, i.e., the two sampling sites at the airport, for a total of 19 sampling sites in the fall flood period (Photo 3.17).

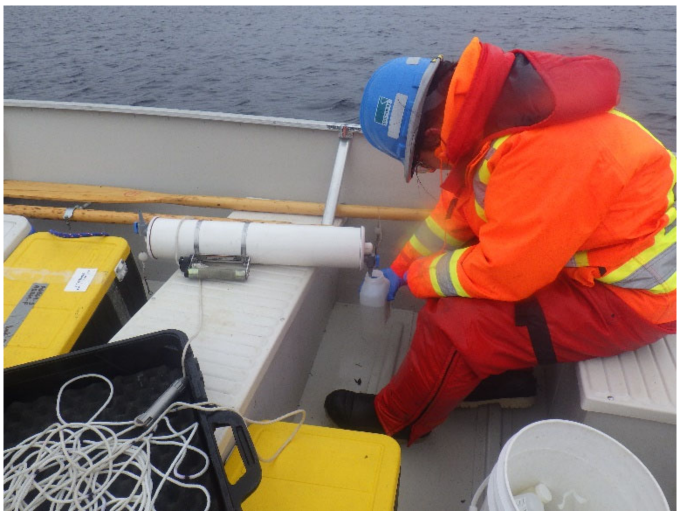


Photo 3.17 Surface water quality monitoring in spring 2019

3.6.4.2 2019 results

SWY had all the 2019 surface water and sediment test results compiled by an external consultant. The statistical descriptive analyses of surface water samples collected in 2019 could then be compared with baseline values (2010), the construction phase (2015) and recent years of operations (2017 and 2018).

Surface water quality in the Renard mine area in 2019 is generally comparable with that in 2015, 2017 and 2018. It has however changed since 2010 and differs from the baseline values (Roche, 2011a et 2011b). A summary of descriptive statistics for surface water quality in the 2010 baseline, as well as in 2015 to 2019, is presented in Table 3.11. Water quality results are compared with:

- the MELCC's criteria for contamination prevention and the protection of aquatic life and surface water;
- the CCME's guidelines for the protection of aquatic life;
- monitoring guidelines and requirements defined by federal authorities (Appendix 10 of the CSR; CEAA, 2013).
- initial concentrations measured in surface water in the receiving environment for the 2010 baseline conditions (Roche, 2011b).

These criteria are used to assess the quality of surface water (Table 3.11). Notes related to these criteria are presented in Appendix III. The main characteristics of surface water quality in 2019 are described in the following sections.

Physical-Chemical Characteristics

The water in the lakes and streams in 2019 was generally only mildly turbid and had very low total suspended solids (TSS) concentrations, as in the 2010 baseline.

The streams and lakes had dissolved oxygen concentrations comparable with previous years and remained well oxygenated in every season at the sites sampled in 2019. In winter, dissolved oxygen concentrations are higher at the bottom of the lake, in the presence of the winter thermocline. The reverse occurs in summer once the summer thermocline appears, in that dissolved oxygen levels increase near the surface (Tetra Tech, 2020b).

Given that in the 2010 baseline, dissolved oxygen levels already exceeded one of the applicable quality criteria, it is normal that in comparing 2010 and 2019 the level will be higher than the applicable standards. In addition, dissolved oxygen peaked in 2019 at levels that had never been reached in previous years, at both the control and the exposed stations. In 2019, average dissolved oxygen concentrations still remained comparable to average concentrations recorded in 2015 to 2018 monitoring as well as the 2010 baseline (Table 3.11; Map 3.8).

pH Values

In the 2010 baseline, pH values were already slightly acidic. The values recorded were for the most part below the 6.5 threshold, the lower limit of the Quebec criteria range for the prevention of the contamination of water and organisms and for the protection of the aquatic environment (chronic effects, MELCC; long-term effects, CCME).

It is therefore not surprising then that in 2019 the streams and lakes were acidic to slightly acidic and that the results showed pH values below the lower limit of CCME criteria (Tetra Tech, 2020b).

The average pH in 2019 (5.94) is comparable with the baseline pH (5.86) and 2018 pH (5.78), and slightly more acidic than the threshold pH in 2015 (6.28) and 2017 (6.15). It is therefore assumed that aquatic life was not affected by conditions recorded in 2019.

Finally, it should be noted that the mine effluent that was treated and discharged into Lake Lagopede in 2019 had an average pH that was greater than 7. It is therefore highly unlikely that mine effluent discharged into the lake contributed to the acidic pH of the surface waters in Lake Lagopede (Tetra Tech, 2020b).

Trophic Level Monitoring

In 2019, the trophic level and physical-chemical characteristics of the lakes and streams remained stable and comparable to previous years. As in the 2010 baseline conditions, the streams and lakes had low concentrations of nutrients and are defined as oligotrophic environments. Two parameters are used to track the trophic level in lakes and streams on the site:

- Total phosphorus, which promotes or limits algae and aquatic plant growth;
- Chlorophyll a, a plant pigment involved in photosynthesis of phytoplankton.

Mean concentrations of total phosphorus measured in the lakes and streams are comparable with 2015 to 2018 values and are even slightly lower than the 2010 baseline conditions. They are also characteristic of ultra-oligotrophic (< 0.0004 mg/L) to oligotrophic (0.004 to 0.01 mg/L) lakes, as defined by MELCC (2017).

Note that in summer 2019, and for the first time since the 2010 baseline, total phosphorus concentrations exceeded the criteria throughout the sampling zone, including the stations upstream of mining activities. In addition, maximum concentrations were the highest since 2010.

This indicates that despite the efforts deployed at the Renard mine to thoroughly treat mine and domestic effluent, other natural sources are at play increasing the concentration of nutrients. Total phosphorus, for example, is found naturally on fine particles (sand), as well as in soil with high levels of organic matter and organic carbon (Tetra Tech, 2020b), such as the soils in the peat bogs in the study area (Roche, 2011b).

Total phosphorus will be monitored in upcoming monitoring campaigns so as to validate whether the baseline for this parameter is in the process of changing in the lakes and streams in the study area.

Mean chlorophyll a, concentrations measured in 2019 in the lakes and streams in the study area (0.00076 mg/L) are comparable to mean concentrations in 2015 survey (0.0006 mg/L) and have remained constant since 2015.

The maximum concentration measured in 2019 (0.0017 mg/L) is comparable to the 2015 maximum (0.0015 mg/L) in lakes (Table 3.11).

Chlorophyll a concentrations in the study area continue to be characteristic of ultra-oligotrophic lakes, which are defined as a chlorophyll a concentration below 0.001 mg/L (MELCC, 2017).

Other Nutrients

A majority of the parameters measured in the 2019 campaigns generally complied with provincial surface water quality criteria and recommendations (MELCC) (Table 3.11).

During operations, surface water quality in the Renard mine area overall remained comparable with 2010 baseline conditions and the 2017 and 2018 monitoring results.

As compared with previous years, 2019 monitoring indicated that nitrates and nitrites as wall as ammonium nitrogen and BOD5 reached the highest maximum concentrations since 2016 throughout the study area, with all sampling stations combined.

This trend needs to be monitored in future so as to determine whether a change in baseline conditions has occurred.

Nitrates and Nitrites

In 2019, mean concentrations of nitrates in lakes declined slightly in relation to 2017 and 2018, but increased slightly in streams. The number of samples with concentrations greater than applicable criteria remained the same and the stations (AQR65, AQR69 et AQR11) where the increase occurred has not changed since 2017.

Nitrite samples in 2019 with concentrations that exceed applicable criteria come from more geographically diverse sampling stations than in the 2017 and 2018 monitoring.

Ammonium Nitrogen

In 2019, the mean concentration of ammonium nitrogen measured in surface water across all the campaigns and samples is 0.172 mg\L, which is ten times higher than mean concentrations measured in MIR2 mine effluent (0.0145 mg/L).

Table 3.11 Global descriptive statistics of surface water quality of rivers and lakes for the 2015 to 2019 monitoring campaigns and the 2010 baseline condition

Parameters	Unit	Federal (CCME)		Provincial (MELCC)				LDR 2019	WATER COURSE																	
		Guideline for the protection of aquatic life		Protection of aquatic life		Contamination Prevention			Follow-up 2019						Follow-up 2015 to 2018						Baseline Study 2010					
		Short term	Long term	Chronic Effect	Acute Effect	With drinking water intake	Without drinking water intake		Number of values	%<DL	Non respect criterion(s) (Nb)	Minimum	Median	Maximum	Number of values	%<DL	Non respect criterion(s) (Nb)	Minimum	Median	Maximum	Number of values	%<DL	Non respect criterion(s) (Nb)	Minimum	Median	Maximum
General Parameters																										
Alcalinity	mg/L	-	-	[o]	-	-	-	1	17	24%	0	<1	2	7	50	24%	0%	<1	2	23	19	47%	0%	<1	1	4
Ammonia Nitrogen (N-NH_3)	mg/L	-	-	1,23[s]	17,9[s]	0,2[t] et 1,5[u]	-	0,02	17	6%	4	<0.02	0,061	0,74	50	62%	8%	0,012	<0.02	0,75	19	100%	0%	<0,06	<0,06	<0,06
Total Nitrogen (N tot)	mg/L	-	-	-	-	-	-	0,3	13	69%	0	<0.3	<0.3	1,72	45	58%	0%	<0.02	<0.3	8,16	0	-	-	-	-	-
Total Kjedahl Nitrogen (TKN)	mg/L	-	-	-	-	-	-	0,3	17	71%	0	0,14	<0.3	1,53	22	77%	0%	0,176	<0.3	<1	19	21%	0%	<0,4	0,51	0,69
Bromides (Br-)	mg/L	-	-	0,0027	0,0024	-	-	0,1	17	94%	0	*<0.1*	*<0.10*	*0,4*	47	94%	0%	*<0.1*	*<0.1*	*0,6*	0	-	-	-	-	-
Total Organic Carbon (COT)	mg/L	-	-	-	-	-	-	0,2	17	0%	0	4,42	7,04	17	50	0%	0%	2,88	5,9	22,2	0	-	-	-	-	-
Dissolved Organic Carbon (COD)	mg/L	-	-	-	-	-	-	0,2	17	0%	0	3,92	6	13,1	50	2%	0%	<0.20	5,29	21,6	0	-	-	-	-	-
Chlorophylle A	mg/L	-	-	-	-	-	-	0,00005	3	0%	0	0,00029	0,0004	0,00067	5	0%	0%	0,00012	0,00034	0,0008	0	-	-	-	-	-
Pheopigments	mg/L	-	-	-	-	-	-	0,00005													0	-	-	-	-	-
Chlorides (Cl-)	mg/L	640	120	230	860	250	-	0,05	17	0%	0	0,069	0,164	35,9	50	10%	0%	0,06	0,292	45,8	19	0%	0%	0,06	0,1	0,49
Conductivity *	S/cm	-	-	-	-	-	-	*In situ*	16	0%	0	2	8,5	72	51	0%	0%	1	13	311	19	0%	0%	6,1	10,3	26,9
BOD_5	mg/L	-	-	3[r]	-	-	-	2	17	94%	1	<2	<2	*6*	50	94%	14%	<2	<2	*4*	0	-	-	-	-	-
Chmical Oxygen Demand (COD)	mg/L	-	-	-	-	-	-	3	17	35%	0	<3	17	263	51	8%	0%	<3	17	130	0	-	-	-	-	-
Total Hardness ($CaCO_3$)	mg/L	-	-	-	-	-	-	1	17	0%	0	2,19	3,07	42,4	45	0%	0%	1,75	3,1	72,6	19	68%	0%	<1	<1	6,5
Fluorides (F-)	mg/L	-	0,12	0,2[z]	4[z]	1,5[A]	-	0,01	17	29%	2	<0.01	0,015	***0,223***	50	50%	0%	<0.01	0,044	<0.1	0	-	-	-	-	-
Total Suspended Solids (TSS)	mg/L	+25[d]	+5[d]	+5 à 25[p]	+25[q]	-	-	1	17	59%	2	<1	<1	***272***	51	59%	2%	0,2	1	***42***	19	95%	0%	<3	<3	3
Nitrates (NO_3^-)	mg/L	550	13	2,9[w]	-	10[x]	-	0,01	17	24%	0	<0.01000	0,044	2,86	50	36%	2%	<0.01	0,0305	*7,85*	19	100%	0%	<0,1	<0,1	<0,1
Nitrites (NO_2^-)	mg/L	-	0,06	0,02 à 0,20[y]	0,06 à 0,60[y]	1[x]	-	0,01	17	71%	3	<0.01	<0.01000	***0,105***	50	90%	14%	<0.01	<0.01	***<0.1***	9	100%	0%	<0,02	<0,02	<0,02
Dissolved Oxygen (%)*	%	-	-	54 à 63% [X]	-	-	-	*In situ*	17	0%	0	*61,1*	86,9	125,7	49	0%	0%	66,1	84,8	112,4	17	0%	0%	*60,6*	86,8	106
Dissolved Oxygen (mg/l)*	mg/L	-	6,0 à 9,5[b]	5 à 8 mg/l [X]	-	-	-	*In situ*	17	0%	1	***5,69***	10,09	14,03	50	0%	2%	***5,95***	9,6	16,53	17	0%	6%	***5,84***	***7,59***	11,33
pH*	pH unit	-	6,5 à 9,0	6,5 à 9,0[j]	5,0 à 9,0[k]	6,5 à 8,5[l]	-	*In situ*	17	0%	14	***5,0***	***5,80***	6,87	51	0%	90%	***4,0***	***5,86***	8	19	0%	95%	***4,97***	***5,7***	7,93
Phenols-4AAP	mg/L	-	-	-	-	-	0,005[U]	0,002	17	29%	3	<0.002	0,002	0,009	48	46%	33%	<0.002	0,0045	0,019	0	-	-	-	-	-
Total Phosphorus (P)	mg/L	-	0,004 à 0,01[e]	0,02, 0,03 ou >50%[v]	-	-	-	0,0006	17	6%	6	*0,0022*	***0,0046***	***0,257***	50	10%	10%	<0.0006	***0,00485***	***0,0168***	19	11%	5%	***<0,005***	***0,006***	***0,011***
Redox Potential *	mV	-	-	-	-	-	-	*In situ*	17	0%	0	168	240	338,2	25	0%	0	137,8	304,6	394,5	19	0%	0%	100	205	297,8
Total Dissolved Solids	mg/L	-	-	-	-	-	-	9	17	12%	0	<9	36	150	51	25%	0%	<9	<25	194	19	16%	0%	<25	31	54
Total Solids	mg/L	-	-	-	-	-	-	4	17	0%	0	10	34	1100	51	14%	0%	<4	28	196	0	-	-	-	-	-
Sulphates (SO_4^{2-})	mg/L	-	-	500[B]	500[B]	500[C]	-	0,08	17	0%	0	0,783	1,41	20,1	50	14%	0%	<0.5	1,705	29,8	19	89%	0%	<2	<2	6
Temperature*	°C	[a]		[W]	-	-	-	*In situ*	17	0%	0	-0,3	6,6	19,2	51	0%	0%	0	9,7	21,6	18	0%	0%	9,6	16,03	26
Transparency*	m	-	-	-	-	-	-	*In situ*							9	0%	0%	0,2	0,3	1,4	0	-	-	-	-	-
Turbidity*	UTN	+8[c]	+2[c]	+2[m]	+8[n]	-	-	*In situ*	13	0%	0	0	0	***591***	50	0%	0%	0	0,1	***9,6***	19	0%	0%	0	1,01	***2,41***
Metals																										
Aluminium (Al)	mg/L	-	0,005 et 0,1[f]	0,087[D]	0,75[E]	0,2 [F]	-	0,0005	17	0%	17	**0,056**	***0,119***	***4,68***	49	0%	100%	**0,0601**	***0,15***	***0,58***	19	16%	84%	**<0,03**	***0,13***	***0,48***
Aluminum (available fraction)	0							0,03													19	53%	0%	<0,03	<0,03	0,3168
Antimony (Sb)	mg/L	-	-	0,24	1,1	0,006[G]	0,64	0,000005	17	94%	0	<0.000005	<0.000005	0,000356	49	65%	0%	<0.000005	<0.000005	<0.001	0	-	-	-	-	-
Silver (Ag)	mg/L	-	0,00025	-	-	-	-	0,000003	17	59%	3	<0.000003	0,000003	**<0.0003**	46	85%	0%	0,0000004	<0.000003	<0.00015	0	-	-	-	-	-
Arsenic (As)	mg/L	-	0,005	0,15[J]	0,34[J]	0,0003[K]	0,021[L]	0,00008	17	47%	1	<0.00008	0,00009	0,00033	49	61%	10%	<0.00008	0,00008	<0.001	0	-	-	-	-	-
Baryum (Ba)	mg/L	-	-	0,038[H]	0,11[H]	1[M]	160	0,00003	17	0%	0	0,00206	0,00307	0,0315	49	0%	2%	0,00177	0,0035	*0,0428*	0	-	-	-	-	-
Beryllium (Be)	mg/L	-	-	-	-	-	-	0,000006	17	24%	0	<0.000006	0,00001	0,000119	49	47%	0%	<0.000006	<0.00001	<0.002	0	-	-	-	-	-
Boron (B)	mg/L	29	1,5	5	28	0,2	160	0,0003	17	41%	0	<0.0003	0,0005	0,0399	49	35%	0%	<0.0003	0,0007	0,113	0	-	-	-	-	-
Cadmium (Cd)	mg/L	0,001	0,00009	0,0002[H]	0,0004[H]	0,005[M]	0,13	0,000006	17	6%	1	<0.000006	0,000009	**0,000137**	49	33%	8%	<0.000006	0,000008	***0,00026***	0	-	-	-	-	-
Calcium (Ca)	mg/L	-	-	G	-	-	-	0,02	17	0%	0	0,558	0,791	11,1	49	2%	0%	0,329	0,8	22,8	19	5%	0%	<0,5	0,8	2,6
Total Chromium (Cr)	mg/L	-	CrIII: 0,0089	CrIII: 0,55[H]	CrIII: 0,27[H]	0,05[M]	CrVI: 9,4	0,00004	17	0%	1	0,00029	0,00058	**0,0223**	49	10%	0%	<0.00004	0,00049	<0.005	0	-	-	-	-	-
Cobalt (Co)	mg/L	-	-	0,1	0,37	-	-	0,000005	17	0%	0	0,000035	0,00012	0,00225	49	6%	0%	0,000039	0,00016	<0.001	0	-	-	-	-	-
Copper (Cu)	mg/L	-	0,002[g]	0,0016[HN]	0,0032[HN]	1[O]	38	0,00005	17	0%	1	0,00024	0,0004	***0,00868***	49	6%	2%	0,00012	0,00036	***0,00405***	0	-	-	-	-	-
Iron (Fe)	mg/L	-	0,3	1,3[P]	3,4[P]	0,3Q	-	0,0005	17	0%	4	0,0686	0,165	***10,3***	49	0%	12%	0,064	0,172	**0,704**	19	0%	11%	0,1	0,22	**0,55**
Iron (available fraction)								0,1													19	26%	0%	<0,1	0,11	0,275
Magnesium (Mg)	mg/L	-	-	-	-	-	-	0,01	17	0%	0	0,165	0,266	3,57	49	0%	0%	0,15	0,26	3,81	19	26%	0%	<0,2	0,2	0,85
Manganese (Mn)	mg/L	-	-	0,26[H]	0,6[H]	0,05[Q]	59	0,00003	17	0%	0	0,00144	0,00338	0,0242	49	0%	0%	0,00116	0,0028	0,0188	19	63%	0%	<0,003	<0,003	0,005
Mercury (Hg)	mg/L	-	0,000026	0,00091	0,0016	0,0000018[S]	0,0000018[S]	0,000003	17	65%	17	<0.0000019	0,0000021	0,0000062	49	59%	100%	<0.0000019	0,0000026	<0.000025	0	-	-	-	-	-
Molybdenum (Mo)	mg/L	-	0,073	3,2	29	0,04[R]	10	0,00001	17	0%	0	0,00005	0,00012	0,00073	49	4%	0%	0,00003	0,00008	0,00152	0	-	-	-	-	-
Nickel (Ni)	mg/L	-	0,025[h]	0,007[H]	0,07[H]	0,07[R]	4,6	0,00003	17	0%	1	0,00034	0,00064	*0,0107*	49	6%	0%	0,00018	0,0006	0,00213	0	-	-	-	-	-
Lead (Pb)	mg/L	-	0,001[i]	0,00017[H]	0,004[H]	0,01[M]	0,19	0,00001	17	0%	6	0,00004	0,00014	***0,00577***	49	8%	24%	<0.00001	0,00013	*<0.0005*	0	-	-	-	-	-
Potassium (K)	mg/L	-	-	-	-	-	-	0,01	17	0%	0	0,06	0,233	3,83	49	4%	0%	0,089	0,228	3,84	19	11%	0%	<0,1	0,2	0,9
Selenium (Se)	mg/L	-	0,001	0,005	0,062	0,01[M]	4,2	0,00005	17	29%	2	<0.00005	0,00029	**0,00138**	49	67%	12%	<0.00005	<0.00005	**<0.003**	0	-	-	-	-	-
Silicium (Si)	mg/L	-	-	-	-	-	-	0,02	17	0%	0	1,09	1,54	6,29	37	0%	0%	1,02	1,7	4,47	0	-	-	-	-	-
Sodium (Na)	mg/L	-	-	-	-	-	-	0,00005	17	0%	0	0,431	0,662	14,4	49	2%	0%	0,43	0,69	19,3	19	26%	0%	<0,5	0,56	1,1
Strontium (Sr)	mg/L	-	-	21	40	4	-	0,00005	17	0%	0	0,00531	0,00731	0,228	46	0%	0%	0,0044	0,00736	0,264	0	-	-	-	-	-
Uranium (U)	mg/L	0,033	0,015	0,014[Y]	0,32[Y]	0,02[M]	-	0,000005	17	0%	0	0,000005	0,000008	0,000312	49	24%	0%	0,000004	0,000008	<0.001	0	-	-	-	-	-
Vanadium (V)	mg/L	-	-	0,012	0,11	0,22	2,2	0,00002	17	94%	0	<0.00002	<0.00002	*0,0163*	46	67%	0%	<0.00002	<0.00002	0,00081	0	-	-	-	-	-
Zinc (Zn)	mg/L	-	0,03	0,017[H]	0,017[H]	5[O]	26	0,0005	17	0%	1	0,0006	0,0026	***0,0489***	49	10%	0%	<0.0005	0,0016	0,016	10	100%	0%	<0,002	<0,002	<0,002
Hydrocarbons																										
C_{10}-C_{50} Hydrocarbons	mg/L	-	-	0,010[T]	-	-	-	0,1	17	82%	17	*0,165*	*<0.1*	*0,274*	51	92%	100%	*<0.1*	*<0.1*	*0,2*	19	100%	0%	*<0,1*	*<0,1*	*<0,1*
Propylen glycol	mg/L	-	500	500 [aa]	1 000	580	47 000	5	1	100%	0	0,00144	<5	<5	4	100%	0%	<5	7,5	<10	0	-	-	-	-	-
Bacteriology												<0.0000019														
Atypical Bacteria	nb /membrane	-	-	-	-	-	-	2	-	-	-	0,00005	-	-	0	-	-	-	-	-	0	-	-	-	-	-
Feacal Coliforms	UFC/100 ml	-	-	-	-	200[V]	-	2	-	-	-	0,00034	-	-	0	-	-	-	-	-	0	-	-	-	-	-
Total Coliforms	UFC/100 ml	-	-	-	-	-	-	2	-	-	-	0,00004	-	-	0	-	-	-	-	-	0	-	-	-	-	-
Escherichia coli	UFC/100 ml	-	-	-	-	150[V]	-	2	-	-	-	0,06	-	-	0	-	-	-	-	-	0	-	-	-	-	-
Phenols												<0.00005														

Legend :

bold	**Result above the Canadian guideline for the protection of aquatic life (long term)**
hatched	Result above the Canadian guideline for the protection of aquatic life (short term)
italics	*Result above the Quebec criterion for the protection of aquatic life (chronic effect)*
underlined	Result above the Quebec criterion for the protection of aquatic life (acute effect)
(black frame)	Result above the Quebec criteria for the prevention of contamination (with water intake)
(grey fill)	Result above the Quebec criteria for the prevention of contamination (without water intake)
*	*in situ* Data

Table 3.11 Global descriptive statistics of surface water quality of rivers and lakes for the 2015 to 2019 monitoring campaigns and the 2010 baseline condition

Parameters	Unit	Federal (CCME)		Provincial (MELCC)				LDR 2019	LAKES																	
		Guideline for the protection of aquatic life		Protection of aquatic life		Contamination Prevention			Follow-up 2019						Follow-up 2015 to 2018						Baseline Study 2010					
		Short term	Long term	Chronic Effect	Acute Effect	With drinking water intake	Without drinking water intake		Number of values	%<DL	Non respect criterion(s) (Nb)	Minimum	Median	Maximum	Number of values	%<DL	Non respect criterion(s) (Nb)	Minimum	Median	Maximum	Number of values	%<DL	Non respect criterion(s) (Nb)	Minimum	Median	Maximum
General Parameters																										
Alcalinity	mg/L	-	-	[o]	-	-	-	1	93	8	0	<1	2	12	290	14%	0%	<1	2	15	25	36%	0%	<1	2	7
Ammonia Nitrogen ($N\text{-}NH_3$)	mg/L	-	-	1,23[s]	17,9[s]	0,2[t] et 1,5[u]	-	0,02	93	6	23	<0.02	0,05	*1,39*	290	48%	7%	0,014	0,02	*4,34*	25	100%	0%	<0,06	<0,06	<0,06
Total Nitrogen (N tot)	mg/L	-	-	-	-	-	-	0,3	64	26	0	<0.3	0,434	5,88	254	37%	0%	<0.02	0,3	12,6	0	-	-	-	-	-
Total Kjedahl Nitrogen (TKN)	mg/L	-	-	-	-	-	-	0,3	93	63	0	0,143	<0.3	1,09	121	74%	0%	0,0256	<0.3	3,34	25	44%	0%	<0,4	0,44	0,72
Bromides (Br-)	mg/L	-	-	0,0027	0,0024	-	-	0,1	93	87	0	*<0.1*	*<0.1*	*0,7*	276	93%	0%	*<0.1*	*<0.1*	*0,88*	0	-	-	-	-	-
Total Organic Carbon (COT)	mg/L	-	-	-	-	-	-	0,2	93	0	0	3,43	5,8	10,8	290	0%	0%	1,7	5,16	17,2	0	-	-	-	-	-
Dissolved Organic Carbon (COD)	mg/L	-	-	-	-	-	-	0,2	93	0	0	2,82	5,16	8,18	290	0%	0%	<0.20	4,8	15,2	0	-	-	-	-	-
Chlorophylle A	mg/L	-	-	-	-	-	-	0,00005	12	0	0	0,00009	0,00076	0,0017	44	5%	0%	<0.00005	0,000625	0,00123	0	-	-	-	-	-
Pheopigments	mg/L	-	-	-	-	-	-	0,00005							12	0%	0%	0,0003	0,0005	0,0009	0	-	-	-	-	-
Chlorides (Cl-)	mg/L	640	120	230	860	250	-	0,05	93	0	0	0,087	1,92	50	290	9%	0%	<0.05	0,743	85,9	25	0%	0%	0,05	0,26	0,85
Conductivity *	S/cm	-	-	-	-	-	-	*In situ*	89	0	0	3	23	423	288	1%	0%	<1	24	660	25	0%	0%	6,8	10,8	28,4
BOD_5	mg/L	-	-	3[r]	-	-	-	2	93	88	4	<2	<2	*59*	290	92%	12%	<2	<2	*4*	0	-	-	-	-	-
Chmical Oxygen Demand (COD)	mg/L	-	-	-	-	-	-	3	93	26	0	<3	14	103	291	7%	0%	<3	14	75	0	-	-	-	-	-
Total Hardness ($CaCO_3$)	mg/L	-	-	-	-	-	-	1	93	0	0	1,7	6,24	77	270	0%	0%	1,6	4,61	135	25	72%	0%	<1	<1	14
Fluorides (F-)	mg/L	-	0,12	0,2[z]	4[z]	1,5[A]	-	0,01	93	48	17	<0.01	0,014	***0,4***	290	51%	4%	<0.01	0,051	***0,3***	0	-	-	-	-	-
Total Suspended Solids (TSS)	mg/L	+25[d]	+5[d]	+5 à 25[p]	+25[q]	-	-	1	93	58	1	<1	<1	***22***	291	52%	1%	<0.2	1,6	***23***	25	96%	0%	<3	<3	***19***
Nitrates (NO_3^-)	mg/L	550	13	2,9[w]	-	10[x]	-	0,01	93	8	6	<0.01000	0,22	*7,06*	288	20%	4%	<0.01	0,1465	*12,6*	25	100%	0%	<0,1	<0,1	<0,1
Nitrites (NO_2^-)	mg/L	-	0,06	0,02 à 0,20[y]	0,06 à 0,60[y]	1[x]	-	0,01	93	58	19	<0.01	<0.01	***5,88***	290	85%	15%	<0.01	0,01075	***0,2***	16	100%	0%	<0,02	<0,02	<0,02
Dissolved Oxygen (%)*	%	-	-	54 à 63% [X]	-	-	-	*In situ*	89	0	10	*3,4*	88,5	103,2	288	0%	7%	*2,1*	89,6	113,6	22	0%	0%	65,5	87,5	105
Dissolved Oxygen (mg/l)*	mg/L	-	6,0 à 9,5[b]	5 à 8 mg/l [X]	-	-	-	*In situ*	89	0	7	***0,46***	10,37	30	288	0%	6%	***0,3***	10,2	15,48	22	0%	5%	**5,28**	**8,05**	**9,32**
pH*	pH unit	-	6,5 à 9,0	6,5 à 9,0[j]	5,0 à 9,0[k]	6,5 à 8,5[l]	-	*In situ*	89	0	74	***4,4***	***5,9***	***9,4***	290	0%	84%	***4,0***	***6,1***	7,8	25	0%	68%	***4,7***	***5,9***	7,1
Phenols-4AAP	mg/L	-	-	-	-	-	0,005[U]	0,002	93	37	13	<0.002	0,002	0,01	266	39%	32%	<0.002	0,003	0,018	0	-	-	-	-	-
Total Phosphorus (P)	mg/L	-	0,004 à 0,01[e]	0,02, 0,03 ou >50%[v]	-	-	-	0,0006	93	3	19	<0.0006	*0,0038*	***0,152***	290	6%	4%	0,0000036	*0,0036*	***0,0216***	25	40%	8%	***<0,005***	***0,006***	***0,022***
Redox Potential *	mV	-	-	-	-	-	-	*In situ*	57	0	0	109,0	257,8	374,5	77	0%	0%	156,8	292,1	395	25	0%	0%	105,0	232,9	293,3
Total Dissolved Solids	mg/L	-	-	-	-	-	-	9	93	4	0	<9	30	258	291	16%	0%	<9	24	360	25	64%	0%	<25	<25	57
Total Solids	mg/L	-	-	-	-	-	-	4	93	4	0	16	32	262	291	8%	0%	<4	30	362	0	-	-	-	-	-
Sulphates (SO_4^{2-})	mg/L	-	-	500[B]	500[B]	500[C]	-	0,08	93	0	0	0,558	3,41	101	288	4%	0%	0,0006	2,3	49,3	25	92%	0%	<2	<2	6,75
Temperature*	°C	[a]		[w]	-	-	-	*In situ*	89	0	0	-0,2	7,5	20,4	288	0%	0%	0	8,05	22,3	25	0%	0%	12,09	15,99	26,7
Transparency*	m	-	-	-	-	-	-	*In situ*	10	0	0	2,75	3,00	3,25	105	0%	0%	0,3	3,00	5,50	0	-	-	-	-	-
Turbidity*	UTN	+8[c]	+2[c]	+2[m]	+8[n]	-	-	*In situ*	70	0	0	0	0	***3,6***	288	0%	0%	0	0,1	***11,4***	25	0%	0%	0	0,87	***29,5***
Metals																										
Aluminium (Al)	mg/L	-	0,005 et 0,1[f]	0,087[D]	0,75[E]	0,2 [F]	-	0,0005	93	0	93	**0,0561**	***0,107***	***0,183***	289	0%	100%	0,0011	***0,123***	***0,343***	25	32%	68%	**<0,03**	**0,08**	***0,87***
Aluminum (available fraction)	0							0,03													25	40%	0%	<0,03	*0,0462*	*0,3102*
Antimony (Sb)	mg/L	-	-	0,24	1,1	0,006[G]	0,64	0,000005	93	77	0	<0.000005	<0.000005	0,000815	289	50%	0%	<0.000005	0,000009	<0.001	0	-	-	-	-	-
Silver (Ag)	mg/L	-	0,00025	-	-	-	-	0,000003	93	65	11	<0.000003	<0.000003	**<0.0003**	277	84%	0%	<0.000003	<0.000003	<0.00015	0	-	-	-	-	-
Arsenic (As)	mg/L	-	0,005	0,15[J]	0,34[J]	0,0003[K]	0,021[L]	0,00008	93	54	4	<0.00008	<0.00008	**<0.008**	289	57%	8%	<0.00008	0,00008	0,00282	0	-	-	-	-	-
Baryum (Ba)	mg/L	-	-	0,038[H]	0,11[H]	1[M]	160	0,00003	93	0	0	0,00255	0,00417	0,0213	289	0%	0%	0,0013	0,00419	*0,0762*	0	-	-	-	-	-
Beryllium (Be)	mg/L	-	-	-	-	-	-	0,000006	93	11	0	<0.000006	0,000008	<0.0006	289	51%	0%	<0.000006	<0.00001	<0.002	0	-	-	-	-	-
Boron (B)	mg/L	29	1,5	5	28	0,2	160	0,0003	93	15	0	<0.0003	0,0051	0,0997	289	22%	0%	<0.0003	0,0016	0,192	0	-	-	-	-	-
Cadmium (Cd)	mg/L	0,001	0,00009	0,0002[H]	0,0004[H]	0,005[M]	0,13	0,000006	93	14	2	<0.000006	0,000011	***<0.0006***	289	24%	5%	<0.000006	0,000008	**<0.0002**	0	-	-	-	-	-
Calcium (Ca)	mg/L	-	-	G	-	-	-	0,02	93	0	0	0,47	1,89	26,9	289	0%	0%	0,324	1,3	43	25	8%	0%	<0,5	0,7	2,85
Total Chromium (Cr)	mg/L	-	CrIII: 0,0089	CrIII: 0,55[H]	CrIII: 0,27[H]	0,05[M]	CrVI: 9,4	0,00004	93	1	1	<0.00004	0,00047	**0,072**	289	8%	0%	<0.00004	0,00038	<0.005	0	-	-	-	-	-
Cobalt (Co)	mg/L	-	-	0,1	0,37	-	-	0,000005	93	1	0	<0.000005	0,00011	0,00158	289	4%	0%	<0.000005	0,00013	0,00172	0	-	-	-	-	-
Copper (Cu)	mg/L	-	0,002[g]	0,0016[HN]	0,0032[HN]	1[O]	38	0,00005	93	1	4	0,00024	0,00039	***<0.005***	289	4%	2%	<0.00005	0,00033	***0,0147***	0	-	-	-	-	-
Iron (Fe)	mg/L	-	0,3	1,3[P]	3,4[P]	0,3Q	-	0,0005	93	0	7	0,0034	0,101	***2,88***	289	0%	5%	<0.0005	0,103	***2,34***	25	48%	12%	<0,1	0,1	**0,8**
Iron (available fraction)								0,1													25	64%	0%	<0,1	<0,1	**0,35**
Magnesium (Mg)	mg/L	-	-	-	-	-	-	0,01	93	0	0	0,129	0,348	3,95	289	0%	0%	<0.01	0,33	6,62	25	20%	0%	<0,2	0,2	2,3
Manganese (Mn)	mg/L	-	-	0,26[H]	0,6[H]	0,05[Q]	59	0,00003	93	0	1	0,00142	0,0035	0,07	289	0%	1%	0,00163	0,00453	0,0795	25	48%	0%	<0,003	0,003	0,012
Mercury (Hg)	mg/L	-	0,000026	0,00091	0,0016	0,0000018[S]	0,0000018[S]	0,000003	93	76	93	<0.0000019	<0.0000019	0,0000058	289	70%	100%	<0.0000019	<0.000002	<0.000025	0	-	-	-	-	-
Molybdenum (Mo)	mg/L	-	0,073	3,2	29	0,04[R]	10	0,00001	93	1	0	0,00004	0,00068	0,0204	289	5%	0%	0,00001	0,00021	0,0109	0	-	-	-	-	-
Nickel (Ni)	mg/L	-	0,025[h]	0,007[H]	0,07[H]	0,07[R]	4,6	0,00003	93	1	1	<0.00003	0,00079	*0,017*	289	4%	0%	<0.00003	0,00074	0,00485	0	-	-	-	-	-
Lead (Pb)	mg/L	-	0,001[i]	0,00017[H]	0,004[H]	0,01[M]	0,19	0,00001	93	1	9	0,00003	0,00008	*<0.001*	289	5%	9%	<0.00001	0,00007	*0,00063*	0	-	-	-	-	-
Potassium (K)	mg/L	-	-	-	-	-	-	0,01	93	1	0	0,102	0,385	9,07	289	3%	0%	<0.01	0,421	7,8	25	12%	0%	<0,1	0,2	1
Selenium (Se)	mg/L	-	0,001	0,005	0,062	0,01[M]	4,2	0,00005	93	24	7	<0.00005	0,00022	***0,01***	289	68%	6%	<0.00005	<0.00005	**<0.003**	0	-	-	-	-	-
Silicium (Si)	mg/L	-	-	-	-	-	-	0,02	93	0	0	1,02	1,4	5,29	198	0%	0%	0,881	1,52	4,51	0	-	-	-	-	-
Sodium (Na)	mg/L	-	-	-	-	-	-	0,00005	93	0	0	0,348	1,61	32,2	289	0%	0%	0,0088	1,03	34,9	25	56%	0%	<0,5	<0,5	1,25
Strontium (Sr)	mg/L	-	-	21	40	4	-	0,00005	93	0	0	0,00473	0,022	0,677	277	0%	0%	0,00015	0,0135	0,41	0	-	-	-	-	-
Uranium (U)	mg/L	0,033	0,015	0,014[Y]	0,32[Y]	0,02[M]	-	0,000005	93	4	0	<0.000005	0,000016	<0.0005	289	9%	0%	0,000004	0,00001	<0.001	0	-	-	-	-	-
Vanadium (V)	mg/L	-	-	0,012	0,11	0,22	2,2	0,00002	93	93	0	<0.00002	<0.00002	<0.002	277	64%	0%	<0.00002	<0.00002	0,00731	0	-	-	-	-	-
Zinc (Zn)	mg/L	-	0,03	0,017[H]	0,017[H]	5[O]	26	0,0005	93	1	1	<0.0005	0,0029	***0,094***	289	4%	0%	<0.0005	0,0022	*0,0181*	9	100%	0%	<0,002	<0,002	<0,002
Hydrocarbons																										
C_{10}-C_{50} Hydrocarbons	mg/L	-	-	0,010[T]	-	-	-	0,1	93	78	93	*<0.1*	*<0.1*	*15,5*	291	95%	100%	*<0.1*	*<0.1*	*0,2*	24	96%	4%	*<0,1*	*<0,1*	*0,42*
Propylen glycol	mg/L	-	500	500 [aa]	1 000	580	47 000	5	1	1	0	<5	<5	<5	4	100%	0%	<5	7,5	<10	0	-	-	-	-	-
Bacteriology																										
Atypical Bacteria	nb /membrane	-	-	-	-	-	-	2	12	4	0	<2	56	240	34	6%	0%	1	105	980	0	-	-	-	-	-
Feacal Coliforms	UFC/100 ml	-	-	-	-	200[V]	-	2	16	14	0	<2	<2	2	48	75%	0%	0	<2	<10	0	-	-	-	-	-
Total Coliforms	UFC/100 ml	-	-	-	-	-	-	2	16	0	0	6	98	860	46	15%	0%	0	32,5	470	0	-	-	-	-	-
Escherichia coli	UFC/100 ml	-	-	-	-	150[V]	-	2	16	15	0	<2	<2	2	50	86%	0%	0	<2	<10	0	-	-	-	-	-
Phenols																										

Legend :

bold	**Result above the Canadian guideline for the protection of aquatic life (long term)**
hatched	Result above the Canadian guideline for the protection of aquatic life (short term)
italics	*Result above the Quebec criterion for the protection of aquatic life (chronic effect)*
underlined	Result above the Quebec criterion for the protection of aquatic life (acute effect)
	Result above the Quebec criteria for the prevention of contamination (with water intake)
	Result above the Quebec criteria for the prevention of contamination (without water intake)
*	*in situ* Data

This indicates that there is no direct correlation between the ammonium nitrogen concentration in surface water and the final mine effluent discharged (Tetra Tech, 2020b).

In addition, some ammonium nitrogen concentrations measured in 2019 are higher at certain sampling stations, without any clear geographical trend. There does not seem to be any trend in the changes in ammonium nitrogen concentrations based on the location of sampling stations.

On the basis of seasonal variations, the ammonium nitrogen concentration in 2019 was higher in summer in the diffusion zone, the deepest area in Lake Lagopede. As a point of comparison, in 2018, the ammonium nitrogen concentration was higher in the same effluent diffusion zone, but in the spring and fall (Tetra Tech, 2020b).

Bear in mind that the summer thermocline forms at this deepest point in the lake (AQR69 station) and momentarily blocks dilution of substances throughout the entire water column owing to low oxygen concentrations. This natural situation therefore maintains nitrogen in the form of ammonium nitrogen.

In 2020, the Renard mine will continue its efforts to control ammonium nitrogen at source (see Chapter 4). With monitoring in 2020 we will continue to evaluate the effectiveness of the MWWTP's mine water treatment system. The focus will be to shed light on certain sectors with particularly high ammonium nitrogen concentrations, specifically on a seasonal basis.

Biochemical Oxygen Demand (BOD$_5$)

BOD$_5$ sheds light on the level of biodegradable organic matter in the aquatic environment. BOD$_5$ has been increasing in lakes and streams since 2015. In 2019, the mean concentration of BOD$_5$ in Lake Lagopede in certain areas exceeded the MELCC's criteria (3 mg/L) for the protection of aquatic life (chronic effects) on two occasions:

- in the fall immediately downstream of the domestic effluent outfall (station AQR63), a situation that was forecast in the impact assessment (Roche, 2011a) (max of 4 mg/L);
- and for the first time since 2010, upstream of mining activities (station AQH1) (mean of 8 mg/L; maximum of 59 mg/) in summer;

Future monitoring will help identify the source of the organic substances observed in Lake Lagopede, specifically upstream of mining activities.

Heavy Metals

In 2019, a majority of the parameters analyzed generally complied with MELCC and CCME criteria. The concentrations of most metals in surface water are low and near detection limits (Tetra Tech, 2020b), as was observed in the 2011 impact assessment (Roche, 2011b).

Note that in the 2010 baseline study (Roche, 2011b) and as part of the 2015-2016 monitoring (Stornoway, 2017a), natural concentrations (natural geochemical background levels) were recorded for some metals including aluminum, beryllium, copper, mercury and lead. These concentrations in fact exceeded at least one of the criteria for the protection of aquatic life.

In the study area, therefore, the natural geochemical background, which is influenced by the geology of the area, contains metals. It is therefore not surprising that metals were detected in water samples at concentrations that were naturally greater than surface water quality criteria.

In 2019 for example maximum copper and lead concentrations were measured upstream of the effluent, i.e., outside areas exposed to mining activities (Map 3.8).

Maximum concentrations of chromium, iron, nickel and selenium as well as PH C10-C50 were also measured at the control stations (e.g., AQH3 and AQH5) as well as stations exposed to mining activities.

As anticipated, these concentrations exceeded MELCC criteria for the protection of aquatic life (chronic effects) and the criterion recommended by the CCME for the protection of aquatic life (long term) (Table 3.11). Also, note that the values were the highest values measured since 2010.

Maximum concentrations of other metals, such as arsenic, cadmium and manganese, were measured. They were found to be comparable with 2015-2018 values and to exceed the criteria (Table 3.11). This trend should be confirmed in future monitoring to determine whether a gradual change has occurred in natural conditions in relation to the baseline.

Petroleum hydrocarbons C_{10}-C_{50}

As in the case of metals, the concentrations of petroleum hydrocarbons (PH) C10-C50 measured in surface water in the 2010 baseline and before mining operations were launched (2015) were already higher than MELCC criteria for the protection of aquatic life (chronic effects). The degradation of organic matter in fens and bogs in the study area could well explain the sporadic natural presence of PH C10-C50 (Tetra Tech, 2020b).

In 2019, C10-C50 hydrocarbon concentrations exceeded the MELCC's criterion for the protection of aquatic life (chronic effects) throughout almost the entire sampling area, i.e., 12 of the 18 surface water sampling stations, including three stations in the control area (AQH3, AQH5 and AQR77). It was however not feasible to identify the source of the increased concentrations measured in 2019.

Impact of the Hydrological Regime

Water quality in the streams and lakes in the study area is aligned with the natural hydrological regime associated with Lake Lagopede. The projected mine effluent dispersion conditions described in 2017 (Englobe, 2017) along with the natural geochemical background levels could well influence the concentrations measured for some metals.

Winter and summer thermoclines could affect effluent dispersion as described in the effluent dispersion model (Englobe, 2017). Thermoclines naturally restricts plume dispersion throughout the entire water column and prevent water mixing.

Contaminants, such as ammonium nitrogen, discharged in the north basin of Lake Lagopede therefore accumulate at the bottom of the lake, especially during the summer low-flow period, when effluent mixing is limited to the area near the discharge point (Englobe, 2017).

It is therefore natural that substances sampled on the surface and at the bottom of the water column present varying concentrations. The differences vary with the seasons and the depth in the water column, as was found in the 2019 monitoring results.

In 2019, the differences observed in metal concentrations on the surface and bottom of Lake Lagopede are particularly marked in March, June and July, but disappeared in October (Tetra Tech, 2020b).

Notwithstanding the anticipated influence of Lake Lagopede's hydrological regime on effluent dispersion (Englobe, 2017), the maximum concentrations of heavy metals and PH C_{10}-C_{50} measured in the lakes and streams in 2019, including the control stations, cannot be attributed to the final mine effluent from Renard mine.

Water quality surveys in 2020 will help identify trends and confirm surface water quality conditions or changes in baseline conditions.

3.6.4.3 Conclusion

Surface water quality results are largely comparable to 2010 baseline conditions, as well as the 2015 to 2018 monitoring results. Maximum concentrations of total phosphorus, BOD_5, ammonium nitrogen and PH C_{10}-C_{50} were the highest since 2015 in the control area as well as the area exposed to mining activities.

There was however no clear trend in terms of geographical distribution or seasonal variation that would explain the increase. The 2019 monitoring results simply seem to indicate that the natural lake and stream conditions in the receiving environment have evolved since 2010, specifically in terms of the hydrological regime described above.

Although some parameters are an exception, the annual change in concentrations of various parameters in the 2017, 2018 and 2019 monitoring remain strongly tied to alternating thermoclines and seasonal mixing of the water column, as predicted in the effluent dispersion model.

Future surface water quality monitoring will help validate any trends upstream of mining activities in 2019 and determine any change in the baseline conditions. In this regard, statistical analyses will be required to determine whether the physical-chemical characteristics of the receiving environment have changed significantly.

3.6.5 Sediment Quality

Sediments are recognized as the ultimate sink for contaminants, metals and organic matter (Roche, 2011a). Monitoring sediment quality is therefore essential for evaluating any potential impact of mining activities.

3.6.5.1 Monitoring frequency

Sediment quality monitoring was carried out in 2019 as per the schedule set out in the environmental monitoring program (Norda Stelo, 2016). Sampling was done during the fall flood in October 2019 at each of the 19 stations specified in the ESMP in the mine and airstrip areas.

3.6.5.2 2019 Results

A summary of the descriptive statistics on sediment quality results from the 2019 fall sampling campaign is provided in Table 3.12, and the results are compared with criteria presented in the Environment Canada and MDDEP document (2007).

The 2019 sediment results are generally comparable with 2010 baseline conditions (Roche, 2011b) and monitoring results prior to the start-up of operations (2015), as well and the 2017 and 2018 monitoring results during operations.

Particle Size and Physical-Chemical Characteristics

The sediment on the bottom of lakes and streams in the study area consists primarily of fine sediment, which is moreover rich in organic matter (Roche, 2011a). It is therefore not surprising that samples from the 2019 campaign consisted mostly of silt and sand size particles (Table 3.12).

In 2019, sediment in the study area consisted mostly of silt, as in 2018 and 2017. This particle size distribution was found in the same proportions in the control station (AQH3) as well as the stations exposed to the mine effluent outfall (AQR69, AQR65) and the domestic effluent outfall (AQR63, AQR64).

Note that lake turbidity in 2019 was lower than in 2010 baseline conditions, and it declined in relation to 2015-2018 monitoring results. In addition, total suspended particulate (TSP) concentrations have been relatively stable over the years the mine has been in operation (20-15 to 2018) (see Table 3.11) and the maximum concentration was recorded near the domestic effluent outfall (Map 3.8), as anticipated in the 2011 impact assessment (Roche, 2011a). Sediment samples collected in 2019 from lakes and streams in the mine and airstrip areas were quite acidic (4.95 to 6.33) as in the 2010 baseline (3.90 to 5.64).

Nutrients

Note that the proportion of fine sediments is correlated with total phosphorus and total organic carbon (TOC) concentrations. Total phosphorus therefore serves as a good indicator of sediment quality in Lake Lagopede (Roche, 2011a). TOC for its part is used to assess the quantity of organic matter present in sediment samples (CEAQ, 2014).

In 2019, the mean phosphorus concentration measured in sediments is slightly lower (737 mg/kg) than that measured in 2017 (781 mg/kg). Moreover, as anticipated in the impact assessment (Roche, 2011a), the results from station AQR63 seem at first glance to indicate localized enrichment of sediments just downstream of the mine effluent discharge point (Table 3.12). Sediments surveyed in 2019 contained highly variable quantities of total organic carbon (TOC) (from 0.24% to 66%) that exceed the quantities measured in 2107 and 2018.

Other parameters that are indicators of sediment quality, such as calcium and magnesium concentrations in 2019, were in 2019 highly variable at stations located near the mine site (AQR10 and AQR11) and near the mine effluent diffuser (AQR65 and AQR69). The only trend observed at these stations was a slight fluctuation since 2017 in the concentrations of calcium and magnesium in sediments.

Nitrogen Compounds

In 2019, nitrogen compounds measured in sediment were present in low concentrations, all sectors combined. The 2019 concentrations are comparable with those measured in 2015 prior to mining operations and those measured in 2018 during operations, and are below those measured in 2017 during operations, all sectors combined.

In the mine area, nitrogen compounds measured upstream and downstream from the effluent discharge point are comparable and of the same order of magnitude. The same applies to nitrogen compound concentrations measured in the airstrip area (Table 3.12).

Heavy Metals

Most of the metals, detected in sediments in 2010, including cadmium, lead, selenium and mercury, which are part of the natural geochemical background of streams and lakes in the mine area, tend to be absorbed by fine sediments like sand and silt and the organic matter they contain (Roche, 2011a).

That is why cadmium and mercury were detected in sediments in the 2019 sampling campaign (Table 3.12), as in the 2010 baseline study and the 2015, 2017 and 2018 monitoring programs (Tetra Tech, 2020b).

In 2019, metal concentrations in sediments varied significantly from station to station, and those with the highest concentrations were located near the treated mine wastewater diffuser and in the south basin of Lake Lagopede (Tetra Tech, 2020b).

The mean mercury concentration in 2019 was lower than in 2018, and it complied with almost all the criteria. The maximum mercury concentration measured in the fall as part of 2010 baseline conditions in the control area (Lake F2607), exceeded all sediment quality criteria (except the CEC criterion) (ECCC and MDDEP, 2007) (Table 3.12). As in the 2010 baseline and the 2015 to 2018 monitoring campaigns, the maximum mercury concentration measured in sediment in 2019 exceeded the REC criterion.

An increase in mercury concentrations has been observed since 2017, at the control station (AQH1) as well as the exposed area (AQR69), all sectors combined (Map 3.8).As for lead, the median concentration in 2019 was comparable with concentrations measured in the 2010 baseline as well as the 2015-2016 monitoring campaigns. It remains well within sediment quality criteria (ECCC and MDDEP, 2007). The analysis of metal concentrations in 2019 sediment samples therefore revealed no difference between stations located upstream and downstream of the mine effluent diffuser.

To conclude, the 2019 monitoring results indicate a change in the particle size distribution throughout the sampled area, i.e., upstream and downstream of mining activities. In addition, there appears to have been a general increase in mercury concentrations throughout the study area. No clear trend could be established for analyzing the impact of mine effluent on sediment quality (Tetra Tech, 2020b).

3.6.6 Comparison of Monitoring Results

SWY has compiled historical data on water and sediment quality in the study area from the baseline conditions established in 2010, the 2015-2016 monitoring programs, and for control and exposed (mine and airstrip) areas since the start of operations.

As planned, data from 2017 and 2019 were compared with historical data (2010 and 2015) to determine whether surface water and sediment quality measured between 2017 and 2019 differed significantly from historical data.

In relation to 2010, concentrations for all the water quality monitoring parameters showed an upward trend throughout the sampling area, both upstream and downstream of mining activities (Tetra Tech, 2020b).

These results do not seem to point to drier hydrological conditions as a cause given that meteorological (precipitation and temperature) and hydrological (peak floods) data for 2019 are comparable with control conditions (Grande Rivière, 1981-2010). Refer to section 3.1.2 for further information.

Between 2017 and 2019, in the operation sector near the processed kimberlite containment (MPKC) facility as well as upstream and downstream of the effluent diffuser, variations in surface water quality do not point to any significant trend involving all the study parameters (Tetra Tech, 2020b). The same applies when seasonal data are compared; no correlation can be clearly demonstrated.

The same observation applies to sediments: variations in metal concentrations provide no clear picture of the change in sediment quality whether in relation to the 2010 baseline conditions, or since facilities were brought online. When 2017, 2018 and 2019 values are compared, no clear trend emerges.

In short, it is not possible to demonstrate beyond a reasonable doubt that surface water and sediment quality have deteriorated or improved over time.

To conclude, the short time span for the data (three years of operation from 2017 to 2019) does not currently make it possible to detect a clear trend in the temporal evolution or spatial distribution of surface water and sediment quality in the study area.

The next three-year monitoring period (2020 to 2022) will shed light on whether a temporal evolution or spatial distribution can be detected in the water and sediment quality monitoring results.

3.6.7 Depollution Attestation Requirements

A depollution attestation (Authorization No. 2019-10002) was issued to Stornoway by the MELCC on November 15, 2019. A municipal depollution attestation (MDA) is a legal document that regulates the operation of a wastewater treatment plant.

The depollution attestation requires that all equipment, systems, existing facilities, or facilities required under the environmental authorization be maintained in good operating condition at all times. Conditions 4.1 and 4.2 set out in the depollution attestation specifically address surface water quality monitoring. The results of monitoring required by the attestation will be provided in 2021.

Table 3.12 General descriptive statistics for stream and lake sediment quality for the fall 2018 and 2019 monitoring campaigns and the 2010 baseline study

		Sediment Quality Criteria*					Summer 2010							Fall 2018							Fall 2019						
Parameters	Unit	CER	CSE	CEO	CEP	CEF	RDL	NB of value	%<RDL	Non-complianc e with criteria	Minimum	Median	Maximum	RDL	NB of value	%<RDL	Non-compliance with criteria	Minimum	Median	Maximum	RDL	NB of value	%<RDL	Non-compliance with criteria	Minimum	Median	Maximum
General Parameters																											
Total Kjedahl Nitrogen	mg/kg N	-	-	-	-	-	–	–	–	–	–	–	–	50	19	21%	-	25	207	9640	90	19	0%	-	135	4660	10300
Total Organic Carbon	% g/g	-	-	-	-	-	–	25	0%	–	0,33	1,3	39	0,05	19	0%	-	0,36	9,53	38,2	0,05	19	0%	-	0,24	9,34	66,36
Nitrates	mg/kg N	-	-	-	-	-	–	–	–	–	–	–	–	0,2	19	42%	-	<0,2	0,5	1,7	0,2	19	58%	-	<0.2	<0.2	3,2
Nitrites	mg/kg N	-	-	-	-	-	–	–	–	–	–	–	–	0,2	19	84%	-	<0,2	<0,2	1	0,2	19	89%	-	<0.2	<0.2	0,4
Total Phosphorus	mg/kg	-	-	-	-	-	20	25	0%	–	150	360	920	10	19	84%	-	<10	<10	1290	40	19	0%	-	82	599	2050
Total Volatil Solids (at 550°C)	mg/kg	-	-	-	-	-	-	-	-	-	-	-	-	2000	19	0%	-	4310	26000	76200	2000	19	0%	-	2250	24000	72900
Sulphates (available)	mg/kg	-	-	-	-	-	–	–	–	–	–	–	–	1	19	0%	-	13	143	454	1	19	16%	-	<100	810	2050
Total Sulfur	mg/kg	-	-	-	-	-	-	-	-	-	-	-	-	100	19	21%	-	<100	1120	3040	100	-	-	-	-	-	-
Total Sulfur	% g/g	-	-	-	-	-	0	25	0%	–	0,07	0,14	0,46	-	-	-	-	-	-	-	-	-	-	-	-	-	-
pH	pH	-	-	-	-	-	–	23	0%	–	3,9	4,9	5,64	NA	19	0%	-	5,23	5,76	6,19	NA	19	-	-	4,95	5,76	6,33
REDOX Potential	mV	-	-	-	-	-	–	–	–	–	–	–	–	5	19	0%	-	242	270	324	NA	19	0%	-	40	158	371
Métals and metalloids																											
Aluminium	mg/kg	-	-	-	-	-	–	–	–	–	–	–	–	10	19	0%	-	1480	7710	22500	10	19	0%	-	2130	8970	23200
Antimony	mg/kg	-	-	-	-	-	–	–	–	–	–	–	–	0,5	19	100%	-	<0,5	<0,5	<0,5	0,5	19	100%	-	<0,5	<0,5	<0,5
Silver	mg/kg	-	-	-	-	-								0,5	19	95%	-	<0,5	<0,5	0,6	0,5	19	100%	-	<0,5	<0,5	<0,5
Arsenic	mg/kg	4,1	5,9	(1) **7,6**	17	23	0,5	25	56%	0%	<0,5	<0,5	3,55	0,2	19	26%	5,3%	<0,2	0,5	**8,7**	0,2	19	16%	-	<0.2	1	2,1
Baryum	mg/kg	-	-	-	-	-	–	–	–	–	–	–	–	1	19	0%	-	7	43	111	1	19	0%	-	9	43	80
Boron	mg/kg	-	-	-	-	-	–	–	–	–	–	–	–	5	19	21%	-	<5	13	86	5	19	53%	-	<5	<5	69
Beryllium	mg/kg	-	-	-	-	-	-	-	-	-	-	-	-	0,5	19	100%	-	<0,5	0,5	0,5	0,5	19	100%	-	<0,5	<0,5	<0,5
Cadmiun	mg/kg	(2) **0,33** (5)	0,6	1,7	3,5	12	0,2	25	88%	8%	<0,2	<0,2	**0,5**	0,1	19	58%	10,5%	<0,1	0,1	**0,5**	0,1	19	26%	26,3%	<0.1	0,3	0,5
Calcium	mg/kg	-	-	-	-	-	–	–	–	–	–	–	–	20	19	0%	-	332	2050	7220	20	19	0%	-	349	1790	3870
Total Chromium	mg/kg	(5) **25** (13)	(6) **37** (5)	57	90	120	1	25	0%	36%	3	17	**210**	1	19	0%	57,9%	7	**26**	**49**	1	19	0%	68,4%	8	30	**50**
Cobalt	mg/kg	-	-	-	-	-	1	25	32%	0%	<1	1	23	1	19	11%	-	1	6	37	0,1	19	0%	-	1,4	7,1	25,3
Copper	mg/kg	(2) **22** (2)	36	63	200	700	1	25	0%	8%	1	6	**25,5**	1	19	11%	10,5%	1	13	**23**	1	19	0%	10,5%	2	9	23
Iron	mg/kg	-	-	-	-	-	10	25	0%	0%	820	3700	30000	10	19	0%	-	1650	10200	32400	10	19	0%	-	2560	14000	72600
Magnesium	mg/kg	-	-	-	-	-	10	25	0%	0%	170	810	8850	5	19	0%	-	613	1160	3150	5	19	0%	-	584	1320	3430
Manganese	mg/kg	-	-	-	-	-	1	25	0%	0%	6	26	490	1	19	0%	-	16	65	699	1	19	0%	-	16	87	476
Mercury	mg/kg	(2) **0,094** (5)	(2) **0,17** (4)	(1) **0,25** (4)	(4) **0,49** (1)	(3) **0,87**	0	25	44%	16%	<0,01	0,01	**0,16**	0,01	19	21%	63,2%	<0,01	**0,19**	**1,4**	0,01	19	21%	26,3%	<0.01	0,06	**0,55**
Molybdenum	mg/kg	-	-	-	-	-	1	25	36%	0%	<1	1	6	1	19	37%	-	<1	2	6	0,5	19	21%	-	<0,5	2	4,5
Nickel	mg/kg	-	-	47	-	-	0,5	25	0%	12%	2	9,7	**81**	1	19	0%	0,0%	3	14	27	0,5	19	0%	-	4,3	13,7	25,5
Lead	mg/kg	(2) **25**	(1) **35**	52	91	150	1	25	0%	0%	2	5	22	1	19	5%	10,5%	1	4	**35**	1	19	5%	-	<1	4	20
Potassium	mg/kg	-	-	-	-	-	–	–	–	–	–	–	–	20	19	0%	-	161	507	957	20	19	0%	-	141	584	1720
Selenium	mg/kg	-	-	-	-	-	0,5	25	84%	0%	<0,5	<0,5	1,1	0,5	19	68%	-	<0,5	<0,5	1,3	0,5	19	74%	-	21	75	234
Silicium	mg/kg	-	-	-	-	-	–	–	–	–	–	–	–	20	19	0%	-	238	686	1680	20	19	0%	-	<0,5	<0,5	1
Sodium	mg/kg	-	-	-	-	-	–	–	–	–	–	–	–	10	19	0%	-	15	83	250	10	19	0%	-	122	785	1140
Strontium	mg/kg	-	-	-	-	-	–	–	–	–	–	–	–	10	19	42%	-	<10	18	68	10	19	37%	-	<10	17	42
Uranium	mg/kg	-	-	-	-	-								10	19	100%	-	<10	<10	<10	10	19	100%	-	<10	<10	<10
Vanadium	mg/kg	-	-	-	-	-								5	13	15%	-	<5	13	39	-	-	-	-			
Zinc	mg/kg	80	120	170	310	770	5	25	12%	0%	<5	9	55	2	19	0%	0,0%	4	22	54	2	19	0%	-	5	34	54
Composés organiques																											
C_{10}-C_{50} Hydrocarbons	mg/kg	-	-	-	-	-	100	25	84%	–	<100	<100	190	50	19	47%	-	<50	67	256	50	19	42%	-			
Volatile Matters (at 550 °C)	% g/g	-	-	-	-	-	–	25	-	–	0,7	4,1	87	-	-	-	-	-	-	-	-	-	-	-			
Grain size distribution																											
Clay (<0,0039 mm)	%	-	-	-	-	-	0,1	25	0%	-	1,1	6,8	67	0,01	18	67%	-	<0,01	<0,01	0,12	0,01	19	74%	-	<0,01	<0,01	5,09
Silt (0,0039 to 0,063 mm)	%	-	-	-	-	-	0,1	25	0%	-	0,9	7,4	56	0,01	18	0%	-	0,37	33,985	79,54	0,01	19	0%	-	2,03	69,5	97,65
Sand (0,063 to 2 mm)	%	-	-	-	-	-	0,1	25	0%	-	4,6	67,5	94	0,01	18	0%	-	15,93	49,93	98,38	0,01	19	0%	-	2,37	21,7	88,71
Gravel (2 to 32 mm)	%	-	-	-	-	-	0,1	25	4%	-	<0,1	4,5	35	0,01	18	50%	-	<0,01	0,02	70,12	0,01	19	68%	-	<0,01	<0,01	77,65

(1) 0,5 (2) Exceeding criteria. Numbers in brackets on the left are the number of samples exceeding the criteria for 2018 and on the right for 2019.

CER Concentration of rare effects
CSE Threshold concentration producing an effect
CEO Concentration of occasional effects
CEP Concentration producing a probable effect
CEF Concentration of frequent effects
* Source : EC and MDDEP, 2007. Criteria for the assessment of sediment quality in Quebec and application frameworks: prevention, dredging and remediation. 30 pages + appendices

3.6.8 2020 Monitoring

Current water and sediment quality monitoring required under the Global CA (MDEFPP, 2012) will continue in 2020.

The upward trend in the number of samples whose phosphorus concentration exceeds applicable criteria at both control and exposed stations will be verified in 2020 monitoring.

Monitoring in 2020 could also provide further information on changes in historical maximum concentrations for this parameter, specifically during the summer period (Tetra Tech, 2020b).

The pH, which is an indicator of the accumulation of mine effluent at the bottom of Lake Lagopede, especially in the presence of a thermocline, will continue to be measured in 2020, as required.

A focus on pH values measured in the surface water at stations near the diffuser (AQR65 and AQR69) will help document the potential effects on water quality, the thermocline, and consequently the accumulation of mine effluent at the deepest part of Lake Lagopede.

In 2020, another water and sediment quality monitoring program should be undertaken in parallel with the first cycle of the EEM biological monitoring initially scheduled for 2019, then delayed until the fall 2020 (see section 3.8 for further information).

The components associated with this monitoring were specified in the 2019 update to the environmental monitoring program (Norda Stelo, 2019a).

The results from this monitoring will help determine the precise frequency of subsequent EEM campaigns. This first cycle of the EEM, which includes biological monitoring of fish, will enable SWY to determine the precise effects of the temporary increase in pH recorded in recent years on a seasonal basis.

3.6.9 Monthly Temperature and Conductivity Monitoring at the Mine Effluent Outfall

Lake Lagopode is a dimictic lake, which means water mixing occurs at least twice yearly in the spring and fall, and the different water layers in the water column are mixed together including the bottom layer where treated mine effluent is discharged into the lake.

Effluent discharge objectives (EDOs) for mine effluent were in fact determined on the basis of these assumptions in order to protect the ecosystem even during low-flow periods.

Since the treated mine water that is discharged into the lake is warmer and ion-rich, temperature and conductivity represent two good indicators for monitoring final mine effluent. Monthly monitoring of water conductivity and temperature was initiated in September 2015.

This monitoring entails measuring the distribution of temperature and conductivity every metre in the water column on a monthly basis. Temperature measurements illustrate thermal stratification and hence the presence of a thermocline.

Also, since it has been established that the conductivity of mine effluent would be higher than the low- conductivity of water in the receiving environment, conductivity monitoring helps determine any potential accumulation of final mine effluent below the thermocline and define the dispersion plume of the final mine effluent.

3.6.9.1 Monitoring frequency

Monthly data collection began once mine effluent was produced in April 2016, continued through 2019 and will continue in 2020, i.e., for three years following the start of operations during which effluent is generated.

In 2019, temperature and conductivity measurements were recorded monthly from January to December, so as to track low-flow periods and seasonal mixing.

3.6.9.2 Sampling stations

Monthly temperature and conductivity monitoring was carried out at three stations. The first two, AQR71 and AQR70, are located 300 m upstream and 300 m downstream respectively of the treated mine effluent discharge point. The third station, AQR69, is located in the deepest area of the north basin of Lake Lagopede (Photo 3.18).

Monthly temperature and conductivity profiles for 2019 are shown in Figure 3.15 and Figure 3.16. Annual temperature profiles are in fact measured by a line of thermographs installed in summer 2016 in two deep areas of Lake Lagopede. One of the pools is near the effluent and AQR69 station. Figure 3.17 shows the annual temperature profiles measured since November 2017.

Photo 3.18 Monthly monitoring of temperature and conductivity at AQR69 station - north basin of Lake Lagopede (June 2019)

Temperature

According to the monthly profile at AQR69 station (Figure 3.15), the temperature varied very little between January and May 2019 (from 0°C to 3.6°C).

It increased substantially in June in the surface water layer between 0 and 8 m deep, thereby marking the flood period. The temperature then continues to increase until the appearance of the summer thermocline, which was clearly observed between 6 and 14 m deep in July 2019. This thermocline was maintained until September.

Fall mixing of the water column occurred rapidly in October when the temperature clearly stabilizes throughout the water column in the north basin of Lake Lagopede.

A slight winter thermocline was finally observed under the ice cover in December.

Figure 3.17 illustrates the annual temperature profile by depth (from 1 to 20 m deep). This profile suggests that the approximate spring mixing period (boxes 1 and 3) occurred during a short period of time at station AQR69. Spring mixing was somewhat less defined than fall mixing (side bar 2) at this station, lasting just over a month.

Conductivity

According to the monthly profile at station AQR69 (Figure 3.16), conductivity increased sharply between January and June in the water layer under the ice between 6 and 14 m deep.

Spring mixing in 2019 was only very briefly observed, since conductivity was still under the effects of the winter thermocline in May and June before decreasing drastically owing to two summer thermoclines that formed in July and August at 6 and 15 m deep.

Conductivity values started to stabilize as of September from the surface to 15 m deep, and fall mixing was clearly visible in November. Conductivity values in December were grouped into three distinct layers at station AQR69, which is consistent with the winter thermocline observed for temperature

Temperature-Conductivity Correlation

As observed in previous years, conductivity values recorded in 2019 followed thermal variations in the receiving environment at station AQR69.

Conductivity recorded monthly in Lake Lagopede in 2019, in all the sampling campaigns (March, June, July and October) was characterized by a precise pattern according to time of year. In Lake Lagopede, the summer and winter thermoclines alternate, between seasonal mixing in the water column, thereby impacting the conductivity pattern at station AQR69.

Since 2017, conductivity recorded at station AQR69, which is downstream of the final mine effluent, follows a variation pattern similar to the Lake Lagopede pattern: it increases gradually in early spring until late summer, when it peaks. It gradually decreases and stabilizes in fall (November) then remains low throughout the winter.

3.6.10 Conclusion

Correlating surface water and sediment quality results with monthly and temperature and conductivity values recorded at station AQR69 in 2019 revealed that there was an accumulation of mine effluent under the winter and summer thermoclines, as occurred in 2018.

This naturally occurring situation (resulting from thermoclines) restricts the dispersion of the plume in the vicinity of the discharge point. These results are consistent with the effluent dispersion model results (Englobe, 2017).

As observed in the baseline conditions and reported in the 2011 impact assessment (Roche, 2011a), a number metals including cadmium and mercury, make up the natural geochemical background of the water and sediments in the lakes and streams sampled.

The sediment in the lakes and streams sampled in the fall 2019 therefore presented mercury and cadmium concentrations that exceeded quality criteria (ECCC and MDDEP, 2007), as occurred in the baseline study and in more recent monitoring carried out during operations.

In both winter and summer however the 2019 monitoring results overall comply with applicable Canadian and provincial water and sediment quality criteria. In conclusion, the water and sediment quality monitoring results along with temperature and conductivity in 2019, indicate that:

- The trophic level in Lake Lagopede is comparable with the level observed in the 2010 baseline conditions;
- Phosphorus and total suspended solids (TSS) concentrations in the lakes and streams are identical to even lower than the concentrations in the 2010 baseline;
- Water and sediment quality is comparable for the control and exposed areas, all sectors combined. It is also comparable with the 2010 baseline conditions and the more recent 2015 to 2017 monitoring results;
- Effluent seems to concentrate under the thermocline, which is consistent with the assumptions advanced in the plume dispersion model (2011 and 2017);
- The dimictic characterization (bi-annual mixing) of Lake Lagopede means that effluent is dispersed throughout the entire water column in winter and summer.

Overall, water and sediment quality in 2019 did not appear to be altered by mining operations. The sporadic trends recorded in 2019 will be monitored in 2020. Monitoring in 2020 will also be undertaken in line with Environment Canada's new recommendations with regard to chlorophyll ***a*** measurements in the receiving environment as well as nitrates and nitrites in effluent.

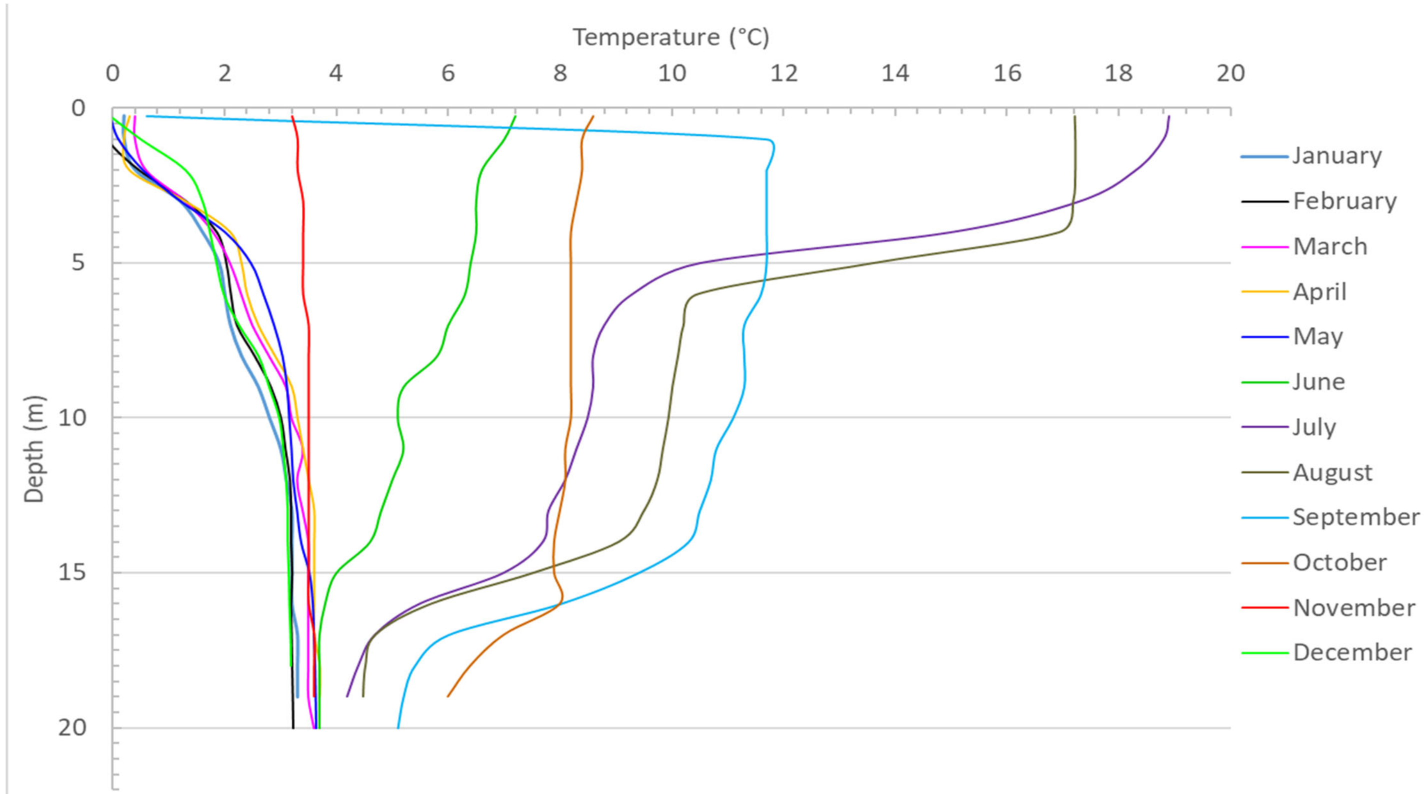


Figure 3.15 Monthly temperature profile at station AQR69 for 2019

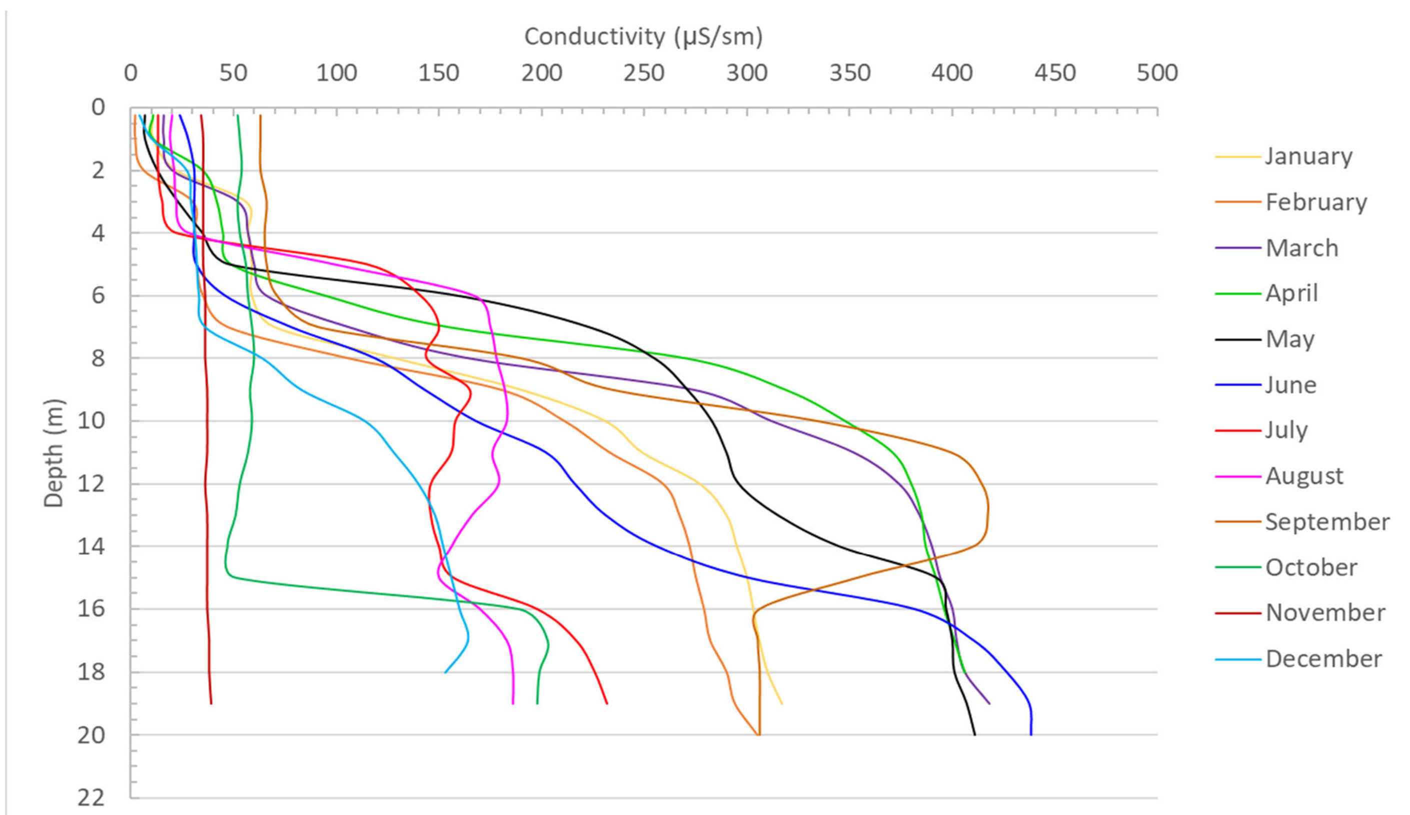


Figure 3.16 Monthly conductivity profile at AQR69 station in 2019

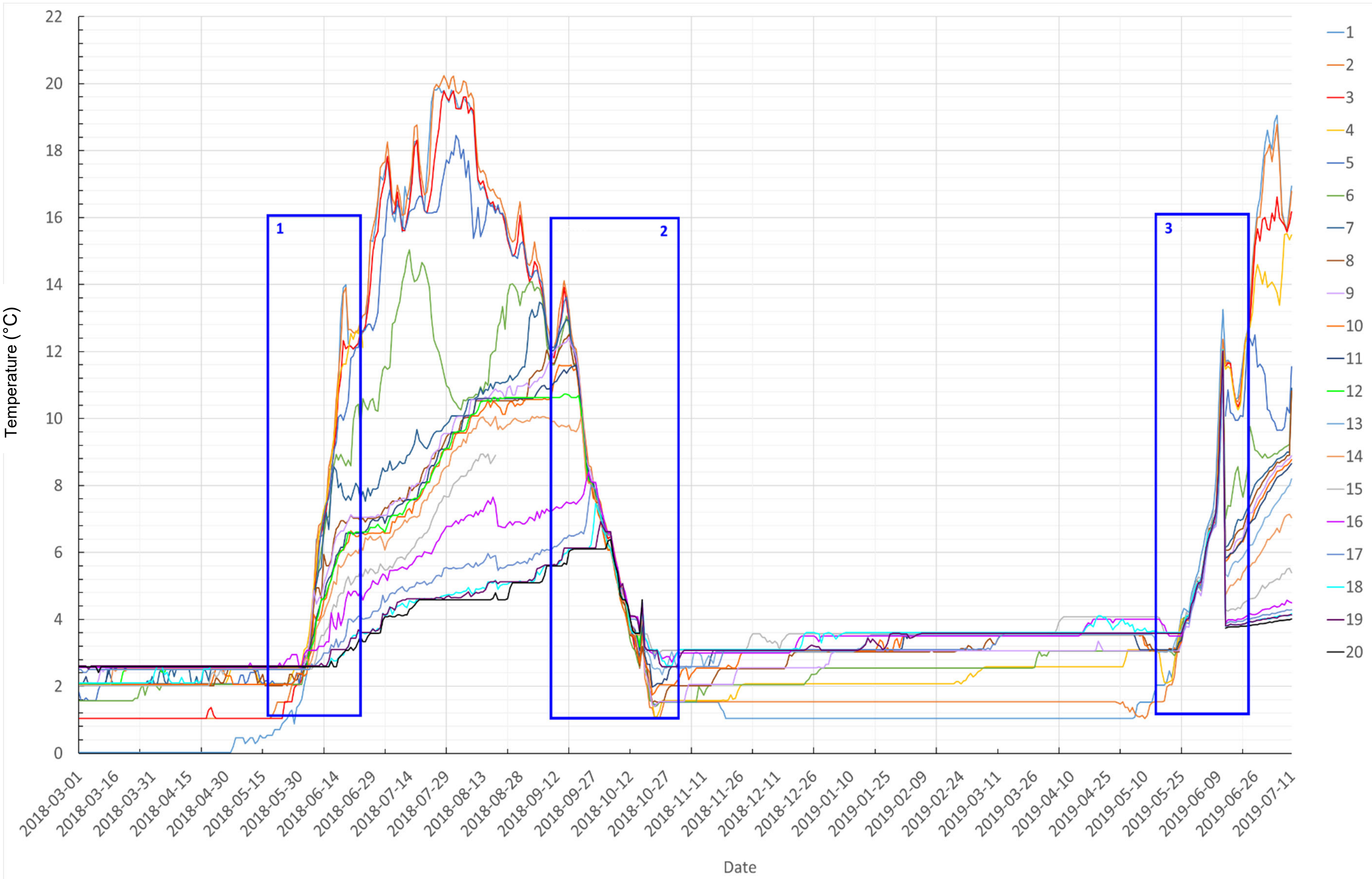


Figure 3.17 Temperature (°C) measured by depth (m) in the water column at station AQR69 from January 2018 to July 2019

3.7 Vegetation and Wetlands

The overall objective of monitoring vegetation and wetlands is to track vegetation restoration operations, changes in the restored areas, and implementation of the mitigation and compensation measures specified in the Global Certificate of Authorization (Global CA) to preserve plant biodiversity.

The specific objectives of the monitoring work are to:

- Monitor the application of vegetation mitigation, compensation and restoration measures;
- Track revegetation (agronomic monitoring of plant regrowth in revegetated areas);
- Apply wetlands compensation measures set out in the wetlands compensation plan in compliance with the Global CA;
- Monitor wetlands along the mine access road.

3.7.1 Application of Vegetation Mitigation, Compensation and Restoration Measures

Revegetation – Mine Site

Gradual revegetation of areas at risk of erosion and where mining operations have been completed officially began in 2016. A number of work areas and sectors used during Renard mine exploration work were revegetated in 2016, i.e., the former Lagopede camp that was dismantled in 2015, material storage areas, the former heliport, and so forth. Since 2017, about 32,000 m² have been revegetated on the mine site.

Photo 3.19 Spreading Indigo Graminord seed mix (June 2019)

The area was monitored in 2018 and 2019 (section 3.7.2). The variables listed in Table 3.13 are inspected or measured as part of revegetation monitoring.

Plots were in fact seeded with the *Indigo Graminord* seed mix, a mix of a variety of grass species that adapt to a broad range of temperatures. This mix was applied to a total area of about 1,480 m² in summer 2019 (Photo 3.19). These revegetated areas are shown in Map 3.9 by seeding or planting year and by sector.

3.7.2 Plantation Performance by Restored Area

3.7.2.1 Objective

The overall objective of monitoring plantation performance is to identify long-term trends in vegetation regrowth and ensure that revegetation is successful on all restored sites.

3.7.2.2 Schedule

Plant regrowth will be monitored for five years. In the first year (2017), monitoring was carried out twice:

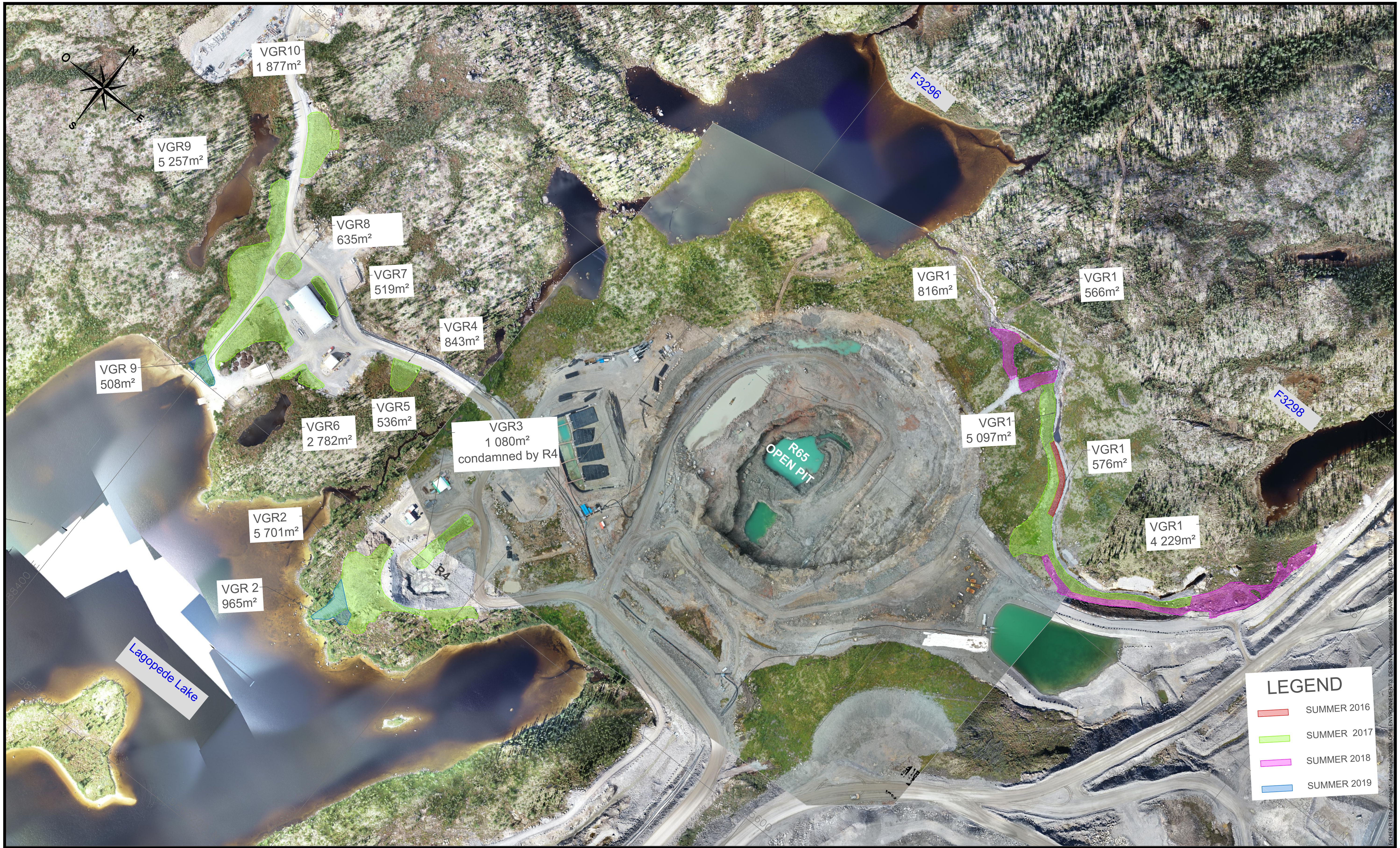
- In spring, after snow melt, when spring shoots just start to appear;
- In summer (August) when the growing season is well under way.

As of 2018, and for the next four years, monitoring will be done once a year. The initial plan was to monitor plant growth in late spring; however, to get a more representative assessment of the start of the growing season at the Renard mine site, and in line with recommendations from a specialized consultant, spring monitoring was moved to the end of June.

In addition, according to the Environment Canada site, the growing season begins once there have been 10 days with an average daily temperature above 5°C, which means the end of May at the Renard mine site. Plant regrowth was therefore monitored on June 20 to 21 on the mine site and on June 23 on the borrow pits along Route 167 North. In 2020, monitoring of plant cover will be carried out in the spring and the fall.

3.7.2.3 Methodology

The number and location of the monitoring sites are specified in the map showing the revegetated sectors in 2016 and 2017 (Map 3.9). The agronomic monitoring sites were marked on the ground as permanent 100-m² sample plots (SP) (circle with a radius of 5.64 m) where the variables in Table 3.13 were measured and recorded.



NO.	DATE	REVISIONS / RELEASES	BY	APP.
02	200323	ADDITION OF TWO ZONES OF REVÉGÉTALISATION (2019)	YD	

DESIGNED BY: Y.DUGUAY
DATE: 2018-08-20
APPROUVED BY: ENGINEER
DATE: AAAA-MM-JJ
SCALE: 1:4 000
PRINTED: 2020-03-23
SCEAU

PROJECT: RENARD MINE
TITLE: REVEGETATION AREA
MINERAL SITE
PLAN VIEW

Map 3.9
stornoway

DRAWING NUMBER
SUR-AP-ENV-000-VEG-01-02
SECTEUR DISCIPLINE DÉTAIL NIVEAU TRAVAIL SÉQUENCE RÉVISION

3.7.2.4 Results

Growth

Plant regrowth was monitored on June 20 and 21, 2019, including all the plants that showed signs of growth in 2018 (photos 3.20 and 3.21).

Plant regrowth is generally continuing. The average percentage of total cover, all species combined, was 30%, an increase of 4% compared with plant cover observed in 2018 and a 26% increase from spring 2017.

Revegetation monitoring in 2019 confirmed the success of the plantations and slow regeneration of vegetation observed following the seeding in summer 2017 and 2018.

Borrow Pits

Borrow pits BE639 and BE639,8 along Route 167 North were monitored on June 23, 2019. The seedlings planted in July 2018 were inspected to determine their rate of survival (Table 3.14).

Survival rates of 92% and 100% were observed respectively at borrow pits BE639 and BE639,8. These are considered excellent survival rates since the seedlings were initially planted in soil with no plant matter (photos 3.22 to 3.27).

In conclusion, plant regrowth seems to reflect the effectiveness of restoration activities, along with the study that have been put in place and monitored by SWY.

Table 3.13 Agronomic monitoring variables and methodology

Variables	Methodology
Herbaceous Species	
Percentage of plant cover	Visual inspection
Percentage of live and dead plants and spatial distribution	Visual inspection
Plant height (average in cm)	Measurement
Presence of outside disturbances and signs of disease	Visual inspection
Arborescent Species	
Percentage of plant cover	Visual inspection
Number of live and dead plants and spatial distribution	Visual inspection
Height of plants	Measurement
Root collar diameter	Measurement
Crown width	Measurement
Signs of disease	Visual inspection

Table 3.14 Survival rate of seedlings on borrow pits BE639 and BE639,8

Sample Plot	Number of Seedlings Planted			Survival Rate (%)
	August 2018	June 2019	August 2019	
Borrow Pit BE639				
BE639-01	22	18	18	82
BE639-02	31	31	31	100
BE639-03	25	22	22	88
BE639-04	23	21	21	91
BE0639-05	27	24	24	89
BE-639-06	24	24	24	100
Moyenne	**25**	**23**	**23**	**92**
Borrow Pit				
BE-639.8-01	21	21	18	100
BE639.8-02	21	21	21	100
BE639.8-03	29	29	29	100
BE639.8-04	22	22	22	100
BE639.8-05	21	21	21	100
Average	**23**	**23**	**22.8**	**100**

Photo 3.20 Plant regrowth monitoring - Station VGR1-04 (August 2018)

ee

Photo 3.21 Plant regrowth monitoring - Station VGR1-04 (June 2019)

Photo 3.22 Monitoring plant regrowth on borrow pit BE 639 (August 2018)

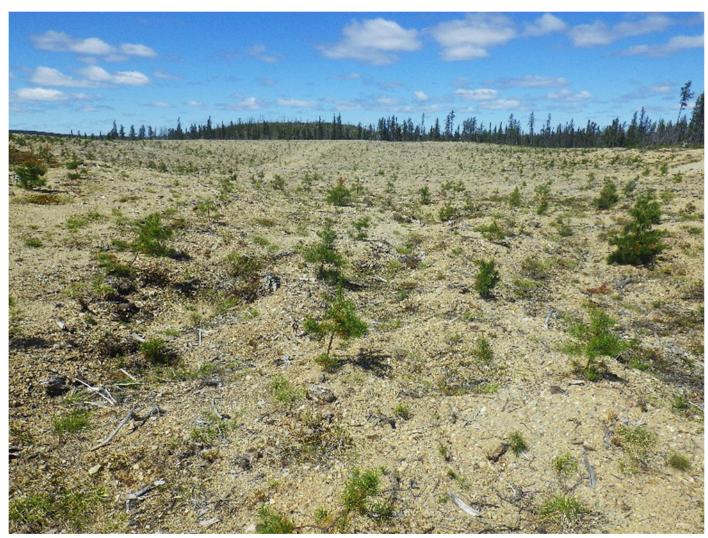


Photo 3.23 Monitoring plant regrowth on borrow pit BE 639 (June 2019)

Photo 3.24 Monitoring plant regrowth on borrow pit BE 639 (August 12, 2019)

Photo 3.25 Monitoring plant regrowth on borrow pit BE 639,8 (August 12, 2019)

Photo 3.26 Monitoring of plant regrowth on borrow pit BE 639 (August 12, 2019)

Photo 3.27 Monitoring of plant regrowth on borrow pit BE 639,8 (August 12, 2019)

3.7.3 Wetlands Compensation Program

The construction of the Renard diamond mine project resulted in an unavoidable loss of wetlands (17.1 ha).

In 2014, Stornoway indicated to the MELCC that it would support the development and implementation of a scientific research project to determine the social and biophysical criteria for measuring the ecological value of boreal fens and bogs in the Eeyou Istchee James-Bay region.

A knowledge acquisition project on the region's fens and bogs was therefore proposed and approved as a wetlands compensation measure for Stornoway's Renard diamond mine project under the *Act respecting Compensation Measures for the Carrying out of Projects Affecting Wetlands or Bodies of Water.*

This knowledge acquisition project has two components: the first component involves fens and bogs and the second northern biodiversity. A decision-making tool will be proposed based on the research results from both projects with a view to targeting environmental services and the most appropriate locations for compensation.

The new knowledge and tools will help guide and improve the analysis of future proposed compensation measures for northern environments

3.7.3.1 Monitoring of the first component – fens and bogs

The first component involves compiling knowledge about the hydrological and biogeochemical functions of fens and bogs in a context of climate change.

Very little is known about these functions in the boreal region, but they are of paramount importance in the development of northern Quebec for social and cultural reasons (land use by the Cree Nation) as well as economic reasons (infrastructure flooding and road erosion).

The project aims to examine:

- Holocene eco-hydrological dynamics (geological epoch over the last 10,000 years);
- The carbon balance of oligotrophic bogs (nutrient-poor bogs) in northern Quebec.

This first research component began in 2016, and its main objectives are to:

- Reconstitute palaeohydrological and palaeoecological conditions that influenced the accumulation of peat and carbon during the Holocene period;
- Reconstitute regional vegetation and climatic variations (temperature and precipitation) during the Holocene period;
- Document recent hydrological dynamics of the water table in the peatland drainage basin;
- Simulate the impact of climate forcing (temperatures and precipitation) on ecohydrological functions of peatland in the past 5,500 years.

To continue the research initiated in 2016, students from the University of Quebec at Montreal (UQAM) visited the site to characterize and sample peatlands in the Renard mine area as part of two field campaigns from June 3 to 11 and September 2 to 7, 2019 (Figure 3.18).

The UQAM students completed all the field work associated with the research project; hence no further field work is scheduled for this component in 2020. The analytical work and drafting of a report are scheduled for summer 2020.

3.7.3.2 Monitoring the second component – northern biodiversity

The second component involved Stornoway partnering with the University of Quebec in Abitibi-Témiscamingue (UQAT) to set up an industrial research chair CRSNG-UQAT on biodiversity and mining (created in April 2018).

The Chair's mission is to obtain and publish scientific and traditional knowledge on northern biodiversity to help develop strategies to reduce the environmental footprint of a mine throughout its life cycle in a context of multiple impacts, including climate change.

This component entails using traditional knowledge to develop compensation measures so that the needs of the Indigenous communities that use the land can be incorporated into future compensation projects in northern and boreal areas. Two studies have therefore been proposed as part of the Chair's work.

The first study aims to describe the diversity of vertebrate communities in small wetlands in Northern Quebec (UQAT).

Following the field work conducted in late May 2019 on 50 ponds, a second field work session totalling 22 days was undertaken by two teams of UQAT students who visited the mine site in June and July 2019. Their objective was to re-visit the 50 ponds evenly distributed by type (beaver ponds and peatland ponds) on the north-south gradient.

Part of the surveys were conducted at the Renard mine on May 30 to June 2, June 6 to 17, and July 12 to 23, 2019. The data included a number of vertebrate sightings in the various ponds, which proved promising. No further field work is planned for 2020.

The second study aims to analyze and model the dynamics of typical lichen and plant communities in the wetlands of northwestern Quebec. Two field campaigns were undertaken in 2019.

The first campaign took place from July 13 to 18, 2019. To complete the 2018 observation of several plant species (Photo 3.28), a total of 45 sites were visited in 2019 in the northern region, including 15 sites in the vicinity of the Renard mine.

Photo 3.28 Sphagnum moss (*Sphagnum subfulvum*)

While visiting the fens and bogs, temperature and humidity readings were recorded using instruments installed at various mine sites for 12 months. Water and peat samples were also collected for physical-chemical analyses. This component is now complete, and no further field work is planned for 2020. The study findings are expected to shed light on plant dynamics in the fens and bogs in the region.

The second campaign was undertaken on September 3 to 5, 2019, and nine fens and bogs were visited in the wetland areas around the Renard mine. The students are currently identifying the samples collected and analysing the environmental factors associated with the development of fens and bogs.

3.7.4 Wetland Monitoring (Route 167 North)

When Route 167 North was extended in 2012-2014, some of the construction work impacted 18.4 ha of wetlands on the footprint of the road (Roche, 2013a).

An agreement was reached with the MELCC that if there was insufficient natural revegetation in the 2016 growing season, the area would be revegetated with native species.

Remedial action was in fact taken on the wetlands and monitoring done at the end of the 2016 growing season. The monitoring confirmed that plant regrowth was a success in a majority of the wetlands, amounting to at least 80% on the 19 sites, except for five where regrowth amounted to under 70%.

At the end of the 2016 growing season, SWY decided to implement remedial action in 2017 in five of the wetlands with less than 80% regrowth.

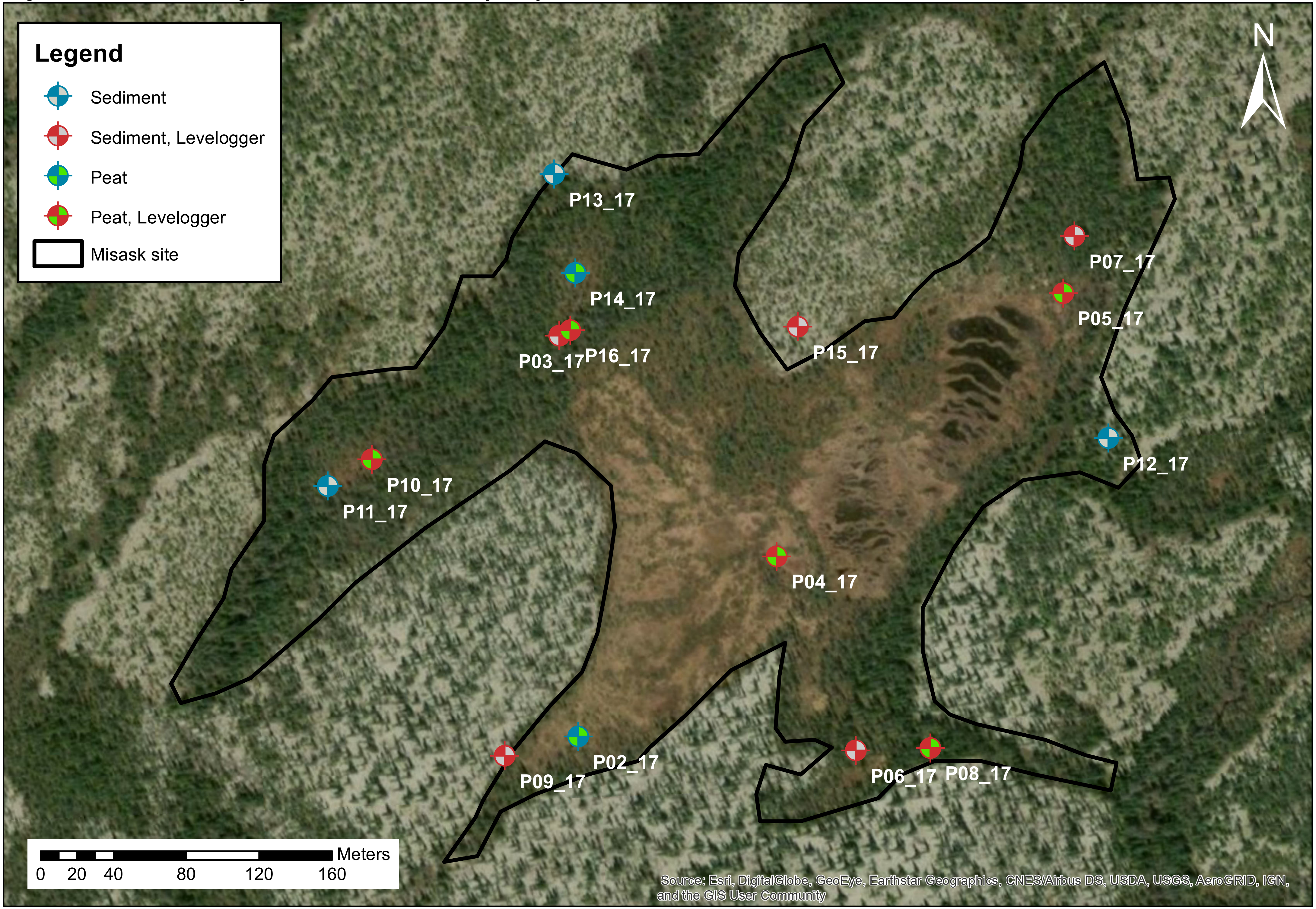
Remedial measures were applied as planned in 2017. The corrective action involved seeding the wetlands with typical native species in order to promote regrowth on the edge of five wetlands along Route 167. The wetlands seeded in 2017 were monitored for plant growth in 2019 (Photo 3.29).

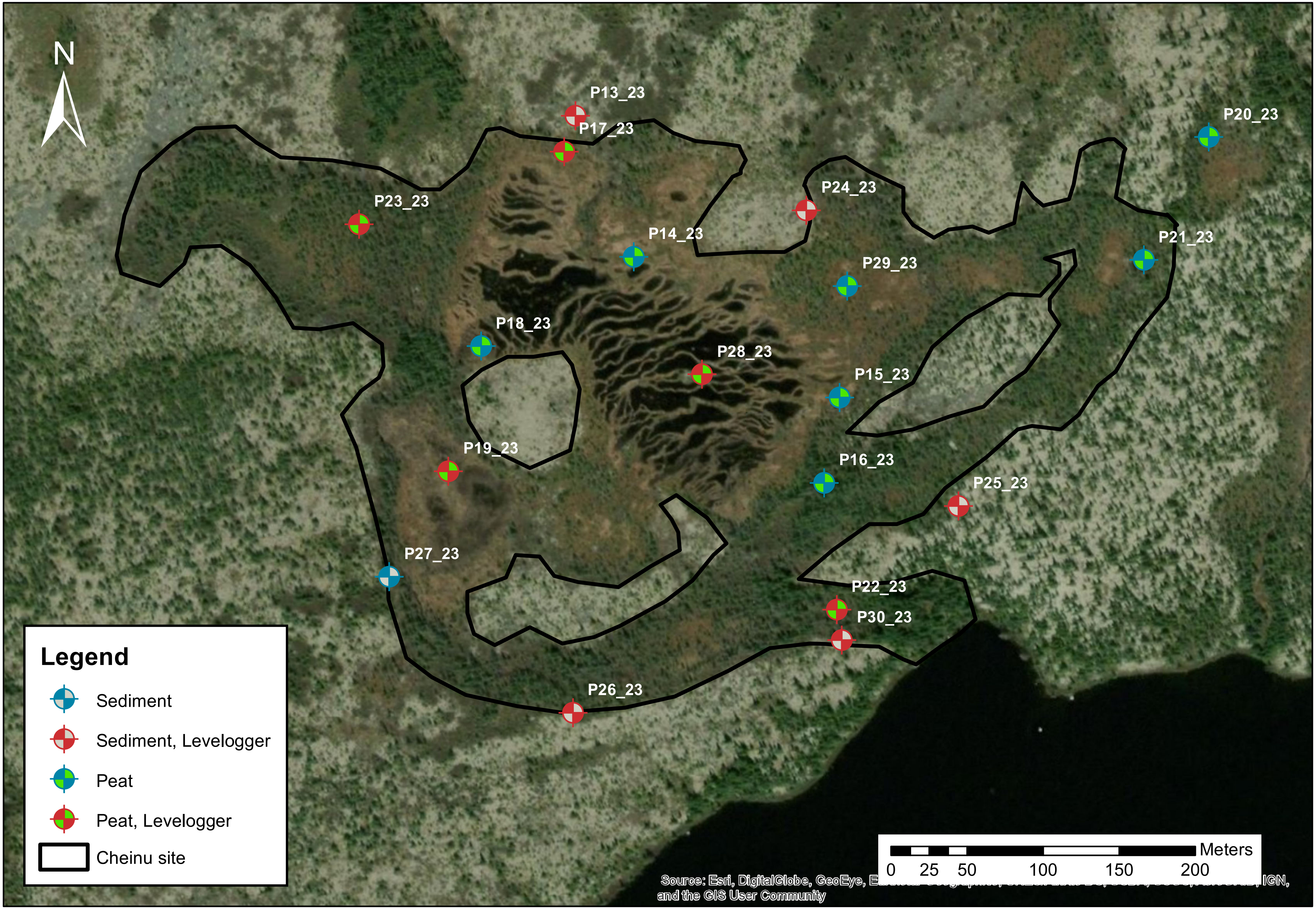
Plant growth on the five sites seeded in 2017 and visited in 2019 covered on average 70% of the area, and three sites had a plant regrowth success rate greater than 70%. Only two sites required reseeding, which was done on June 23, 2019.

Monitoring will be carried out in 2020 at the same time as the various borrow pits are monitored, i.e., in late June. Monitoring will also continue until 2022 as described in the environmental monitoring program (ESMP).

Photo 3.29 Wetland seeded along Route 167 North in 2017 (a) and in 2019 (b)

Figure 3.18 Fens and bogs characterized and surveyed by the UQAM research team in 2019




N
P13_23
P17_23
P20_23
P23_23
P24_23
P14_23
P21_23
P29_23
P18_23
P28_23
P15_23
P19_23
P16_23
P25_23
P27_23
P22_23
P30_23
P26_23
Legend
Sediment
Sediment, Levelogger
Peat
Peat, Levelogger
Cheinu site
Meters
0 25 50 100 150 200
Source: Esri, DigitalGlobe, GeoEye, E
and the GIS User Community

3.8 Fish and Benthic Communities (EEM)

The Renard Diamond Mine environmental monitoring program requires the components of the Lake Lagopede ecosystem to be monitored, specifically its fish populations. Since June 1, 2018, the Renard mine has been subject to the new *Metal and Diamond Mining Effluent Regulations* (MDMER).

In 2016, SWY had however committed to monitoring fish communities in compliance with the requirements of the former regulation (MMER) and the various recommendations set out in the *Metal Mining Environmental Effects Monitoring (EEM) Technical Guidance Document* (Environment Canada, 2012). The current MDMER contains essentially the same monitoring as in the previous regulations, with just a few amendments. The main objective of the monitoring remains the same, which is to assess the impacts of the treated mine effluent discharged into Lake Lagopede on fish and fish habitat, along with potential use of fisheries resources.

3.8.1 Study Design

To implement this monitoring, a study design plan for the first cycle of biological monitoring was prepared in 2018 and submitted for approval in February 2019 to the authorization officer, or six months prior to the first sampling campaign (Norda Stelo, 2019b).

The study plan provided all the methodological indications for assessing the impact on fish, evaluating potential use of fish habitats, and studying benthic invertebrate communities. Also included in the plan were:

- A summary of previous biological monitoring studies;
- A summary of effluent and water quality monitoring; and
- Information on the environmental characterization of the site, including the results of the effluent plume delineation study.

An overview of the plan, including the study area and selected sentinel species, is provided in the sections below. In March 2019, Environment Canada evaluated the study design plan for EEM at the Renard mine, and issued its recommendations.

3.8.1.1 Schedule

The first EEM-related sampling campaign was initially scheduled for fall 2019. But the field work was postponed until fall 2020. This new schedule is still in compliance with regulated timelines, given that the deadline for submitting the cycle one interpretive report to the authorities is February 15, 2021.

SWY will undertake to submit its final biological monitoring schedule without delay to Environment Canada and at least two weeks prior to the start of sampling work, as required.

3.8.1.2 Study area

The fish and benthic community monitoring study applies to Lake Lagopede, the receiving environment where the treated mine effluent has been discharged since April 14, 2016. The surveys conducted in the control and exposed areas before effluent was discharged into the lake showed that the habitats were similar in terms of surface water quality, sediment, water depth, and benthic community composition (Norda Stelo, 2015)

The exposed area was positioned close to the treated mine effluent discharge point and within the effluent dispersion plume. The control area is in the West bay of Lake Lagopede, about 1.7 km upstream from the discharge point and the mine site. As recommended by Environment and Climate Change Canada in March 2019, mine effluent concentration will be estimated 100 m and 250 m from the diffuser.

3.8.2 Fish Study

3.8.2.1 Sentinel species

The fish study will examine adult specimens of a relatively sedentary fish species that has been exposed to the effluent for a long time. According to experimental fishing conducted in 2010 and 2011 for the environmental baseline study (Roche, 2011b, white sucker (58.7%) and northern pike (22.1%) accounted for over 80% of all fish caught. These two species were retained as sentinel species for monitoring purposes.

Various types of fishing gear will be used to target these species and various size classes, as specified in the study plan. Fishing stations will be positioned so as to track the impact of final mine effluent in control areas, which are not subject to effluent, and exposed areas, which are affected by effluent. The impact indicators used to determine whether the effluent had caused changes in fish are growth, reproduction, fish condition and survival of individuals. Table 3.15 shows the monitoring indicators measured in the 2020 fish population study.

Table 3.15 Monitoring indicators measured as part of fish population study

Indicator	Accuracy	Required Statistics
Age	0+(1)	Mean, median, standard deviation, standard error, minimum and maximum values in the sampling areas
Total body weight (fresh)	±0.1 g(2)	
Total length	±1 mm	
Gonad weight (if fish is sexually mature)	±0.1 g(2)	
Weight of 100 eggs (if fish is sexually mature)	±0.001 g	(Minimum recommended subsample size: 100 eggs) mean, median, standard error, minimum and maximum values in the sampling areas
Fecundity (if fish is sexually mature)	±1.0 %	Total number of eggs per female, mean, median, standard error, minimum and maximum values in the sampling areas
Liver weight	±0.1 g(2)	Mean, median, standard deviation, standard error, minimum and maximum values in the sampling areas
Anomalies	n/a	Presence of parasites, lesions, tumours or other anomalies
Sex	n/a	% of females and males in the sampling areas

(1) 10% require independent confirmation.
(2) For large species, and ±0.001 g for small fish species.

3.8.3 Analysis of Potential Use of Fish

In biological monitoring studies, such as the study prescribed by the MDMER (Appendix V, Subsection 9c), a study of mercury in fish tissue is required:

- If the mean annual concentration of total mercury measured is equal to or greater than 0.10 g/L;
- If the detection limit is equal to or greater than 0.01 g/L.

According to mine effluent quality monitoring results in 2019, mercury concentrations in final mine effluent remain below 0.10 g/l, and the analytical method detection limits remain below 0.10 g/L. SWY will nonetheless determine fish mercury concentration levels despite the fact that this is not a regulatory requirement for this first monitoring survey.

3.8.4 Benthic Invertebrate Community Study

Benthic invertebrate communities are mainly studied for the purpose of assessing fish habitat and benthic communities, which serve as precursor indicators of changes caused by the project. The benthic community study will be carried out simultaneously with the fish community study, in the fall 2020.

Biological diversity peaks in the fall, and the development level of the organisms facilitates identification (Norda Stelo, 2019B). A control-impact (or control-exposure) sampling plan was chosen to detect possible differences in benthic community richness and abundance between the exposed and control areas.

Both sampling areas are in Lake Lagopede and contain five stations each. Three subsamples (triple benthos sample) will be randomly collected at each substation.

3.8.5 Supporting Environmental Variables

As part of the ESMP, Renard mine is currently monitoring surface water and sediment quality (section 3.6 herein), as well as effluent quality (section 3.13).

In 2020, in addition to being part of the annual environmental monitoring report, the analysis of this monitoring data will be discussed in greater detail in the EEM cycle one interpretive report, given that they will be used to interpret the biological monitoring results

3.8.6 EEM Cycle One Interpretative Report

Under Subsection 38(9) of the MDMER, the EEM cycle one interpretative report must be submitted to provincial and federal authorities no later than 24 months after the study plan is submitted.

Since the study plan for the Renard mine was filed in February 2019, and evaluated by Environment Canada in March 2019, the EEM cycle one interpretative report must therefore be submitted by March 2021.

3.9 Fish Habitat

Under condition 5.1 of Fisheries and Oceans Canada (DFO) authorization No. 2014-002 (April 9, 2014), the project's medium and long-term impacts on fish and fish habitat must be monitored.

To meet this requirement, the environmental monitoring program includes monitoring fish and fish habitat to achieve the following objectives:

- Confirm that fish habitat conditions are maintained in Lake F3298;
- Ensure the free movement of fish is maintained in streams south of the mine (from the outlet to Lake F3300 to the tributary of Lake F3301);
- Determine that appropriate hydraulic conditions for brook trout incubation and spawning are maintained in the tributary of Lake F3301;
- Determine that the downstream migration of fish is maintained in the diversion channel at the Lake F3298 outlet.

3.9.1 Maintaining Fish Habitat Conditions in Lake F3298

3.9.1.1 Schedule

As described in the ESMP, monitoring to ensure fish habitat conditions are maintained in Lake F3298 is scheduled for years 1, 3, 5, 10 and 15 after the start-up of mining operations (Map 3.10). Year 1 monitoring was undertaken in 2018. No monitoring was therefore carried out in 2019 but will be in 2020 (year 3). Water renewal conditions in Lake F3298 are described in section 3.4.1 herein.

3.9.1.2 Experimental fishing

In 2020, water quality surveys and experimental fishing will be carried out at stations ST1 and ST2 (as defined in 2018) to track changes in the physical-chemical parameters of the water, the habitat conditions in Lake F3298, and the fish populations using the habitat.

The next monitoring phases will determine whether indicators of the condition of the fish population in Lake F3298 remain stable during the mining operations phase.

3.9.2 Maintaining Free Movement of Fish in the Outlets of Lakes F3300, F2607 and F3301

3.9.2.1 Schedule

The second phase in monitoring the effects of the Renard diamond project on fish movement in the outlets of lakes F3300, F2607 and F3301 was carried out in conjunction with the monitoring of Lake F3298 in September 2018, and will be carried out again in 2020.

3.9.2.2 2018 monitoring

Ensuring the free movement of fish through the outlets of lakes F3300, F2607 and F3301 was validated as part of 2018 monitoring. As a reminder, the characteristics observed at the outlet of Lake F3300 in the 2018 monitoring campaign were similar to those recorded for baseline conditions before project start-up (Roche, 2011) as well as to 2016 monitoring results.

The obstacles recorded when the outlet of Lake F2607 was monitored did not impede fish movement in this stream. And there were not new obstacles to fish movement observed in the outlet of Lake F3301 in 2018.

3.9.2.3 2019 monitoring

No monitoring was done in 2019. The third phase of monitoring the effects of the Renard mine on maintaining the free movement of fish and fish habitat in the tributary of and outlet to Lake F3301, the outlet to Lake F2607, and the outlet to Lake F3300 is scheduled for 2020.

3.9.3 Maintaining Brook Trout Spawning Grounds in the Tributary to Lake F3301

3.9.3.1 Schedule

As described in the ESMP, monitoring to ensure compensation measures and use of brook trout habitat are sustained is undertaken in years 1, 3, 5 and 10 following the development of the fish habitat.

An initial survey of the integrity and use of the brook trout spawning grounds was undertaken in 2016 (year 1). In response to this monitoring, the DFO issued recommendations, which were applied by SWY in 2017 with remedial work designed to improve the spawning grounds.

A second survey was conducted in September 2018 (year 3), and the next survey of the condition of the natural brook trout spawning grounds in the tributary to Lake F3301 is scheduled to take place in 2020 (year 5).

3.9.4 Diversion Channel – Outlet of Lake F3298

To safely develop and operate pit R65, the outlet of Lake F3298, a stream north of the sedimentation pond, had to be diverted (Map 3.11).

To prevent stream water from being influenced by mining operations and draining into the network of peripheral ditches, a section of the stream was diverted in 2015 toward Lake F3295.

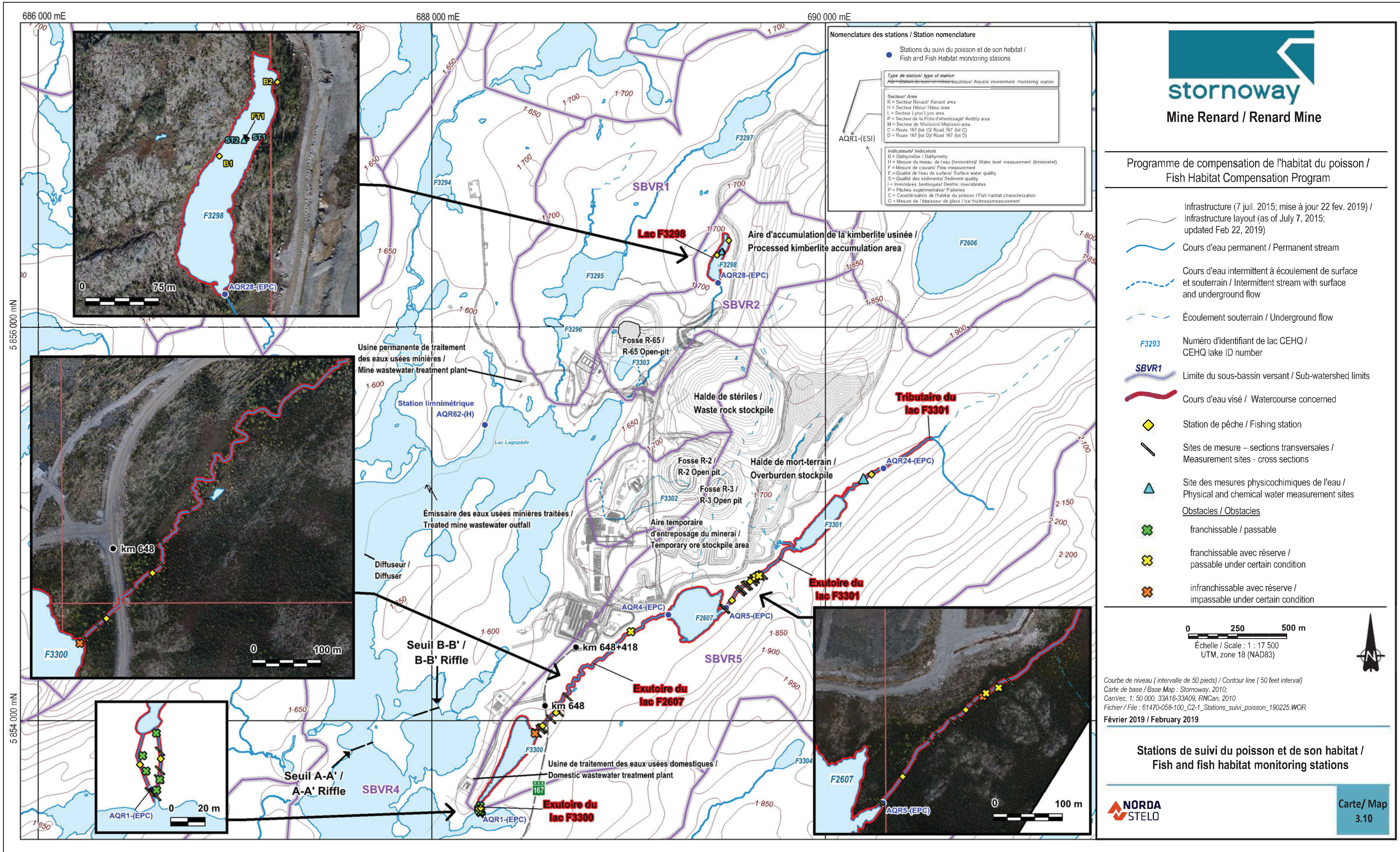
A visual survey of water flow was undertaken in 2019 to ensure the migration of fish in the diversion channel.

The stream was visited during the spring thaw, or during the fish migration period and after heavy spring rains, to observe water levels in the restructured stream, and confirm the presence of water flow (photo 3.30)

As observed in 2018, water flow in the diverted section of the stream was light in 2019, varying significantly with precipitation. These observations indicate that fish movement is assured during migration but is not continuous throughout the summer.

The diversion channel will continue to be monitored in 2020, to confirm the free movement of fish during the high-flow period.

Photo 3.30 Outlet of Lake F3298
Downstream to upstream view (May 2019)



stornoway
Mine Renard / Renard Mine
Programme de compensation de l'habitat du poisson / Fish Habitat Compensation Program
Nomenclature des stations / Station nomenclature
Stations du suivi du poisson et de son habitat / Fish and Fish Habitat monitoring stations
AQR1-(ESI)
Infrastructure (7 juil. 2015; mise à jour 22 fev. 2019) / Infrastructure layout (as of July 7, 2015; updated Feb 22, 2019)
Cours d'eau permanent / Permanent stream
Cours d'eau intermittent à écoulement de surface et souterrain / Intermittent stream with surface and underground flow
Écoulement souterrain / Underground flow
F3293
Numéro d'identifiant de lac CEHQ / CEHQ lake ID number
SBVR1
Limite du sous-bassin versant / Sub-watershed limits
Cours d'eau visé / Watercourse concerned
Station de pêche / Fishing station
Sites de mesure – sections transversales / Measurement sites - cross sections
Site des mesures physicochimiques de l'eau / Physical and chemical water measurement sites
Obstacles / Obstacles
franchissable / passable
franchissable avec réserve / passable under certain condition
infranchissable avec réserve / impassable under certain condition
0 250 500 m
Échelle / Scale : 1 : 17 500
UTM, zone 18 (NAD83)
Courbe de niveau (intervalle de 50 pieds) / Contour line (50 feet interval)
Carte de base / Base Map : Stornoway, 2010;
CanVec, 1: 50 000, 33A16-33A09, RNCan, 2010
Fichier / File : 61470-058-100_C2-1_Stations_suivi_poisson_190225.WOR
Février 2019 / February 2019
Stations de suivi du poisson et de son habitat / Fish and fish habitat monitoring stations
NORDA STELO
Carte/ Map 3.10
686 000 mE
688 000 mE
690 000 mE
5 856 000 mN
5 854 000 mN
Lac F3298
Aire d'accumulation de la kimberlite usinée / Processed kimberlite accumulation area
AQR28-(EPC)
SBVR1
SBVR2
SBVR4
SBVR5
Fosse R-65 / R-65 Open-pit
Usine permanente de traitement des eaux usées minières / Mine wastewater treatment plant
Station limnimétrique AQR62-(H)
Lac Lagopède
Halde de stériles / Waste rock stockpile
Tributaire du lac F3301
AQR24-(EPC)
Fosse R-2 / R-2 Open pit
Fosse R-3 / R-3 Open pit
Halde de mort-terrain / Overburden stockpile
Émissaire des eaux usées minières traitées / Treated mine wastewater outfall
Aire temporaire d'entreposage du minerai / Temporary ore stockpile area
Diffuseur / Diffuser
Exutoire du lac F3301
AQR4-(EPC)
AQR5-(EPC)
km 648+418
Seuil B-B' / B-B' Riffle
Exutoire du lac F2607
km 648
Seuil A-A' / A-A' Riffle
Usine de traitement des eaux usées domestiques / Domestic wastewater treatment plant
Exutoire du lac F3300
AQR1-(EPC)
167
B2
FT1
ST2
ST1
B1
F3298
0 75 m
F3300
0 100 m
0 20 m
F2607

3.10 Fish Habitat Compensation

To offset fish habitat damage and losses caused by Renard project activities and the construction of Route 167 North, two separate fish habitat compensation plans (FHCP) were approved by the DFO. First, the Renard diamond mine FHCP involves five operations in two geographically distinct areas, the Renard mine area and the Mistissini area.

The operations associated with the Renard mine entail:

- Developing 600 m² of brook trout (speckled trout) habitat in four streams (2015);
- Expanding a lake trout spawning ground in Lake Lagopede by an additional 300 m² (2016).
- The operations associated with the Mistissini area entail:
- Developing a 600 m^2 walleye spawning ground in Lake Mistassini (2019);
- Developing a 100 m² habitat for brook trout in a tributary to Lake Mistassini (2019);
- Developing fish habitat in a diversion channel on the former Icon-Sullivan mine site for a target gain of 15,000 m².

A second compensation program was developed to offset habitat losses that occurred as a result of the construction of Route 167 North. Fish habitats were created in 2014, and monitoring studies completed in 2017.

The DFO determined that the compensation program put in place by SWY achieved the objectives set and hence declared monitoring to be complete. See section 3.11 for further information.

3.10.1 Monitoring the Integrity and Use of Brook Trout Habitats

This brook trout habitat monitoring is the first FHCP activity required by the DFO (DFO, 2014). Work to develop brook trout habitats in the Renard mine area was carried out in July 2015 in four streams targeted by the FHCP, specifically the outlets to lakes F3293, F3294, F2604 and F3301.

Riffle-pool-spawning-ground-type development improved the quality of brook trout habitat and promoted access to it by creating feeding, shelter and spawning habitats that meet the species' needs. A total of 21 riffle sections, three gravel boxes, one 50-m channel, and over 530 m² of spawning grounds were developed.

3.10.1.1 2016 and 2018 Monitoring

The physical integrity and use of these brook trout habitats were monitored in September 2016 and 2018. The 2018 monitoring led to remedial action being carried out at the request of the DFO, as described in the 2018 environmental monitoring annual report (Stornoway, 2019c).

3.10.1.2 2019 Monitoring

In 2019, the DFO assessed the compensation measure monitoring reports (Norda Stelo, 2019c; Stornoway, 2019a), and confirmed that "the shelter, rearing and feeding habitats created for brook trout are being used by fish. The habitats developed in 2015 allow for the free movement of fish in the four streams, since the riffles remained stable and impermeable across all the developed sections and the falls in the developed sections remain negotiable."

To ensure the objectives of the compensation program are achieved and to improve the spawning grounds developed for brook trout, remedial measures were planned in 2019. The DFO's comments however were received on December 12, 2019, which made it impossible to carry out the work in 2019. With DFO approval, this work is now scheduled for summer 2020.

3.10.1.3 2020 Monitoring

The next brook trout habitat monitoring phase in the Renard mine area is scheduled for 2020. Once the remedial measures have been put in place, the 2020 monitoring will confirm whether the habitats remain stable. The 2018 and 2020 monitoring results will be compared if necessary.

3.10.2 Monitoring Lake Trout Spawning Ground in Lake Lagopede

3.10.2.1 Expanding the spawning ground

The second FHCP activity involved expanding an existing lake trout spawning ground in Lake Lagopede in the Renard mine area, which was accomplished in 2016 (Stornoway, 2017b). Expanding this spawning ground involved increasing the spawning area by more than 450 m², or 150 m² more than what the DFO required.

The first monitoring phase for this spawning ground was carried out in fall 2017, or one year after it was built. The monitoring showed that the entire expanded area, about 400 m^2 of spawning habitat, was not very accessible or not at all accessible to lake trout during the fall spawning period. This restriction was caused by significant variations in water levels in Lake Lagopede. The observations were made when water depths varied from 0.05 to 0.5 m.

And it was found that the area was also exposed out of the water in winter.

3.10.2.2 Analysis of DFO recommendations regarding spawning ground monitoring report

After analyzing the lake trout spawning ground monitoring report submitted in March 2017, (Norda Stelo, 2017b), the DFO determined that "*owing to the drawdown of the lake, the water depth is inadequate during spawning and incubation periods in certain areas of the developed spawning ground. The developed area, consequently, does not seem to be able to meet all the compensation objectives*" (Ecosystems Management Regional Branch, DFO – by email dated January 8, 2019).

Monitoring the integrity of the spawning ground was undertaken in year one following its development in 2017. The second monitoring phase was scheduled in year 3 or 2019, and it was carried out in fall 2019 to confirm the integrity, use and accessibility of the spawning ground. The results of this round of monitoring are provided in the following section (3.10.2.3).

3.10.2.3 Monitoring spawning ground water quality

As noted in authorization No. 2014-002 issued by the DFO (DFO, 2014), as well as in the environmental monitoring program, monitoring carried out in 2019 represented year three monitoring of the physical-chemical surface water quality parameters at the developed spawning ground.

A report was drafted on this second round of monitoring and submitted to the DFO in March 2020 (Stornoway, 2019b).

To confirm the absence of any intra-annual variability in water quality in the spawning grounds, the results of the sampling campaigns were outlined in the lake trout spawning ground monitoring report submitted to the DFO in March 2020 (Stornoway, 2019b).

Sampling

Water samples were collected near the bottom of the lake at three different spawning ground stations, corresponding to those used in the baseline study (Norda Stelo, 2016b), i.e., AQR68-1, AQR68-2 and AQR68-3 (Map 3.12).

Samples were collected on three occasions, March 24, 2019, September 1, 2019, prior to lake trout spawning, and on November 2, 2019, after lake trout spawning.

The water quality data were compared with provincial criteria as well as with Canadian surface water quality guidelines (MELCC, 2017; CCME, 2013).

Data were then compared with the results of spawning baseline data, as well as water quality monitoring results for Lake Lagopede.

Results

A majority of the parameters comply with provincial and federal water quality criteria. And the results are also comparable with the spawning ground baseline (2015-2016), and the surface-water quality monitoring results for Lake Lagopede (2015-2016).

As in the case of the project baseline, the EBS documented aluminum levels that were naturally higher than certain criteria for the protection of aquatic life in Lake Lagopede as well as the streams and lakes in the region (Roche, 2011b).

Aluminum concentrations in fact also exceeded MELCC and CCME criteria in the 2019 water sampling campaigns at the spawning ground.

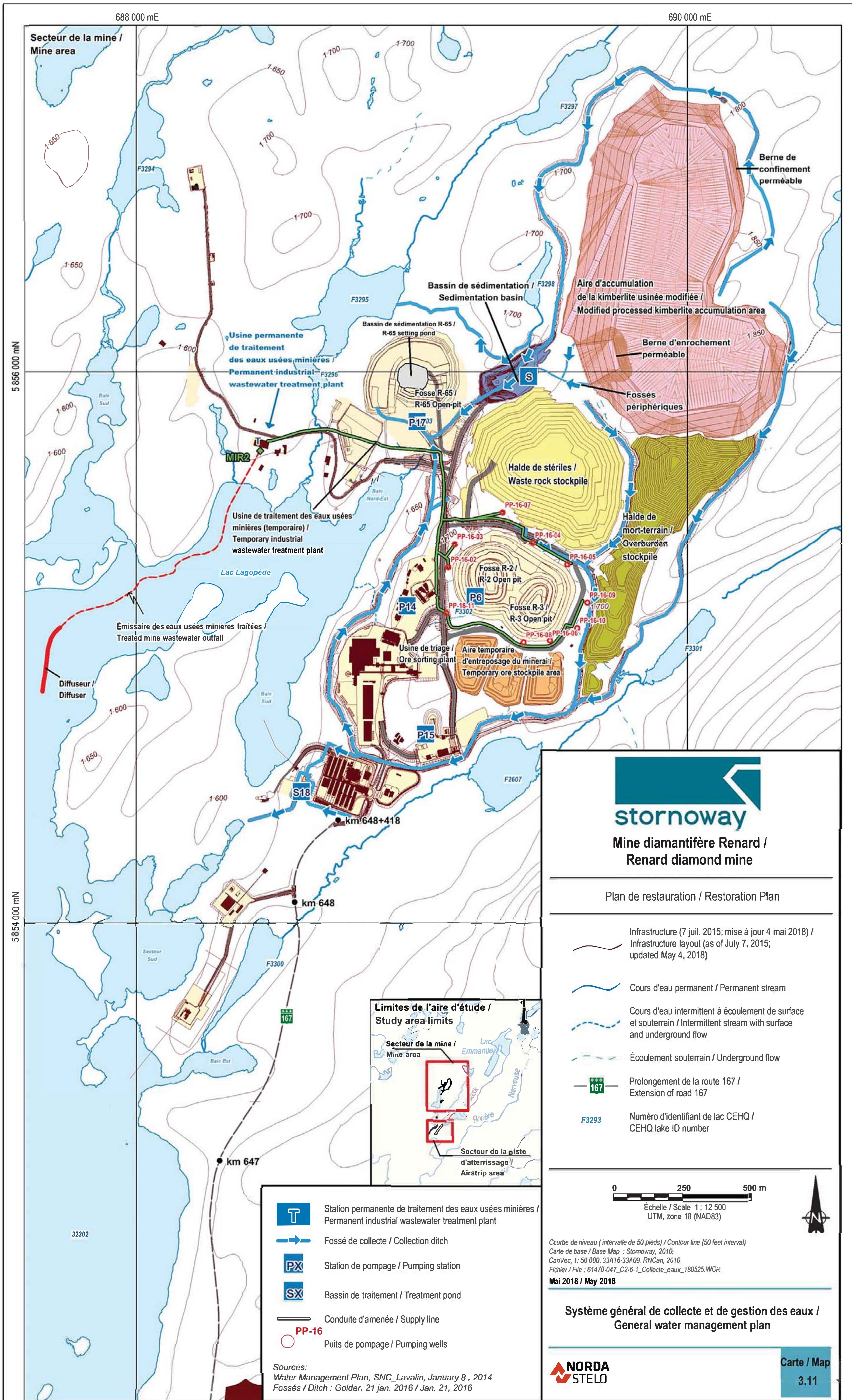
The results of water quality monitoring in 2019 at the lake trout spawning ground were generally similar to those in the initial characterization of the spawning ground's water quality in 2015 and 2016, as well as those from the first two years of monitoring in 2017 and 2018.

Values for the physical-chemical parameters of water quality fall within the range of variability of the lake trout's preferred habitat. Consequently, surface water quality observed at the spawning ground in 2019 does not pose a constraint on lake trout reproduction (spawning, incubation, hatching and rearing).

The next water quality monitoring for the lake trout spawning ground is scheduled for 2020.

2019 Monitoring

Monitoring in 2019 represented the third year of monitoring the physical-chemical parameters of surface water quality at the spawning ground, a report of which was filed in winter 2020. New monitoring and observation techniques were explored in the 2019 monitoring in line with DFO recommendations regarding the integrity and use of the spawning ground.


688 000 mE
690 000 mE
5 856 000 mN
5 854 000 mN
Secteur de la mine / Mine area
Bassin de sédimentation / Sedimentation basin
Aire d'accumulation de la kimberlite usinée modifiée / Modified processed kimberlite accumulation area
Berne de confinement perméable
Berne d'enrochement perméable
Fossés périphériques
Bassin de sédimentation R-65 / R-65 setting pond
Usine permanente de traitement des eaux usées minières / Permanent industrial wastewater treatment plant
Fosse R-65 / R-65 Open-pit
Halde de stériles / Waste rock stockpile
Halde de mort-terrain / Overburden stockpile
Usine de traitement des eaux usées minières (temporaire) / Temporary industrial wastewater treatment plant
Fosse R-2 / R-2 Open pit
Fosse R-3 / R-3 Open pit
Usine de triage / Ore sorting plant
Aire temporaire d'entreposage du minerai / Temporary ore stockpile area
Lac Lagopède
Émissaire des eaux usées minières traitées / Treated mine wastewater outfall
Diffuseur / Diffuser
MIR2
P17
P14
P6
P15
S18
S
PP-16-07
PP-16-04
PP-16-05
PP-16-03
PP-16-02
PP-16-11
PP-16-09
PP-16-10
PP-16-08
PP-16-06
F3294
F3295
F3296
F3297
F3298
F3301
F3302
F2607
F3300
32302
Baie Sud
Baie Nord-Est
Secteur Sud
Baie Est
km 648+418
km 648
km 647
167
Limites de l'aire d'étude / Study area limits
Secteur de la mine / Mine area
Lac Emmanuel
Rivière Nemeuse
Secteur de la piste d'atterrissage / Airstrip area
stornoway
Mine diamantifère Renard / Renard diamond mine
Plan de restauration / Restoration Plan
Infrastructure (7 juil. 2015; mise à jour 4 mai 2018) / Infrastructure layout (as of July 7, 2015; updated May 4, 2018)
Cours d'eau permanent / Permanent stream
Cours d'eau intermittent à écoulement de surface et souterrain / Intermittent stream with surface and underground flow
Écoulement souterrain / Underground flow
Prolongement de la route 167 / Extension of road 167
F3293
Numéro d'identifiant de lac CEHQ / CEHQ lake ID number
T
Station permanente de traitement des eaux usées minières / Permanent industrial wastewater treatment plant
Fossé de collecte / Collection ditch
PX
Station de pompage / Pumping station
SX
Bassin de traitement / Treatment pond
Conduite d'amenée / Supply line
PP-16
Puits de pompage / Pumping wells
Sources:
Water Management Plan, SNC_Lavalin, January 8, 2014
Fossés / Ditch : Golder, 21 jan. 2016 / Jan. 21, 2016
0 250 500 m
Échelle / Scale 1 : 12 500
UTM, zone 18 (NAD83)
Courbe de niveau (intervalle de 50 pieds) / Contour line (50 feet interval)
Carte de base / Base Map : Stornoway, 2010;
CanVec, 1: 50 000, 33A16-33A09. RNCan, 2010
Fichier / File : 61470-047_C2-6-1_Collecte_eaux_180525.WOR
Mai 2018 / May 2018
Système général de collecte et de gestion des eaux / General water management plan
NORDA STELO
Carte / Map
3.11

In this regard, the DFO required that the following new measures be applied:

- Take regular temperature readings as of early September to detect the start of spawning;
- Provide raw temperature data (survey date, depth and temperature) in the next monitoring report for this spawning ground;
- Ensure that the materials used to build the new types of egg traps blend in as much as possible with the spawning ground substrate (round stones, type and colour of artificial substrate)since the traps will be placed directly on the spawning ground;
- Check the egg traps more frequently, for example, every two days, to prevent predation or the degradation of any eggs caught;
- Use appropriate fishing techniques, based on the current literature, for validating the presence of spawners in the spawning ground.

Monitoring in 2019 of the lake trout spawning ground developed in Lake Lagopede focussed on the integrity, water quality and use of the lake trout spawning ground.

No irregularities were detected in monitoring of the integrity of the developed spawning ground. The habitat is still conducive to the deposit of gametes by lake trout as well as to protecting eggs from freezing temperatures and predators.

With regard to the use of the spawning ground developed for lake trout, 12 mature, gravid females and males with milt were caught in the fall 2019 angling campaigns in the vicinity of the spawning ground (photos 3.31 and 3.32 and Table 3.16).

Photo 3.31 Eggs from a female lake trout in October 2019

Photo 3.32 Signs of milt on a male lake trout in October 2019

Table 3.16 Fishing effort and species caught during lake trout monitoring in the fall 2019

Date	Fishing Effort (h)	Species Code	Number of Specimens	CPUE (Catch per Unit Effort)	BPUE (Biomass per Unit Effort)
2019-09-20	1.83	ESLU	2	0.43	-
2019-09-23	2.00	SANA	1	0.50	1067.50
2019-10-09	3.50	ESLU	1	0.29	-
2019-10-09	3.50	SANA	5	1.43	1200.00
2019-10-11	1.00	SANA	2	2.00	1044.00
2019-10-12	2.50	SANA	7	2.80	3676.40
2019-10-14	3.66	ESLU	1	0.56	-
2019-10-14	3.66	SANA	4	1.09	1863.93
2019-10-30	5.00	ESLU	1	0.33	-
2019-10-30	5.00	SANA	1	0.20	158.00
Total	**19.49**	**2**	**25**		
Average				**0.96**	**1501.64**

ESLU: *Esox lucius*

SANA: *Salvelinus namaycush*

These observations indicate that the lake trout spawning ground was actively used by the species in the 2019 spawning period. The method used to capture eggs however was not conclusive since no eggs were seen in the egg traps

2020 Monitoring

Monitoring to confirm the integrity and use of the spawning ground is scheduled for 2020. As in 2019, the lake trout spawning ground will be visited in winter to check that the water level over the spawning ground is adequate to ensure the survival of the eggs. The monitoring will include a visual inspection of the developed site in fall to track changes in the quality of the spawning substrate.

With regard to monitoring the use of the spawning ground, data collected in the 2019 survey will be used to zero in on the lake trout spawning period and hence optimize observation of signs of spawning. Water temperature and wind speed readings will be tracked on a regular basis as of October to detect the likely start of lake trout spawning.

Angling remains the preferred method for catching individual specimens in the vicinity of the spawning ground but a new type of scientifically proven egg trap, will be installed to observe eggs. In addition, an application for a SEG permit will be submitted so that more specimens can be caught over a longer sampling period.

3.10.3 Development of Walleye Spawning Ground near Mistissini

3.10.3.1 Background

Developing a 600-m² walleye spawning ground in Lake Mistassini is the third component of the FHCP required under authorization No. 2014-002 issued by the DFO on April 9, 2014 (DFO, 2014).

In this regard, a design for the construction of a temporary jetty was submitted to the DFO for approval in early 2017. An amendment to the Global CA to include work to develop the walleye spawning ground in Mistissini was granted in November 2018.

The target location for this spawning ground is west of Mistissini, where Lake Mistassini narrows between the Baie du Poste and the main part of the lake further north. At this location, all the water from Baie du Poste has to flow through this area to reach Abatagouche Bay in Lake Mistassini.

In the upstream part of the canal, just before the lake narrows, there used to be a walleye spawning ground on the right bank adjacent to the canal. According to community members, a sawmill operating near the spawning ground in the 1960s was partly responsible for destroying the spawning ground.

Although walleye are still present in this area, they have not spawned there since the sawmill closed.

3.10.3.2 2019 monitoring

Once all required authorizations were obtained, construction of the walleye spawning ground in Lake Mistassini proceeded as planned from September 25 to October 4, 2019 (Map 3.13).

The 636 m^2 area consists of natural round stones, as a spawning substrate, and rocks laid out on the spawning ground to provide fish with shelter (Photo 3.33). During construction, various mitigation measures were implemented to reduce the resuspension of fine particulates in the water and to prevent water contamination due to accidental oil spills or leaks.

The installation of turbidity curtains, the use of clean and dust-free rock, and constant surveillance throughout the construction work made a significant contribution to minimizing the inflow of sediment to the lake.

Photo 3.33 Walleye spawning ground marked by buoys

3.10.3.3 2020 monitoring

The integrity and use of the spawning ground will be monitored during the walleye spawning period in late May 2020.

3.10.4 Development of Brook Trout Habitat in the Lake Mistassini Sector

Development of brook trout habitat in a tributary of Lake Mistassini is the fourth component of the fish habitat compensation program. Prior to beginning this project, a detailed conceptual design plan was submitted to the DFO in June 2017 for approval.

The proposed fish habitat development involved rebuilding a stream crossing on a forest road south of Lake Mistassini. The objective was to enable fish to pass through the crossing and take advantage of the pool downstream of the existing culverts.

More specifically, the work involved:

- Replacing two existing culverts with RNI (*Regulation Respecting Standards of Forest Management*) compliant culverts that support the free passage of fish;
- Building three rock weirs upstream and downstream of the culverts;
- Laying gravel upstream and downstream of the riffles to create spawning grounds over an area of about 100 m².

3.10.4.1 2019 Monitoring

The work was carried out from August 26 to 29, 2019, during the summer low-flow period before the start of the restriction period for work in the aquatic environment.

Mitigation measures were implemented to control the emission and dispersion of suspended solids during fish habitat development work and to prevent leaks and spills of hydrocarbons and any other potential source of contamination.

The work re-established access to at least 2,000 m^2 of habitat upstream of the culverts. In addition, 50 m^2 of spawning substrate was developed preserving some excellent nursery and feeding habitat near the spawning grounds (Photo 3.34).

2.1.1.1 2020 Monitoring

A visual examination of the developed stream section will be undertaken to assess the general condition of the spawning ground. Monitoring of the free movement of fish will also be carried out in the developed reach and the new culvert. Use of the fish habitat will be monitored in early fall (late September) using electrofishing and visual observation.

Photo 3.34 Riffle developed downstream of culverts

3.10.5 Baseline for the Fish Habitat Development in the Diversion Channel on the Former Icon-Sullivan Mine Site

Fish habitat development in the diversion channel on the Icon-Sullivan site (Waconichi River) is the last of the five components of the Renard Diamond Project Fish Habitat Compensation Program.

The work planned at the Icon-Sullivan site is special in that it is located near a former copper mine that was operated in the 1960s and 1970s and may still have the potential to influence water and sediment quality in the diversion channel.

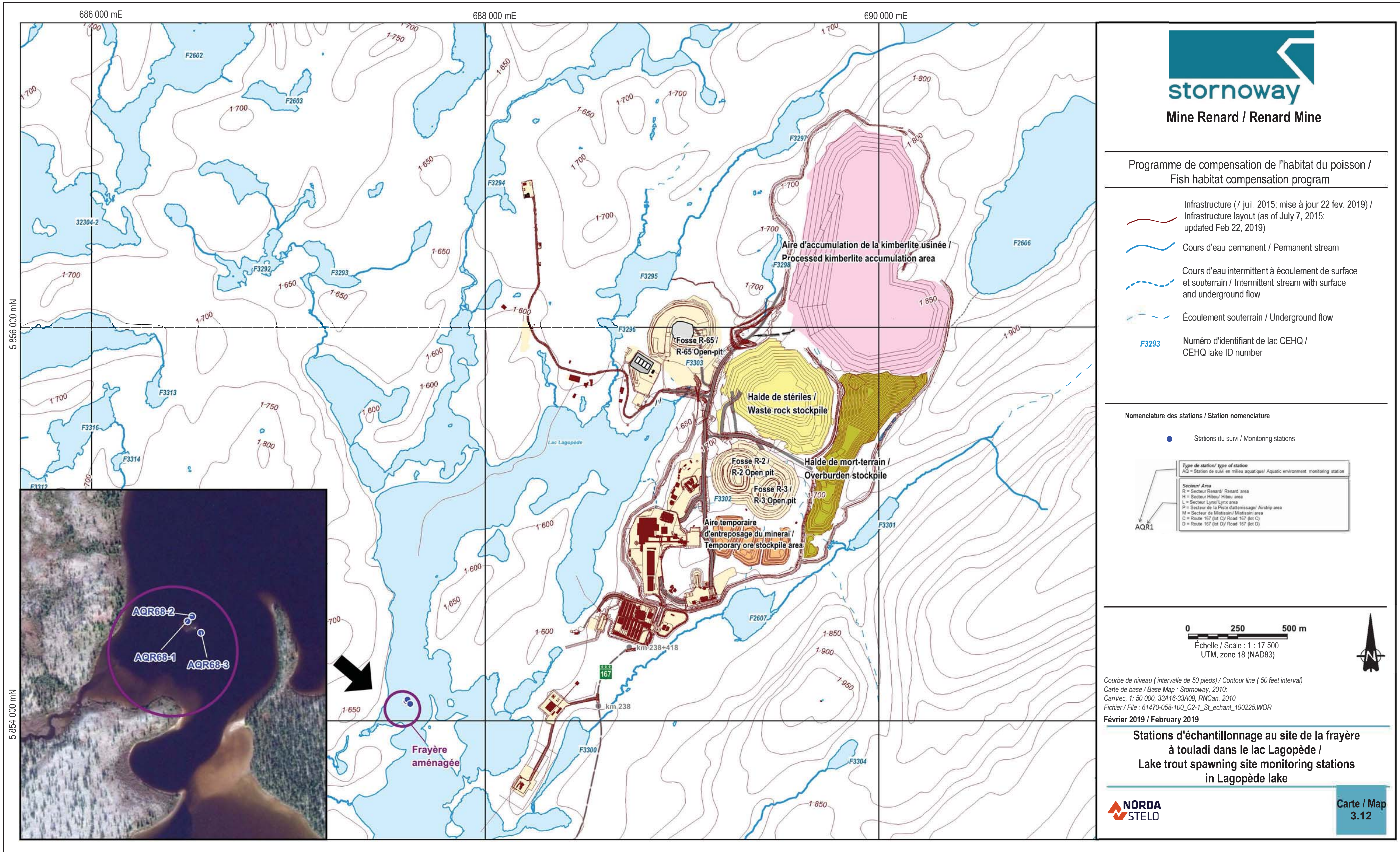
As required by the DFO (DFO, 2014), the initial physical-chemical characterization of the spawning habitat to be developed was completed before fish habitat development work began.

This requirement was completed in two phases, i.e., an initial characterization in 2012 and an additional characterization in 2016.

In general, the 2016 surface water and sediment quality results are comparable with the 2012 data and comply with Canadian and provincial criteria for the protection of aquatic life.

The presence of existing spawning grounds as well as surface water and sediment quality data indicate that the physical-chemical properties at the site to be developed as fish habitat will not pose any problem for walleye growth and reproduction.

The fish habitat development work was not however completed in 2019, given that discussions were still underway concerning the feasibility of this project as well as the stability and hence physical safety of the former mining site (SNC Lavalin, January 2017).


stornoway
Mine Renard / Renard Mine
Programme de compensation de l'habitat du poisson / Fish habitat compensation program
Infrastructure (7 juil. 2015; mise à jour 22 fev. 2019) / Infrastructure layout (as of July 7, 2015; updated Feb 22, 2019)
Cours d'eau permanent / Permanent stream
Cours d'eau intermittent à écoulement de surface et souterrain / Intermittent stream with surface and underground flow
Écoulement souterrain / Underground flow
F3293
Numéro d'identifiant de lac CEHQ / CEHQ lake ID number
Nomenclature des stations / Station nomenclature
Stations du suivi / Monitoring stations
Type de station/ type of station
AQ = Station de suivi en milieu aquatique/ Aquatic environment monitoring station
Secteur/ Area
R = Secteur Renard/ Renard area
H = Secteur Hibou/ Hibou area
L = Secteur Lynx/ Lynx area
P = Secteur de la Piste d'atterrissage/ Airstrip area
M = Secteur de Mistissini/ Mistissini area
C = Route 167 (lot C)/ Road 167 (lot C)
D = Route 167 (lot D)/ Road 167 (lot D)
AQR1
0
250
500 m
Échelle / Scale : 1 : 17 500
UTM, zone 18 (NAD83)
Courbe de niveau (intervalle de 50 pieds) / Contour line (50 feet interval)
Carte de base / Base Map : Stornoway, 2010;
CanVec, 1: 50 000, 33A16-33A09, RNCan, 2010
Fichier / File : 61470-058-100_C2-1_St_echant_190225.WOR
Février 2019 / February 2019
Stations d'échantillonnage au site de la frayère à touladi dans le lac Lagopède / Lake trout spawning site monitoring stations in Lagopède lake
NORDA STELO
Carte / Map
3.12
686 000 mE
688 000 mE
690 000 mE
5 856 000 mN
5 854 000 mN
Aire d'accumulation de la kimberlite usinée / Processed kimberlite accumulation area
Fosse R-65 / R-65 Open-pit
Halde de stériles / Waste rock stockpile
Fosse R-2 / R-2 Open pit
Fosse R-3 / R-3 Open pit
Halde de mort-terrain / Overburden stockpile
Aire temporaire d'entreposage du minerai / Temporary ore stockpile area
Lac Lagopède
km 238+418
km 238
167
Frayère aménagée
AQR68-2
AQR68-1
AQR68-3
F2602
F2603
F3294
F3297
F3298
F3295
F3296
F3303
F3302
F3301
F3292
F3293
32304-2
F3313
F3316
F3314
F3312
F2606
F2607
F3300
F3304

3.11 Segments C and D on Route 167 Extension (Mine Access Road)

As part of the extension and construction of Route 167 North, SWY committed to applying compensation measures along the stretch of road under its responsibility, i.e., six sites beyond km 553 for a total of 1,011.9 m² of fish habitat. This work was completed in summer 2014.

3.11.1 Monitoring Free Passage of Fish at Stream Crossings

The stream crossings along Route 167 North where free passage of fish is required were monitored in September 2014 (Norda Stelo, 2015). The 2014 monitoring results confirmed the free passage of fish at all the crossings.

The related monitoring was completed in summer 2017. The fish habitat development work undertaken does not in any way hinder the free movement of fish and the presence of various fish species was reported in the relevant streams (SWY, 2018b).

3.11.2 Monitoring of Fish Habitat Compensation Measures

In compliance with authorization 2013-011 issued on April 12, 2013 by the DFO (MPO, 2013), this monitoring was undertaken to measure the effectiveness of the fish habitat compensation project and to ensure that areas developed remained stable and recreated fish feeding, rearing and spawning habitats in addition to ensuring the free movement of fish.

The fish habitats developed were monitored first in September 2015, and then for the second and last time in September 2017.

The last monitoring confirmed that the fish habitats created along the mine access road connecting Route 167 North and the Renard mine had remained stable. The rebuilt sections of the streams still allow for the movement of fish upstream and downstream (Stornoway, 2018b).

3.11.3 End of Monitoring

In May 2018, the DFO issued a notice to the effect that the fish habitat development work and the monitoring of the free movement of fish through certain culverts on Route 167 North met the objectives set out in the DFO's Fisheries Protection Program in compliance with authorization 2013-011, issued on April 12, 2013.

The DFO letter is attached in Appendix IV. As is stated in the letter, "the DFO thereby considers the project to be complete", which brings to a close the monitoring of structures along Route 167 North. No further monitoring is therefore required.

In 2020, SWY will however on a voluntary basis inspect the free passage of fish at the fish habitats that have been developed.

3.12 Terrestrial Wildlife and Birds

Terrestrial wildlife and birds are monitored to achieve the following specific objectives:

- Determine how the moose population is affected by the presence and operation of the mine and the airstrip;
- Document the presence of woodland caribou in the mine and airstrip study area and along Route 167;
- Document the presence of nests of migratory and at-risk bird species in the work areas and ensure they are protected;
- Assess the effectiveness of mitigation measures in minimizing the number of road accidents involving big game (*2019 monitoring*);
- Monitor waterfowl nest boxes installed around Lake Lagopede and neighbouring small lakes to maintain the number of breeding pairs in the mine area;
- Make employees and contractors aware of the impacts of poaching and disturbing wildlife;
- Assess the effectiveness of mitigation measures in preventing animal intrusion on the mine site as well as all forms of poaching.

3.12.1 Big Game Monitoring

To measure changes observed in big game population distribution since the construction phase, the opening of the mine access road and the beginning of mine operations, aerial surveys of big game specific to the mine site and mine access road were conducted in March 2010, 2015, 2017 and 2019. These aerial surveys focussed on moose, caribou, grey wolf and black bears. They represent one of the rare surveys undertaken at this scale over such a long period of time (Norda Stelo, 2019d).

The surveys covered various study areas (Map 3.13), including:

- The mine study area (140 km²);
- The airstrip study area (29 km²);
- The control area (140 km²);
- The mine access road study area (300 km²).

As scheduled as part of the environmental monitoring program, a third monitoring phase was undertaken in 2019. And a comparison of the results of surveys since 2011 was also undertaken.

3.12.1.1 Moose

The results of the moose survey in 2019 are shown by study area (Photo 3.35).

Photo 3.35 Visibility during surveying work on March 9, 2019

Airstrip and Route 167 North

As in the 2015-2017 survey, no moose were sighted in March 2019, whereas a single individual was sighted at km 573 in March 2010.

Mine Study Area

No moose at all were sighted in this area in 2019, as was the case in 2011 and 2015, or before and during the mine construction phase. In 2017, moose were sighted with a density of 2 moose/100 km².

Control Area

An aerial survey of the control area covered in the impact assessment (Roche, 2011a) was carried out on March 9, 2019. The moose density observed from 2011 to 2019 varied as follows:

- 2011: 4 moose/100 km² or 0.05 moose/km²;
- 2015: 5 moose/100 km² or 0.06 moose/km²);
- 2017: 7 moose/100 km² or 0.09 moose/km²;
- 2019: 2.34 moose/100 km² or 0.02 moose/km² (not significant).

In other words, moose density was the same in the control in 2011 and 2015. It practically doubled in 2017, then decreased in 2019 (Norda Stelo, 2019d) (Photo 3.36).

2.1.1.1 Caribou

No caribou sightings were recorded in big game surveys in 2011, 2015, 2017 and 2019 in the mine, airstrip and control study areas. For the first time since the start of big game monitoring, however, a herd of 17 woodland caribou was sighted less than 20 km south of the mine site, in the vicinity of km 620 in the aerial survey carried out in March 2019 (Photo 3.37).

Photo 3.36 Moose sighting in control area on March 9, 2019

Photo 3.37 Sighting of a herd of woodland caribou (March 2019)

3.12.1.2 Temiscamie woodland caribou herd

The presence of four woodland caribou herds was confirmed in the Northern Quebec region by the MFFP in the 2000s, specifically the Temiscamie herd whose range crosses the Renard mine study area and the mine access road.

In January 2018, Stornoway signed a partnership agreement with the MFFP to share telemetric data on the location of caribou within a 100-km radius of the Renard mine site. In April 2019, the MFFP shared geographic position data from more than 21 radio collars, including five new collars that were attached to woodland caribou in 2019.

This information in conjunction with the sightings from aerial surveys confirmed the presence of woodland caribou in the big game survey area, more specifically the mine access road study area (Norda Stelo, 2019d).

3.12.1.3 Wolves and fox

In March 2019, a heavy concentration of wolf tracks was observed in the mine and airstrip study areas. Unlike observations in 2017, few tracks were seen along the mine access road.

It is likely that the presence of wolves is correlated with the presence of caribou herds. Note that in the aerial surveys an active wolf den was located in the mine study area and another inactive den was found by tallyman Sydney Swallow outside the study areas.

In 2019, a few fox were sighted on the mine site (Photo 3.38).

Photo 3.38 Fox sighting on mine site (October 2019)

3.12.1.4 Black bear

Black bears were sighted on or near the mine site in late May and mid November 2019. They were simply scared off the site and none had to be shot and killed for safety reasons in 2019.

A number of bears frequented the TLS in spring and summer 2019 (Photo 3.39). Sightings were up in early spring but became less frequent in summer primarily because forest berries were then in season.

2.1.1.1 Sightings at the TLS

Two surveillance (hunting) cameras were installed permanently in 2016 to film big game that visited the trench landfill site (TLS).

In 2019, bears and wolves were observed as in previous years (Photo 3.40). A number of sightings had also been logged by users along Route 167 and near the TLS.

Photo 3.39 Bears photographed at the TLS (June 2018)

3.12.1.5 Wildlife sightings – Route 167 North

To log wildlife sightings along Route 167, the gatehouse security guards systematically ask truck drivers whether they sighted any wildlife along the roadway. All sightings, including sightings by mine workers, are logged. In 2019, 13 wildlife sightings on Route 167 North were recorded. Although bears are the most frequently seen along the roadway, there were five caribou and just one moose sighting along Route 167 North.

Photo 3.40 Wolf photographed at the TLS (December 2019)

Incidents along Route 167 North

Stornoway maintains tight control over all road users who travel as far as the Renard mine by requiring drivers to apply in advance for authorization to use the road. Road users are informed of safety rules, including speed limits and the firearm prohibition.

In addition to keeping road users safe, these measures have reduced road accidents involving big game animals. Since Route 167 North was opened in 2014, only two incidents have been reported, both in 2017.

In 2019, 1,721 trucks travelled along Route 167 North and no incidents involving animals occurred. In addition, no poaching was reported.

3.12.2 Black Bear Management

Stornoway made a considerable effort in 2019 to improve black bear management on the mine site. A number of actions were taken including:

- Having a black bear management plan prepared by a biologist who is a black bear expert;
- Reviewing and implementing the Renard mine procedure in the event of a black bear encounter (HSS-3.6 – Prevention and Interaction with Wild Animals – Black Bear), which was put in place in 2014 and is revised annually;
- Organizing a site visit by the Ministry of Forests, Wildlife and Parks (MFFP);
- Monitoring and strengthening site facilities (TLS fencing, waste containers and bear repellents);
- Raising workers' awareness of the presence of black bears on the mine site.

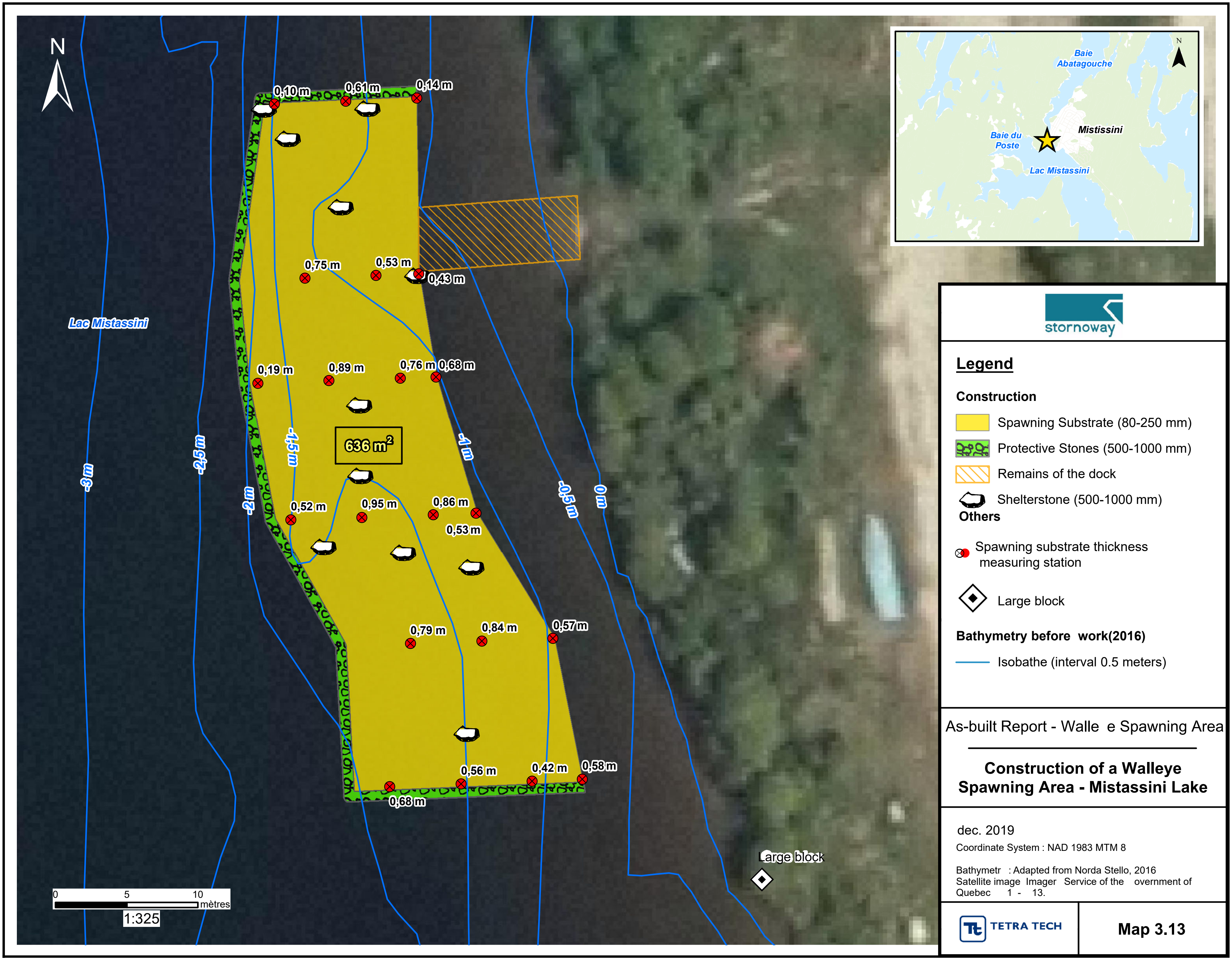
3.12.2.1 Management plan

Fully aware that Renard mine site is located on black bear habitat, Stornoway had a black bear management plan prepared in April 2019 by an external consultant who is a specialist in the species. The management plan is designed to strengthen the measures SWY has put in place since 2014 and hence improve surveillance of the species on the mine site and enhance the safety of workers on site. The management plan incorporates recognized practices for managing black bear approach behaviours and frequentation of the mine site.

The report provides information on the life cycle and behaviours of black bears from biologists who specialize in the species as well as regional biologists and biologists from the Ministry of Forests, Wildlife and Parks (MFFP and the Wildlife Protection Branch.

3.12.2.2 HSS-3.6 procedure

In 2014, SWY put in place the HHS-3.6 procedure (Appendix V), covering the prevention, safety and intervention measures to apply in encounters with black bears. In this procedure, Appendix A provides guidelines for managing encounters with wild animals, specifically black bears, near Renard mine sites.



P:\40604TT\DOC-PROJ\60\60CRO\40604TT_frayèreDoré_FIG1_v2.mxd

3.12.2.3 TLS fencing

In 2019, regular monitoring of the electric fencing was undertaken to ensure it was in good working order throughout the season. Boulders were put down into holes dug by black bears under the fencing to prevent bears from accessing the TLS. Large boulders were also put in place under the entrance gate, which was an effective way of preventing bears from digging their way into the TLS (Photo 3.41).

Photo 3.41 Visit to TLS with MFFP biologist (June 3, 2019)

In summer 2019, the southwest part of the TLS fencing was completely dug up so that wire mesh could be installed outside the TLS fencing. The wire mesh was installed two metres deep along with a layer of rock on top and backfill over the entire area.

This measure is designed to prevent bears from digging under the fencing and make it very difficult for them to access the TLS. The work continued in summer 2020 through the fall until the first snowfall.

3.12.2.4 Waste containers

In 2017, SWY installed freezers to store food waste and prevent bears from visiting the accommodation complex. The food waste is removed from the freezers daily and taken to the TLS. In addition, lids with sliding mesh doors were added in 2019 to domestic waste bins near the kitchen and in front of the garage and the plant. These lids restrict access by wildlife, and since they were installed the number of fox and bears on the mine site has decreased considerably (Photo 3.42).

Photo 3.42 Lids with sliding doors – dryhouse container

3.12.2.5 Bear deterrents

A number of watertight boxes containing an air horn and pepper spray are set up at strategic locations on site (Photo 3.43), providing workers with ready access to these deterrents along sidewalks, and the entry and exit to the pedestrian walkway between the accommodation complex and the dryhouse.

Photo 3.43 Deterrent box at the entrance to the pedestrian walkway (July 2019)

3.12.2.6 Use of M-11 trapline

Despite the fact that bears are drawn to the TLS, which is located on the M-11 trapline, and could provide additional hunting opportunities for the tallyman, members of the Swallow family are not interested in harvesting bears for consumption.

The bear harvest has remained fairly limited since 2012, with only two harvested in 2015-2016 (Norda Stelo, 2019d).

3.12.2.7 Awareness campaign

In spring 2019, the Environment department launched an awareness campaign to encourage Renard mine workers to refrain from feeding wild animals, particularly black bears who come out of hibernation in the spring.

Posters were put up in common areas such as along the corridors in the camp, cafeteria and administrative buildings (Figures 3.19 and 3.20).

An MFFP biologist delivered two information sessions on the biology of black bears for Renard camp workers on June 3 and 4, 2019 (Photo 3.44). The primary objective of these sessions was to present the life cycle of bears, their behaviours during feeding time, as well as safety measures in the event a bear is encountered (Photo 3.45).

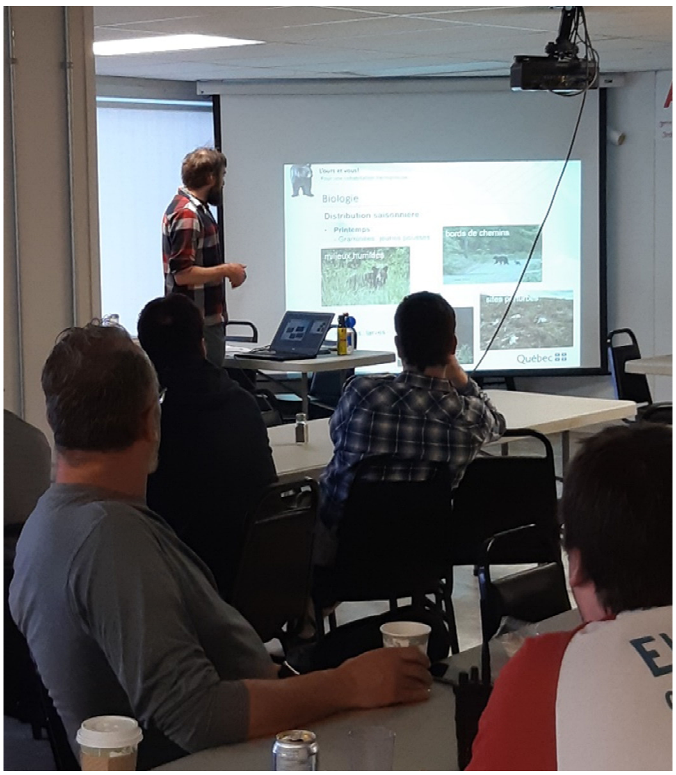


Photo 3.44 Black bear information sessions delivered by MFFP - Renard mine (June 3, 2019)

Photo 3.45 Black bear photographed by an operator at the TLS (July 2019)

3.12.2.8 MFFP visit

An MFFP biologist visited the mine site and the TLS on June 3 and 4, 2019, to assess the impact of mining activities on black bear behaviour, particularly their feeding habits. Various black bear traces, such as holes that had been dug and tufts of bear hair on the barbed wire of the fencing, were observed by the MFFP biologist in and near the TLS (Photo 3.46), indicating ready access to the landfill and hence a source of food. The MFFP biologist also examined the condition of the infrastructure such as the waste containers and deterrents, and the garbage bins at the Cree Cultural Center. The recommendations resulting from this visit are provided in next section (3.12.2.9).

Photo 3.46 Traces of black bears under the TLS fencing (June 2019)

THE BLACK BEAR AT THE RENARD MINE

IN THE SPRING

THE BLACK BEAR COMES OUT OF HIBERNATION, AND HE'S HUNGRY.

HE'S LOOKING FOR EASILY ACCESSIBLE FOOD.

TO PROTECT HIM,
AND FOR THE SAFETY OF ALL :

LET'S NOT ATTRACT IT TO THE SITE!

FOLLOW THESE 2 SIMPLE RULES

- **DISPOSE OF YOUR WASTE IN A CLOSED BIN**
- **DO NOT THROW ANY WASTE ON THE GROUND**

THINK ABOUT EVERYONE'S SAFETY AT ALL TIMES!

stornoway

3.12.2.9 Recommendations for 2020 monitoring

The visit from the MFFP helped zero in on elements of the black bear management approach that could be improved in the short and long term. Since the primary objective is to eliminate black bear access to food on the mine site, the MFFP therefore recommends:

- Reinforcing the TLS fencing by increasing the electric current, placing large boulders under TLS fencing, and securely anchoring the fencing into the ground;
- Recording the number of bears sighted daily at the TLS in the wildlife sighting log;
- Adding a latch to lock the sliding doors on the container lids and make them more difficult for bears to open;
- Installing a bear-proof garbage can at the Cree Cultural Center, which is located in a natural forest corridor between adjacent lakes at the mine site, and represents an entry point for bears to the mine site;
- Emptying the garbage can regularly, particularly during periods when there is increased use of the Cree Cultural Center.

The MFFP also issued recommendations for improving worker safety and managing encounters with bears. It recommends increasing the number of bear deterrent boxes along walkways and set up a system whereby workers can borrow bear deterrents for when they go out walking around the camp and mine site.

3.12.3 Bird Monitoring

3.12.3.1 Monitoring of duck nesting boxes

In compliance with the Canadian Environmental Assessment Agency's instructions, about ten waterfowl nesting boxes were installed around Lake Lagopede and some small neighbouring lakes (CEAA, 2013).

These nesting boxes are intended for Barrow's goldeneye, a small black and white duck. They were installed in live or dead trees near swamps, or quiet, shallow bays in Lake Lagopede or lakes around the mine site where the water is shallow, sites that are conducive to the reproduction of Barrow's goldeneye (Map 3.15).

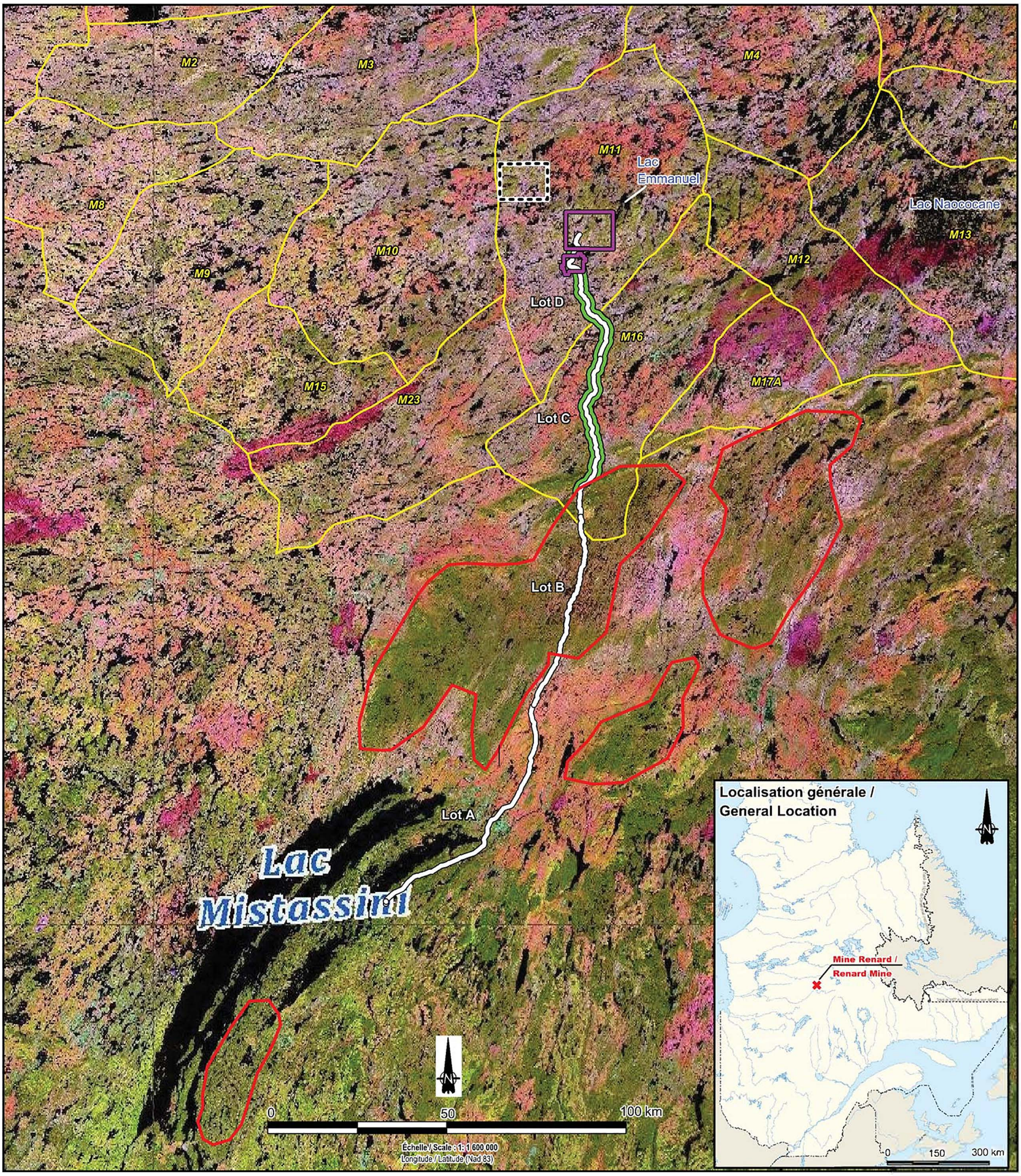
After waterfowl migrated south, the nesting boxes were visited twice. The first was aimed at checking the nesting boxes and recording whether they had been used (signs of presence and identification of the species involved). Although the nesting boxes were intended for Barrow's goldeneye, they could well be used by other species, such as common mergansers, owls or even squirrels.

The purpose of the second visit was to clean the boxes, replace the wood chips and make any necessary repairs before the spring.

After the 2019 nesting season, the ten nesting boxes were still in good condition. None of the boxes showed signs of having been used for nesting. All the boxes were inspected in September and October 2019 (Photo 3.47) and in some cases wood chips were added (Photo 3.48).

Photo 3.47 Visit to bird nesting boxes (October 2019)

Photo 3.48 Wood chips added to a nesting box



Aires d'étude de la mine Renard, mars 2019
Renard Mine study areas, March 2019

- Aire d'étude pour l'inventaire de la grande faune (lignes de vol aux 500 m) / Large mammal survey area (flight lines every 500 m)
- Zone témoin pour l'inventaire de l'orignal (lignes de vol aux 500 m) / Control area for moose survey (flight lines every 500 m)

Aires d'étude pour le chemin d'accès minier (MTQ), mars 2017
Mine access road study areas, (MTQ), March 2017

- Bloc d'inventaire aérien du caribou forestier par le MFFP, Harde de Témiscamie / MFFP caribou aerial survey areas, Temiscamie Herd
- Zone d'inventaire de la grande faune par Norda Stelo dans une zone tampon de 5 km / Nord Stelo large mammals survey area in a 5 km buffer zone

- M11 Terrain de trappage / Trapline

Végétation et occupation du sol
Vegetation and land use

- Pessière à lichens / Lichen Spuce Stand
- Pessière à mousses / Moss Spruce Stand
- Forêt mixte / Mixed Forest
- Forêt décidue / Deciduous Forest
- Brûlis (0 - 5 ans) / Burnt (0 - 5 years)
- Brûlis (5 - 10 ans) / Burnt (5 - 10 ans)
- Épidémie d'insecte / Insect Epidemic Area
- Zone agricole / Agriculture Area

stornoway

Mine Renard / Renard Mine

Inventaire de la grande faune /
Large Mammal Monitoring

Carte de base / Base map : Image Landsat, 2014
Fichier / File : 61470-053_C1-1 Zones_invent_gr_faune_190710.WOR
Juillet 2019 / July 2019

Zones d'inventaire de la grande faune /
Large mammal survey areas

NORDA STELO

Carte / Map
3.14

3.12.3.1 Monitoring of breeding among migratory and special-status birds

Nesting boxes will continue to be monitored in 2020. Based on the results in 2020, some nesting boxes could be relocated to other sites favourable to Barrow's goldeneye in the Renard mine area.

The birds most often sighted at the mine are gray jays and crows in all seasons, tree swallows in summer and willow ptarmigan, and snowy owl on occasion. No migratory or special-status bird nests were observed at the mine site in 2019.

Awareness Campaign

Since 2015, users of motorized small craft on the mine site have been made aware of the presence of waterfowl that use Lake Lagopede, and are advised to avoid sheltered bays in spring and summer when common loon are very likely to be nesting. Boat trips on Lake Lagopede are limited to two or three times a month for environmental monitoring purposes.

Trench Landfill

Since 2015, bald eagles (a vulnerable species according to the MFFP, 2018) have been sighted from year to year at the TLS. Young eagles have also been observed at the TLS, which suggests that eagles nest in the area.

For the moment, despite the large size of bald eagle nests, no such nests have been found either within the TLS enclosure or in trees around the landfill. Special care is taken every year to determine whether the bald eagle has returned and still nests near the TLS.

3.13 Water and Effluent Management

The Renard mine water management plan was designed to prevent and minimize potential impacts on surface and ground water quality. The plan includes the management of mine wastewater (which may be affected by construction activities and mining operations) as well as the management of water that originates upstream of the mine site by preventing it from becoming contaminated by mining operations.

Water that comes into contact with mine facilities is intercepted by a network of perimeter ditches and culverts that channel it to pit R65 retention and sedimentation basin, from where it is directed to treatment facilities before the treated water is discharged into Lake Lagopede (Map 3.16)

The network of ditches is heavily used during certain periods of the year. In 2019, a total of 2,445,971 m³ of water was intercepted by the perimeter ditches and then treated in the mine water treatment plant (MWWTP) (Photo 3.49). The temporary treatment (Geotube) plant was not used in 2019. It is used only intermittently in the event of large floods.

Photo 3.49 Mine wastewater treatment plant (MWWTP)

3.13.1 Dewatering Water

The mine's hydrogeological model was updated in 2017. A geological structure, which had not yet been identified, was determined. To anticipate and adapt to the additional water from this source, which could seriously complicate mining operations, an application for a certificate of authorization to build a network of water pumping and extraction wells was submitted in July 2017 (Norda Stelo, 2017c) and approved in December 2017.

The groundwater from this geological structure was characterized, and its physical-chemical characteristics were found to be comparable with the characteristics of the Lake Lagopede surface water as well as those measured as part of the EBS (Roche, 2011b) for the Renard mine hydrographic network (Roche, 2017c). The water quality is therefore good.

The volume of dewatering water is recorded and sampled, in compliance with the requirements set out in Directive 019. In 2019, the dewatering water was redirected to pit R65 to optimize the water level and hence the mine water re-use rate in winter. In spring 2019, the dewatering water was sent to the MWWTP for treatment along with the mine water.

In 2019, at the MIR2 station, 2,237,584 m³ of final mine effluent was treated and discharged. It contained two intermediate mine effluent flows:

- Effluent from the MWWTP (MIR2-A; 2,132,587 m³);
- Dewatering water (MIR2-B; 104,997 m³).

There was no need to use the temporary (Geotube) water treatment plant; hence, no effluent (MIR2-C) was discharged from this plant in 2019.

Figure 3.20 shows the mine wastewater and process water flow chart for 2019, including final and intermediate effluent at the Renard mine site.

Figure 3.21 depicts the operational water balance for 2019 at the mine site.

3.13.2 Mine Effluent Quality

The objective of monitoring final and intermediate effluent quality is to ensure compliance at all times with Directive 019 (MDDEP, 2012). The monitoring helps confirm whether the results observed for intermediate effluent at the MWWTP are as close as possible to the environmental discharge objectives (EDOs) established for the Renard project by the government (Roche, 2013b).

EDOs are concentration and maximum load values for a given contaminant that protect the receiving environment without compromising its sustainability and uses. Monitoring EDOs therefore protects the receiving aquatic environment, i.e., Lake Lagopede, by regularly tracking effluent quality at the MWWTP.

As noted earlier, diamond mines have been subject to the new *Metal and Diamond Mine Effluent Regulations* (MDMER) since June 1, 2018. The parameters for final mine effluent monitoring, and the discharge point to which these regulations apply, have been adjusted in line with the new requirements.

3.13.2.1 Results

In 2019, the values for all intermediate and final mine effluent parameters were well within the requirements set out in Directive 019. In addition, no acute lethality (toxicity unit below 1 per sample) was discovered in monthly toxicity testing carried out during the year on rainbow trout and daphnia.

MDMER standards were all met in 2019. Table 3.17 provides a summary of water quality results on each intermediate effluent as well as the final mine effluent. The influent values are also provided for comparison purposes. A symbol corresponding to the relevant standard is attached to each effluent concentration.

In addition to complying with Directive 019 requirements, the concentrations of practically all the intermediate METP effluent (MIR2-A) parameters, except nitrites and nitrates, comply with EDOs before effluent is diluted in the receiving environment. The values observed for these two parameters are slightly above their respective EDOs. These nitrogen compounds are derived from the explosives used in blasting operations associated with underground and open pit mining activities.

In 2019, Stornoway continued applying the three-prong action plan put in place in 2018, which included:

- An awareness program for underground mine workers, with training sessions held to inform underground mine workers about best practices for loading explosives in blast holes;
- An internal operational procedure for loading explosives integrated with ESMS and observation of the task being performed;
- An internal program to monitor the concentration of ammonia nitrogen in mine water from underground operations.

The objective of these efforts was to prevent or minimize at source the quantity of explosives that end up in the water circuit to be treated, and thereby reduce nitrogen compound concentrations in mine effluent from the MWWTP. This action plan is also consistent with maintaining industry best practices in mining operations.

Photo 3.50 clearly shows the quality of the water at the outlet to the lamellar clarifier.

Photo 3.50 Treated water at the outlet to the lamellar clarifier

2.1.1.1 Facilities maintenance

To ensure the sustainability of the MWWTP, preventive maintenance is regularly carried out on its operational, mechanical and electrical components. A log is maintained to record observations and facilitate the analysis of situations where action is required to restore the system and preserve long-term effectiveness of the treatment process.

Continuing plant operations while preventive maintenance work is under way is feasible owing to the 100% redundancy of the equipment. The MWWTP as a result achieved an availability rate of 97.1% in 2019.

3.13.3 Contingency Treatment Plant

The contingency treatment plant, which has a capacity of 350 m³/h, is equipped with Geotube® filter bags to recover total suspended solids in the water (Photo 3.51).

Photo 3.51 Modular treatment plant with Geotube® filter bags

This technology was used successfully during peak spring floods in 2015 and 2016, before the MWWTP was brought on line, as well as in 2017 during the spring flood, and in 2018 as a backup system from August 6 to 12 only. In 2019, there was no need to use the backup plant.

3.13.4 Water Withdrawal

Under the MELCC's *Regulation respecting the Declaration of Water Withdrawals*, anyone who withdraws 75,000 L/day (75 m³/day) or more is required to report the amount they withdraw annually. Water withdrawals at the Renard mine site are therefore subject to this regulation.

Water withdrawals are attributed, in decreasing order of importance, to:

- The dewatering of the underground mine and open pits (87%);
- The ore processing plant's freshwater requirements (11%);
- The production of drinking water for the worker's camp (2%);
- The production of explosives in the form of emulsions; and
- The Renard mine airport's sanitary facilities (less than 0.06%).

Withdrawals are divided into two main categories, surface water and ground water. Surface water withdrawals taken directly from Lake Lagopede are used to produce drinking water and meet the ore processing plant's freshwater requirements.

Groundwater withdrawals, via various pumping stations and wells, involve underground mine and open pit dewatering activities. In addition, water for explosives and airport sanitary facilities is drawn from artesian wells. In 2019 as in 2018, a total volume of 2.76 Mm³ of surface and ground water was withdrawn.

As indicated in Directive 019, operators are required to maximize the use of mine wastewater produced at mine sites. SWY therefore makes every effort to minimize the use of freshwater by re-using water produced by the mine wastewater treatment plant and the runoff collected on the mine site. Efforts made in this regard are discussed in the next section (3.13.5).

3.13.5 Water Re-Use

The water balance documents observed or estimated water flows during the year at the mine site. The mine site water balance was updated in 2019 to include new water flows, specifically the dewatering water discussed in section 3.13.1. A mine wastewater and process water flow diagram is illustrated in Figure 3.20.

3.13.5.1 Water flow

The following significant flows have been identified:

- Activities that require water including ore processing plant operations and the washbay in the mechanical maintenance garage, supply of drinking water for the mine camp, development of the underground mine, and water used in dust control procedures;
- Freshwater supply drawn from the natural environment, specifically surface water from Lake Lagopede but also water drawn from artesian wells;
- Water that is re-used from pit R65, where runoff from the mine site is collected and then treated as well as water from underground mine dewatering and from the water retention pond near the MPKC facility;
- Runoff;
- Seepage water in ditches and underground galleries;
- Evapotranspiration and evaporation of surface water at the mine site;
- Final mine effluent, including MWWTP effluent, temporary (Geotube) treatment plant effluent, and dewatering water from the underground mine discharged into Lake Lagopede.

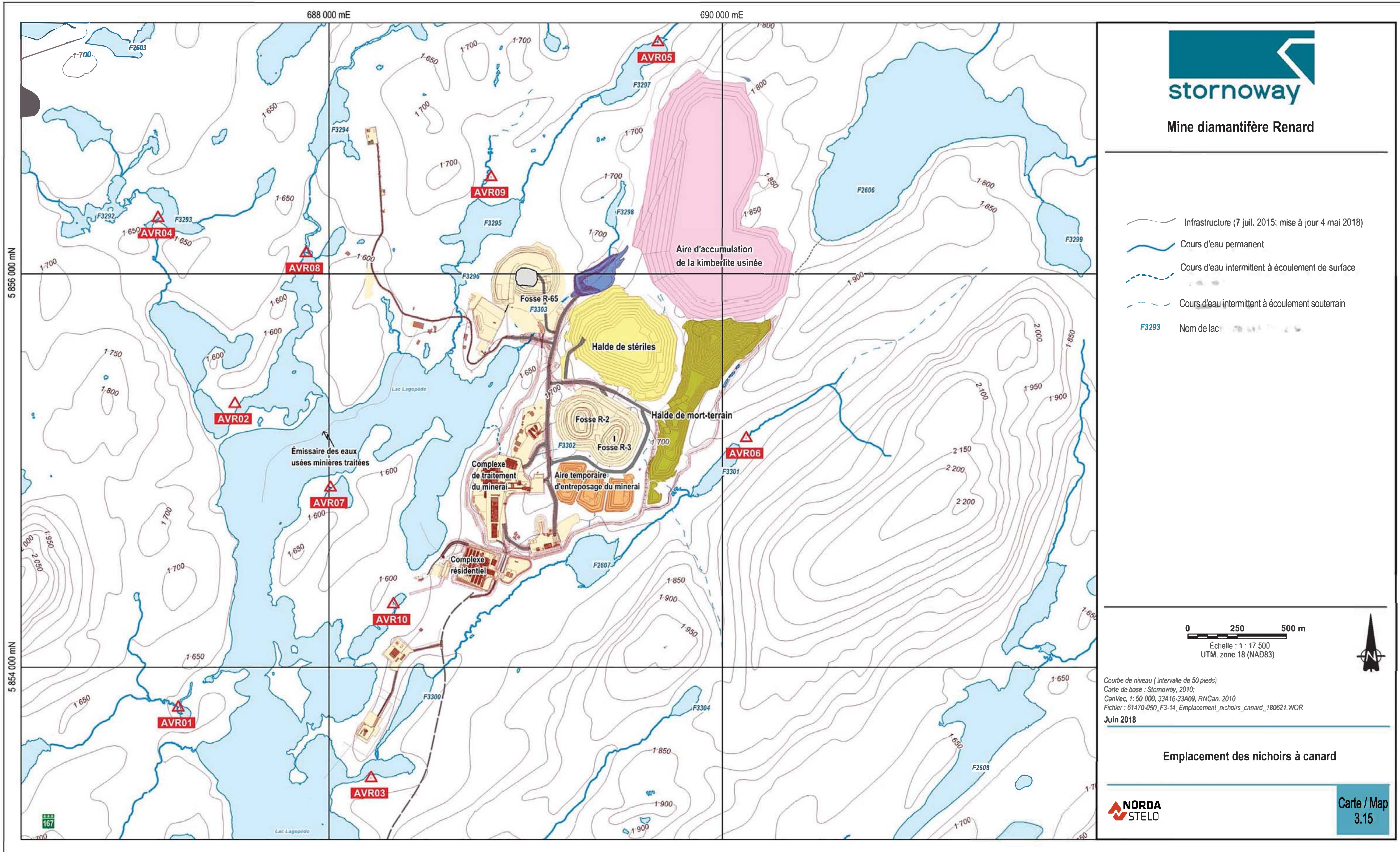
Overall, in 2019, the various water flows described above are divided into three major categories, as set out in Directive 019. The water balance for the Renard mine is defined as follows:

- 0.36 Mm³ of freshwater withdrawn from Lake Lagopede to supply the ore processing plant and from underground wells to supply the airport and the explosives facility;
- 1.68 Mm³ of water that is re-used, i.e., treated water from R65 pit retention basin and water from the water retention pond at the foot of the MPKC facility
- 2.24 Mm³ of final mine effluent that is treated and discharged into Lake Lagopede, including treated water from the MWWTP, dewatering water and water from the temporary treatment plant.

3.13.5.2 Water Re-use Rates

Throughout 2019, SWY maintained and consolidated measures put in place in 2018 to enhance water management on the Renard mine site.

With the water retention pond at the foot of the MPKC facility in operation, the mine site increased its rate of use of mine wastewater (as compared with fresh water).



688 000 mE
690 000 mE
5 856 000 mN
5 854 000 mN
stornoway
Mine diamantifère Renard
Infrastructure (7 juil. 2015; mise à jour 4 mai 2018)
Cours d'eau permanent
Cours d'eau intermittent à écoulement de surface
Cours d'eau intermittent à écoulement souterrain
F3293
Nom de lac
AVR01
AVR02
AVR03
AVR04
AVR05
AVR06
AVR07
AVR08
AVR09
AVR10
Fosse R-65
Fosse R-2
Fosse R-3
Aire d'accumulation
de la kimberlite usinée
Halde de stériles
Halde de mort-terrain
Complexe
de traitement
du minerai
Aire temporaire
d'entreposage du minerai
Complexe
résidentiel
Émissaire des eaux
usées minières traitées
Lac Lagopède
F2603
F2606
F2607
F2608
F3292
F3293
F3294
F3295
F3296
F3297
F3298
F3299
F3300
F3301
F3302
F3303
F3304
167
0
250
500 m
Échelle : 1 : 17 500
UTM, zone 18 (NAD83)
N
Courbe de niveau (intervalle de 50 pieds)
Carte de base : Stornoway, 2010;
CanVec, 1: 50 000, 33A16-33A09, RNCan, 2010
Fichier : 61470-050_F3-14_Emplacement_nichoirs_canard_180621.WOR
Juin 2018
Emplacement des nichoirs à canard
NORDA
STELO
Carte / Map
3.15

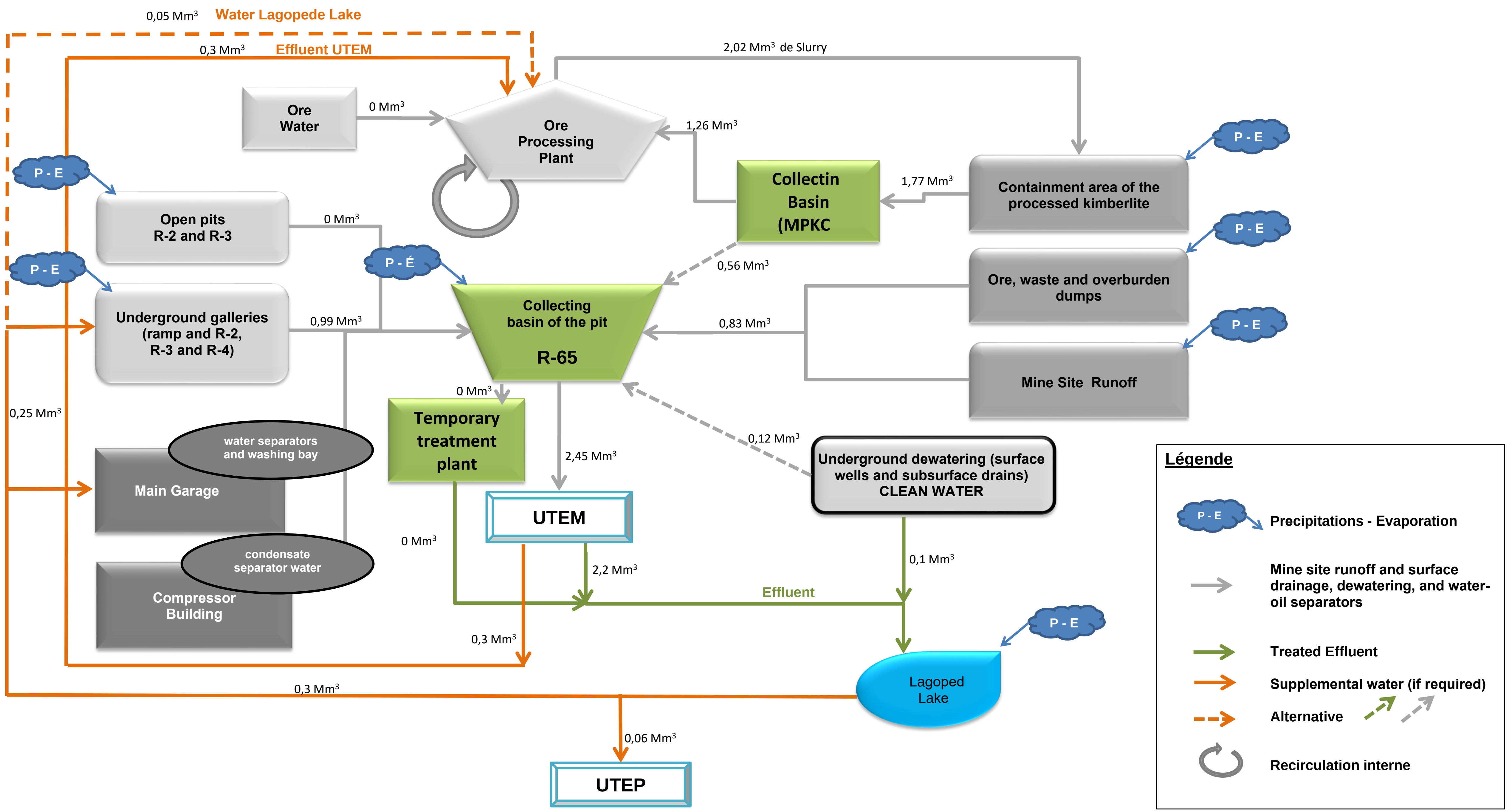
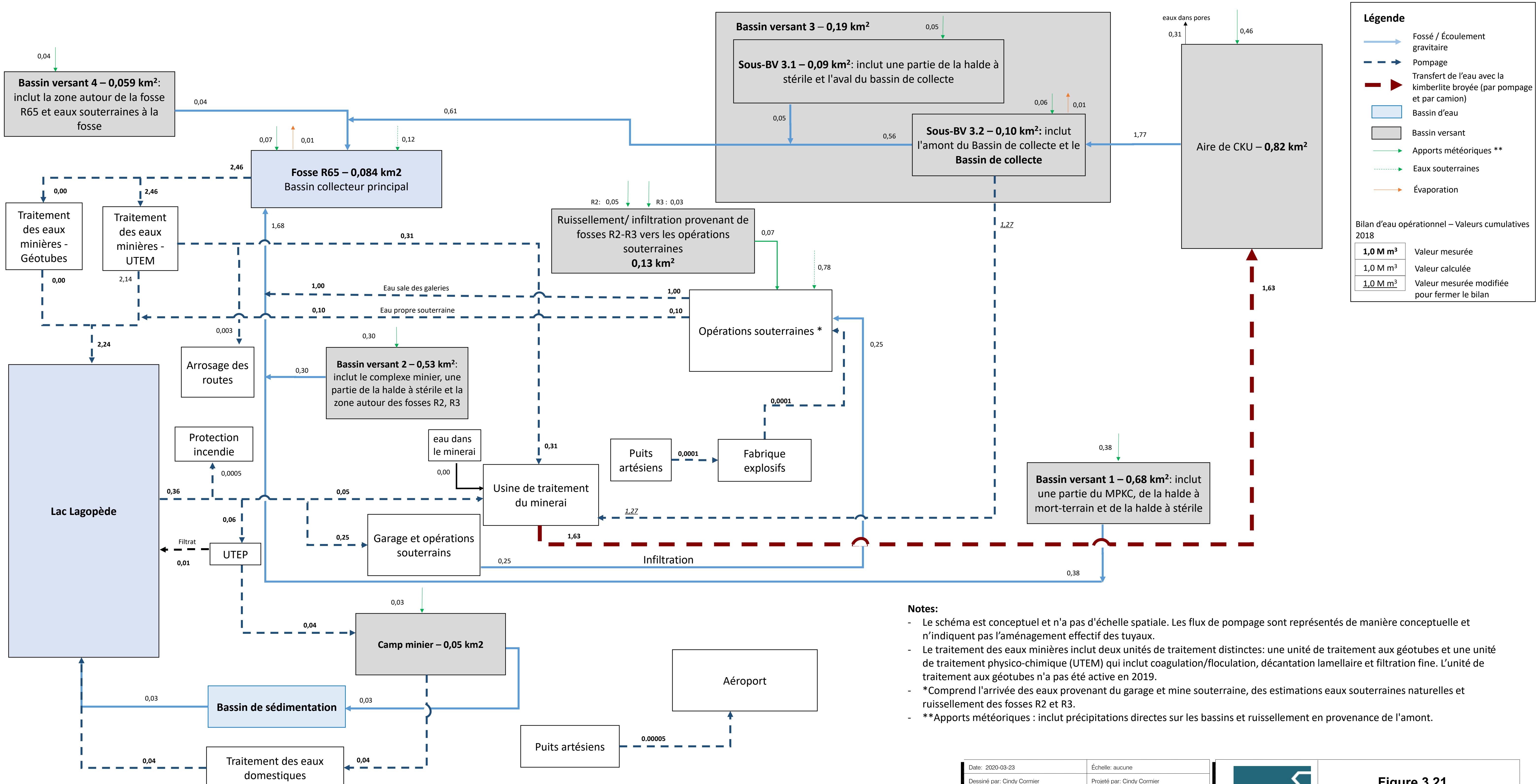


Figure 3.20 Flow diagram for mining wastewater, drinking water and process water during the year 2019.

CONFIDENTIAL
Operational water balance for the Renard mine site in 2019
January to December 2019



Notes:

- Le schéma est conceptuel et n'a pas d'échelle spatiale. Les flux de pompage sont représentés de manière conceptuelle et n'indiquent pas l'aménagement effectif des tuyaux.
- Le traitement des eaux minières inclut deux unités de traitement distinctes: une unité de traitement aux géotubes et une unité de traitement physico-chimique (UTEM) qui inclut coagulation/floculation, décantation lamellaire et filtration fine. L'unité de traitement aux géotubes n'a pas été active en 2019.
- *Comprend l'arrivée des eaux provenant du garage et mine souterraine, des estimations eaux souterraines naturelles et ruissellement des fosses R2 et R3.
- **Apports météoriques : inclut précipitations directes sur les bassins et ruissellement en provenance de l'amont.

Date: 2020-03-23	Échelle: aucune
Dessiné par: Cindy Cormier	Projeté par: Cindy Cormier
Vérifié par: Vlad Rojanschi	Approuvé par: Vlad Rojanschi
No. de dessin: 001-20136844-FIG1_Rev1	No. de projet: 20136844-20100

stornoway

Figure 3.21

GOLDER
7250, rue du Mile End, 3e étage
Montréal (Québec) H2R 3A4
Tel.: (514) 383-0990 Fax: (514) 383-5332

Bilan opérationnel des eaux
Janvier à décembre 2019

FIGURE 1
Rev 1

On an annual basis:

- The rate of use of mine wastewater on the Renard mine site was an estimated 84% compared with 88% in 2018, and 58% in 2017;
- The rate of re-use of mine wastewater in 2019 was about 97.1% based on total water consumption at the ore processing plant, in relation to water pumped from Lake Lagopede, and remains similar to the 2018 rate of re-use (97.2%).

In addition, the difference between the volume of final mine effluent and the volume of water collected in the peripheral ditch system was re-used to supply the ore processing plant (312,723 m^3) and as a dust suppressant on mine roads (3,486 m^3). These results together confirm the effectiveness of the changes made at the ore processing plant.

SWY also deployed efforts in 2019 to reduce its drinking water consumption:

- Ensuring there was no excessive consumption by equipment connected to raw water sources;
- Raising awareness among new employees about the quality of the drinking water on site and the need to avoid wasting water.

Efforts in this regard will continue in 2020, so as to optimize our water management practices (refer to section 3.5 for further information).

3.13.6 Domestic Wastewater

SWY installed a domestic wastewater treatment plant (DWWTP) in early 2015. It includes a SMBR bioreactor, a BOD_5/NH_4 bioreactor and a membrane clarification system. The DWWTP treats and discharges domestic wastewater, called "domestic effluent" from the Renard mine (Photo 3.52).

As indicated in the impact assessment, the objective of domestic wastewater quality monitoring is to ensure compliance with applicable regulations:

- The federal *Wastewater Systems Effluent Regulations* (SOR2012-139), under the Fisheries Act: and
- Effluent discharge objectives (EDOs) established specifically for the Renard project by the MELCC.

EDOs are not considered to be standards but rather a maximum concentration and load for a given contaminant designed to protect the receiving environment, primarily by complying with water quality criteria at the end of the effluent mixing zone. Monitoring EDOs protects the receiving environment, i.e., Lake Lagopede, by regularly controlling the quality of domestic effluent.

Photo 3.52 Domestic wastewater treatment plant (DWWTP)

3.13.6.1 Volume treated at the DWWTP

In 2019, the DWWTP achieved a 100% availability rate. The plant treated about 38,673 m³ of domestic wastewater, 37,385 m³ of which was discharged into Lake Lagopede, which is essentially comparable to volumes in 2018. The remaining portion was re-used as service water, specifically for dissolving reagents in the treatment process.

Note that the difference between the volume treated (38,673 m3) and the volume of drinking water distributed (38,956 m³) is relative and could be attributable to failures leading to small leaks in the drinking water distribution system. In 2019, the average unit flow rate of 367 litres/person/day was sent to the DWWTP by the wastewater collection system, whereas the average unit flow rate, specified in the DWWTP certificate of authorization issued on October 10, 2014, by the MDDELCC, was 440 litres/person/day. This confirms that the DWWTP is being operated in line with design criteria.

2.1.1.1 Quality of domestic influent and effluent

Test results for domestic effluent in 2019 are provided in Table 3.18. The concentrations of physical-chemical parameters and nutrients measured in domestic effluent are all within requirements set out in the Wastewater Systems Effluent Regulations. The criteria for suspended solids (SS), un-ionized ammonia (NH_3), and carbonaceous biological oxygen demand after five days

($CBOD_5$), have all been well within established criteria since the DWWTP came on line.

In the case of suspended solids, a 99% reduction in SS concentrations has been observed on average between the influent and effluent (Table 3.13), clearly demonstrating the effectiveness of the DWWTP.

Phosphorus and total ammonia nitrogen concentrations are well below allowable limits in both summer and winter, an indication of good nitrification even under low temperatures. In addition, no toxicity was observed in the effluent in toxicity testing on rainbow trout and daphnia.

As for bacteriological indicators, the fecal coliform values were minimal and well within regulatory requirements. Domestic influent and effluent analytical results indicated that the domestic wastewater treatment process clearly meets the MELCC's EDOs in terms of both allowable concentrations and loads. It is important to note here that the quality of the domestic effluent that is treated and discharged into Lake Lagopede complies with provincial and federal regulations as well as EDOs at the outlet to the plant.

Despite the absence of standards, regular monitoring is carried out to assess the DWWTP's performance in removing total extractible metals. A comparison of influent and effluent concentrations confirms that total extractible metal concentrations are in fact two to ten times lower in effluent than in influent, demonstrating the effectiveness of the DWWTP.

2.1.1.1 Facilities maintenance

To ensure the sustainability of the facilities, preventive maintenance is regularly carried out on operational, mechanical and electrical components. Observations are logged to facilitate the analysis of situations requiring remedial action to upgrade the system and preserve the long-term efficiency of the treatment process.

Upstream of the domestic wastewater treatment system, a grease trap was installed in the camp cafeteria to prevent grease from entering the domestic wastewater treatment system. The trap is inspected on a regular basis and emptied as required to prevent any slow down in DWWTP operations.

2.1.1.1 Domestic sludge management

Monitoring of post-treatment pressed sludge was initiated in 2016 (Photo 3.53) to collect the data required to ensure compliance with allowable limits for parameters set out in the residual materials fertilizer recycling guide (*Guide sur le recyclage des matières résiduelles fertilisantes*).

Photo 3.53 Sewage treatment sludge press machine at mine wastewater treatment plant (MWWTP)

The objective is to eventually be able to store and use dehydrated sludge in the gradual restoration of the mine site. The characterization work continued in 2019 to track the parameters and confirm sludge quality remains stable over time.

3.13.7 Hydrocarbon Separators

Two certified hydrocarbon separators have been installed, one at the airport in 2015 and the other in the mine's mechanical maintenance garage in 2016. They were designed to comply with the 15 mg/L $C_{10}C_{50}$ discharge criteria set out in the *Guide sur les séparateurs eau-huile* (MDDEP, 2008).

Hydrocarbon separators use gravity to intercept non-soluble and non-emulsive oils and petroleum hydrocarbons (C_{10}-C_{50}) found in wastewater in these maintenance areas. A third condensate separator was installed in the second quarter of 2017 in the underground mine fresh air raise (FAR) building (Photo 3.54).

Two identical units recover small quantities of oil in the compressed air in the four compressors in the building. The condensate is depressurized in an expansion chamber and the emulsified oil-water mixture is absorbed by a series of oleophilic filters that retain only the oil, and active carbon filters that absorb residual oil from the condensate.Regular monthly inspections are conducted for the garage separators, and quarterly inspections for the airstrip and FAR units by a building technician. The height of the oil in the separator and oil storage tank, the height of the oil in the storage tank, and the height of the sludge are measured. The technician also records the presence or absence of liquid in the containment tray and indicates whether the oil has been emptied.

Table 3.17 Analysis of final and intermediate effluent quality, in relation to applicable standards and criteria and EDOs

Parameters	Units	Mean Influent Concentration	ECCC	MELCC		Final Effluent Mean Concentration MIR2	Mean Concentration of MWWTP Effluent MIR2-A	Mean Concentration of Dewatering Water[4] MIR2-B	Mean Concentration of Geotube Effluent MIR2-C[5]	Monthly Load of Final Effluent (kg)
			REMMMD[1] √	Directive 019[2] ◊	Effluent Discharge Objectives (EDO)[3] ●	◊ √	◊●	◊	◊	
Physical-Chemical										
pH	--	8.3	>6 and <9.5	>6 and <9.5	>6.5	7.2	7.1	7.4		--
Suspended solids	mg/L	144	15	15	15	1.0	1.02	0.79		180.3
Conductivity	uS/cm	659	--	--	--	707	709	787		--
Dissolved oxygen	mg/L	--	--	--	--	10.43	--	--		--
Turbidity	UNT	104.6	--	--	--	0.96	0.96	1.57		--
Nutrients and Ions										
Total ammonia nitrogen (NH_3+NH_4)	mg/L de N	1.19 [6] 1.68 [7]	--	--	5.92 [6] 9.42 [7]	1.25	1.20	.226		--
Total Kjeldahl Nitrogen (TKN)	mg/L de N	1.14	--	--	--	1.83	2.20	<0.000003		--
Nitrates (NO_3)	mg/L de N	12.75	--	--	14.34	11.90	12.40	1.49		--
Nitrites (NO_2)	mg/L de N	0.45	--	--	0.08	0.99	0.77	0.00		--
Total Phosphorus	mg/L de P	0.055	--	--	0.075	0.071	0.045	0.031		--
Chlorides	mg/L	80	--	--	1149	81	76	108		--
Fluorides	mg/L	0.5	--	--	0.8	0.7	0.5	0.9		--
Sulphates	mg/L	79	--	--	2495	104	112	67		--
Total Extractible Metals and Metalloids										
Aluminum	mg/L	2.480	--	--	0.132	0.011	0.015	0.018		--
Arsenic	mg/L	0.001	0.3	0.2	0.105	0.001	0.0010	0.0022		0.17
Barium	mg/L	0.06	--	--	0.17	0.05	0.05	0.03		--
Cadmium	mg/L	0.00002	--	--	0.00022	0.00002	0.00002	0.00002		--
Chrome total	mg/L	0.0232	--	--	0.064	0.0004	0.0003	0.0004		--
Copper	mg/L	0.0029	0.3	0.3	0.005	0.0017	0.0005	0.0006		0.17
Iron	mg/L	2.54	--	3	3	0.13	0.07	0.12		17.8
Manganese	mg/L	0.04	--	--	1.28	0.02	0.02	0.05		--
Mercury	mg/L	<0.000003	--	--	--	<0.000003	<0.000003	<0.000003		--
Nickel	mg/L	0.022	0.5	0.5	0.034	0.008	0.008	0.005		1.6
Lead	mg/L	0.00158	0.1	0.2	0.00057	0.00005	0.00002	0.00005		0.023
Aluminum	mg/L	0.012	0.5	0.5	0.077	0.008	0.006	0.064		1.5
Radioactive Elements										
Radium 226	mg/L	--	0.037	--	--	0.002	--	--		--
Organic Compounds										
Hydrocarbons (C_{10}-C_{50})	mg/L	0.17	--	2	0.05	<0.10	0.185	0.121		--
Toxicity Testing										
Acute toxicity (rainbow trout)	Uta	--	--	<1	<1	<1	<1	<1		--
Acute toxicity (daphnia)	Uta	--	--	<1	<1	<1	<1	<1		--

(--) Unregulated parameter

(1) Liability as of June 1, 2018, applicable only to final effluent (MIR2)

(2) Applicable to final mine effluent (MIR2) and intermediate effluent (MIR2-A, MIR2-B and MIR2-C)

(3) Applicable only to MWWTP effluent (MIR2-A)

(4) Brought on line on April 29, 2019

(5) Not in operation in 2019

(6) In summer (June 1 to November 30)

(7) In winter (December 1 to May 31)

Table 3.18 Analysis of domestic wastewater quality in relation to applicable standards and criteria

PARAMETERS	UNITS	Mean Concentration in SWY Influent	ECCC's Wastewater Systems Effluent Regulations	MELCC's Effluent Discharge Objectives (EDOs)			
				Allowed Concentration	Mean Concentration in SWY Effluent	Allowed Load (kg/j)	SWY Load (kg/j)
Physical-Chemical							
pH	mg/L	7.1	--	--	7.46	--	--
$CBOD_5$	mg/L	134	≤ 25	25	2.4	--	--
BOD_5	mg/L	176	--	26	6.1	4	0.22
COD	mg/L	627	--	--	16.7	--	--
SS	mg/L	188	25	25	1.1	8	0.14
Nutrients and Ions							
Un-ionized Ammonia (NH_3)	mg/L of N	0.10	<1.25	--	0.03	--	--
Ammonia Nitrogen (NH_3+NH_4)	mg/L of N	29.30(1) 56.80(2)	--	12.02(1) 18.82(2)	0.375(1) 0.19(2)	1.9(1) 3.0(2)	0.04(1) 0.02(2)
Total Phosphorus	mg/L of P	7.31	--	0.1	0.05	--	--
Bacteriological							
Fecal Coliforms	UFC/100mL	4,012,500	--	10 000	26.8	--	--
Toxicity Testing							
Acute toxicity - Daphnia	Uta	--	--	<1	<1	--	--
Acute toxicity – Rainbow trout	Uta	--	--	<1	<1	--	--
Total Extractible Metals and Metalloids							
Aluminum (Al)	mg/L	7.58	--	--	0.11	--	--
Arsenic (As)	mg/L	0.0006	--	--	0.0002	--	--
Barium (Ba)	mg/L	0.022	--	--	0.004	--	--
Cadmium (Cd)	mg/L	0.00019	--	--	0.00003	--	--
Chromium (Cr)	mg/L	0.0063	--	--	0.0004	--	--
Copper (Cu)	mg/L	0.061	--	--	0.001	--	--
Iron (Fe)	mg/L	1.12	--	--	0.12	--	--
Mercury (Hg)	mg/L	0.000024	--	--	0.00000202	--	--
Manganese (Mn)	mg/L	0.032	--	--	0.008	--	--
Nickel (Ni)	mg/L	0.013	--	--	0.008	--	--
Lead (Pb)	mg/L	0.008	--	--	0.002	--	--
Zinc (Zn)	mg/L	0.22	--	--	0.09	--	--

(--) Unregulated parameter
(1) In summer (June 1 to November 30)
(2) In winter (December 1 to May 30)

Photo 3.54 Fresh air (FAR) condensate separator

This information is all logged. Quarterly monitoring is also undertaken to ensure the quality of the effluent in the separators. A water sample is taken at the outlet to each separator to measure the C_{10}-C_{50} concentration and ensure compliance with the 15 mg/L discharge criteria indicated in the guide (MDDEP, 2008).

3.13.7.1 Airport hydrocarbon separator

The results in 2019 at the outlet to the airport hydrocarbon separator are on average 1.1 mg/L, and only one value exceeded the discharge criteria.

3.13.7.2 Garage hydrocarbon separator

SWY voluntarily committed to complying with discharge criteria for the garage hydrocarbon separator. Note that effluent from this separator is not directly discharged into the receiving environment.

It undergoes a number of processing steps including sedimentation bags in the washbay before being captured by the mine wastewater collection system. It is then directed to pit R-65, where the water is retreated and discharged along with the effluent from the mine wastewater treatment plant.

As in 2018, a number of actions were taken throughout 2019 to improve operational management of this equipment and achieve discharge criteria set out in the Guide (MDDEP, 2008).

3.13.7.3 FAR condensate separator

The 2019 results at the outlet to the FAR separator on average range from 0.59 mg/L to 0.77 mg/L for each of the separator units and both units comply with the 15 mg/L discharge criteria at all times.

3.13.7.4 Oil disposal

Oil collected by all the separators is stored in dedicated containers and transported off site for recovery at authorized centers in compliance with applicable regulations as indicated in section 2.3 (Residual Hazardous Materials Management). A log of disposal dates and volumes is maintained.

3.14 Hydrogeological Regime and Groundwater Quality

In the Environmental and Social Impact Assessment (Roche, 2011) for the Renard Diamond Project, SWY committed to implementing a groundwater monitoring program, which is required by Directive 019 for at-risk facilities. Groundwater monitoring is also required on the periphery of trench landfill sites (TLSs) under the provisions of Section 65 of the *Regulation respecting the Landfilling and Incineration of Residual Materials* (REIMR).

The specific objectives of the groundwater monitoring program are to:

- Monitor groundwater levels and quality in the vicinity of at-risk mining facilities, in compliance with Directive 019 (MDDEP, 2012);
- Monitor groundwater levels and quality at the TLS (including the contaminated soil treatment platform) in compliance with the Regulation respecting the Landfilling and Incineration of Residual Materials (REIMR);
- Measure the impacts of the drawdown of the water table around the open pits on groundwater quality and level.

3.14.1 Sampling Area and Period

To meet these objectives, a network of 39 observation wells (Photo 3.55) are used to cover the entire mine site, the TLS and the airstrip area (maps 3.17 and 3.18).

Photo 3.55 Sampling well UWP1-01

At least three of these wells were installed around each at-risk facility or sector, with at least one well upstream and two wells downstream.

The wells that were installed or in place prior to 2015 are located in the following five sectors:

- **Sector 1**
  - Processed kimberlite containment facility area (UWR5): eight wells;
  - Waste rock stockpile (UWR8): three wells;
  - R65 pit (UWR4): three wells.
- **Sector 2**
  - Explosives storage area (UWR10): three wells.
- **Sector 3**
  - Diesel and gasoline storage area (UWR3): three wells;
  - Ore processing plant (UWR1): two wells;
  - Garage (UWR2): two wells;
  - Temporary ore storage area (UWR9): two wells.
- **Sector 4**
  - Trench landfill site (TLS) (UWP2): eight wells.
- **Sector 5**
  - Airstrip area (UWP1): three wells.

Two monitoring campaigns were undertaken in 2019, in sectors 1, 2, 3 and 5, one in the high-flow period (June) and a second in the low-flow period (July). In sector 4 (TLS), three campaigns took place, in June, September and November (Photo 3.56). A piezometric water level reading was also performed in all the wells as part of the sampling campaigns.

Photo 3.56 Groundwater sampling at the TLS (September 2019)

The groundwater quality criteria used for at-risk facilities are the criteria set out in Directive 019 (MDDEP, 2012), along with some parameters, such as the type of ore, the process, the type of waste, and the activities carried out on the mine site, which were identified as being relevant to the interpretation of the results.

The parameters monitored in the case of the TLS (Sector 4) are those listed in Section 57 of the REIMR in addition to those specified in Section 66 of the REIMR, and petroleum hydrocarbons (C_{10}-C_{50}).

The 2019 analytical results were compared with local geochemical background levels and the resurgence and sewer infiltration criteria set out in the MELCC's soil protection and contaminated site rehabilitation guide (*Guide d'intervention – Protection des sols et réhabilitation des terrains contaminés)* (Beaulieu, 2016).

Local geochemical background levels were determined in the groundwater background levels study (baseline) conducted at the Renard project site (Norda Stelo, 2017d).Note that even before the start-up of mining operations, groundwater background levels measured at the Renard mine site between 2010 and 2016 were already naturally higher than MELCC's resurgence water quality criteria. The higher of the resurgence criteria and the background level was used to compare the results in tables 3.19 to 3.23 to the criteria.

Groundwater samples were collected in observation wells at the at-risk facilities (Photo 3.55). They were analyzed to determine concentrations of the various contaminants defined in Directive 019 (MDDEP, 2012), i.e., major ions (Ca^{2+}, HCO_3^-, K^+, Mg^{2+}, Na^+, SO_4^{2-}), metals (Al, Ag, As, Ba, Cu, Cr, Fe, Mn, Ni, Pb, Zn), and petroleum hydrocarbons (C_{10}-C_{50}).

Samples collected at the TLS were analyzed for major ions and nutrients (Na^+, SO_4^{2-}, S^{-2}, CN^-, Cl^-, NO_2-NO_3, NH_3-NH_4), BOD_5, COD, fecal coliforms, metals (B, Cd, Cr, Cu, Fe, Mn, Hg, Ni, Pb, Zn), petroleum hydrocarbons (C_{10}-C_{50}), BTEX and phenolic compounds, as specified in the REIMR.

3.14.2 Results

Descriptive statistics for the analytical results for the entire mine site (sectors 1 to 5) in 2019 are shown in tables 3.19 to 3.23. Depending on the sector, natural background levels measured in groundwater (Norda Stelo, 2017d) exceed the resurgence criteria prescribed by the MELCC for certain metals (Beaulieu, 2019).

Background levels calculated for copper, for example exceed resurgence criteria in sectors 1, 2 and 3 in both surface deposits and bedrock. Magnesium and zinc also have higher background levels than the resurgence criteria in some of the mine sectors (tables 3.19 to 3.21).

In 2019, the mean concentrations of copper and zinc in Sector 1, and magnesium, sulphate and calcium in sectors 2 and 3, were found, depending on the type of substrate, to exceed local background levels.

3.14.2.1 Sector 1

In the bedrock in Sector 1 (Table 3.19), almost every mean concentration exceeded local background levels. Significant increases in copper, nickel and zinc concentrations were however recorded.

Increases in the concentration of metals such as copper, nickel and zinc were anticipated in the 2011 impact assessment (Roche, 2011a), specifically for the MPKC sector (Golder, 2011c). The concentration of these metals measured in well UWR5-05R, initially below the local background level, increased as anticipated and has exceeded the background level since 2017 or 2018.

It is moreover not surprising to record increases in the concentrations of these metals in 2019 in well UWR5-05R installed in the bedrock downstream of the MPKC facility. In addition, these concentrations were greater than those found in wells UWR5-01R, 02R and 03R upstream of the MPKC. Note that increased copper, nickel and zinc concentrations were not observed in the surface deposits associated with these wells.

The increase in copper, nickel and zinc concentrations in well UWRF-05R may in fact be caused by water infiltration from the MPKC facility. Special attention should therefore be paid to changes in these metal concentrations in the wells surrounding the MPKC facility in future monitoring campaigns (Norda Stelo, 2020).

Initial leaching in reworked soils and the materials deposited at the MPKC facility in 2019 could well explain the strong upward trend in conductivity and concentration of certain ions. This applies to calcium, magnesium, barium, sodium and sulphates measured in bedrock (UWR5-04R), concentrations of barium and magnesium in surface deposits (UWR5-04D) in well UWRF-04.

These major ion concentrations and conductivity values are expected to decline in future (Norda Stelo, 2020).

3.14.2.2 Sectors 2, 3 and 5

In 2019, there were no major issues with underground water in sectors 2, 3 (bedrock and surface deposits) and sector 5, respectively the explosives storage area, mine infrastructure and the airstrip.

The main observation in these three sectors in fact was an increase in conductivity and concentrations of some major ions such as dissolved barium in sectors 2 and 3 in the underground wells downstream of the facilities (tables 3.20 and 3.21).

This increase in ion conductivity and ion concentrations downstream of the infrastructure may well be due to the soil being reworked and granular materials (crushed waste rock) deposited during construction and snow clearing operations.

The exposure of these materials to precipitation and snow melt in the spring could have resulted in initial leaching of surface elements as reported by Golder (2012) with regard to overburden and waste rock. If so, the concentration of these ions should eventually decline over time.

From 2017 to 2019, detectable petroleum hydrocarbon C_{10}-C_{50} concentrations were measured in sectors 2, 3 and 5, but all were below resurgence criteria and the alert threshold for this parameter. Very few samples were involved in these measurements taken for wells in sector 1 upstream of the mining infrastructure. It is therefore highly unlikely that they were contaminated by oil leaks (Norda Stelo, 2020).

3.14.2.3 Sector 4

In sector 4 (TLS), the quality of the groundwater samples collected since 2015, remained very stable (Table 3.22). The 2019 results indicated mean concentrations within applicable REIMR standards.

Groundwater sampled in TLS wells however presented a few quality issues, primarily with regard to bacterial contamination.

Fecal coliform concentrations exceeded the criteria, specifically in wells UWP2-01, 02, 03, 04 and 05, on one or two occasions, in June 2018, September 2019 and/or November 2019. Detecting the presence of fecal coliforms is not surprising in certain wells installed downstream of the TLS, because sludge from the Renard mine’s domestic wastewater treatment plant (DWWTP) is landfilled at the site. The presence of fecal coliforms at well UWP2-04 however is more difficult to explain given that it is upstream of the TLS.

Future monitoring campaigns need to pay special attention to the presence of fecal coliforms in the TLS observation wells. It is absolutely essential to avoid contaminating well samples. REIMR limit values it should be noted are the same as those applicable to water intended for human consumption and that there is no source of water supply in the TLS sector.

Regarding organic compounds monitored at the TLS from 2017 to 2019, no polycyclic aromatic hydrocarbons (PAHs) were detected.

And as for manganese, the natural background level in Sector 4 itself exceeded the REIMR criterion. In 2019, in one of the 24 samples collected, the manganese concentration exceeded the local background level.

3.14.3 Piezometric Levels

One of the objectives of groundwater monitoring was to measure the effects of the drawdown of the water table in the bedrock around the open pit on groundwater levels.

Piezometric water level readings modelled in 2017 (Golder, 2017) were compared with values measured in the field as part of various campaigns undertaken from 2017 to 2019 (Map 3.20).

The piezometric values at the site of each of the observation wells were extracted from Golder’s digital model (2017) for each of the three reference years. Comparisons were made among the wells in bedrock in sectors 1 and 3 alone since the other sectors are not expected to be impacted by the drawdown of groundwater (Norda Stelo, 2020).

The piezometric levels measured in the two 2019 campaigns indicated that water levels generally remained stable as compared with levels measured in previous years. The groundwater levels measured are also consistent with those modelled by Golder in 2017 as part of the last version of the hydrogeological study. As for water levels in sectors 1, 2 and 5, the explosive storage area and airstrip, they too have been relatively stable in relation to levels measured in previous years.

In Sector 1, water levels observed are similar to those modelled by Golder (2017) for the wells in the sector.

In Sector 3, the mining infrastructure area, comparing actual water levels with those modelled by Golder (2017) indicates a strong similarity between the two. Groundwater levels in bedrock have decreased in wells UWR1-01R and UWR2-02R. Note that the 2011 impact assessment (Roche, 2011a) had predicted a decline in piezometric levels, and that it would have a negligible effect on the Lake Lagopede watershed overall (Roche, 2011a).

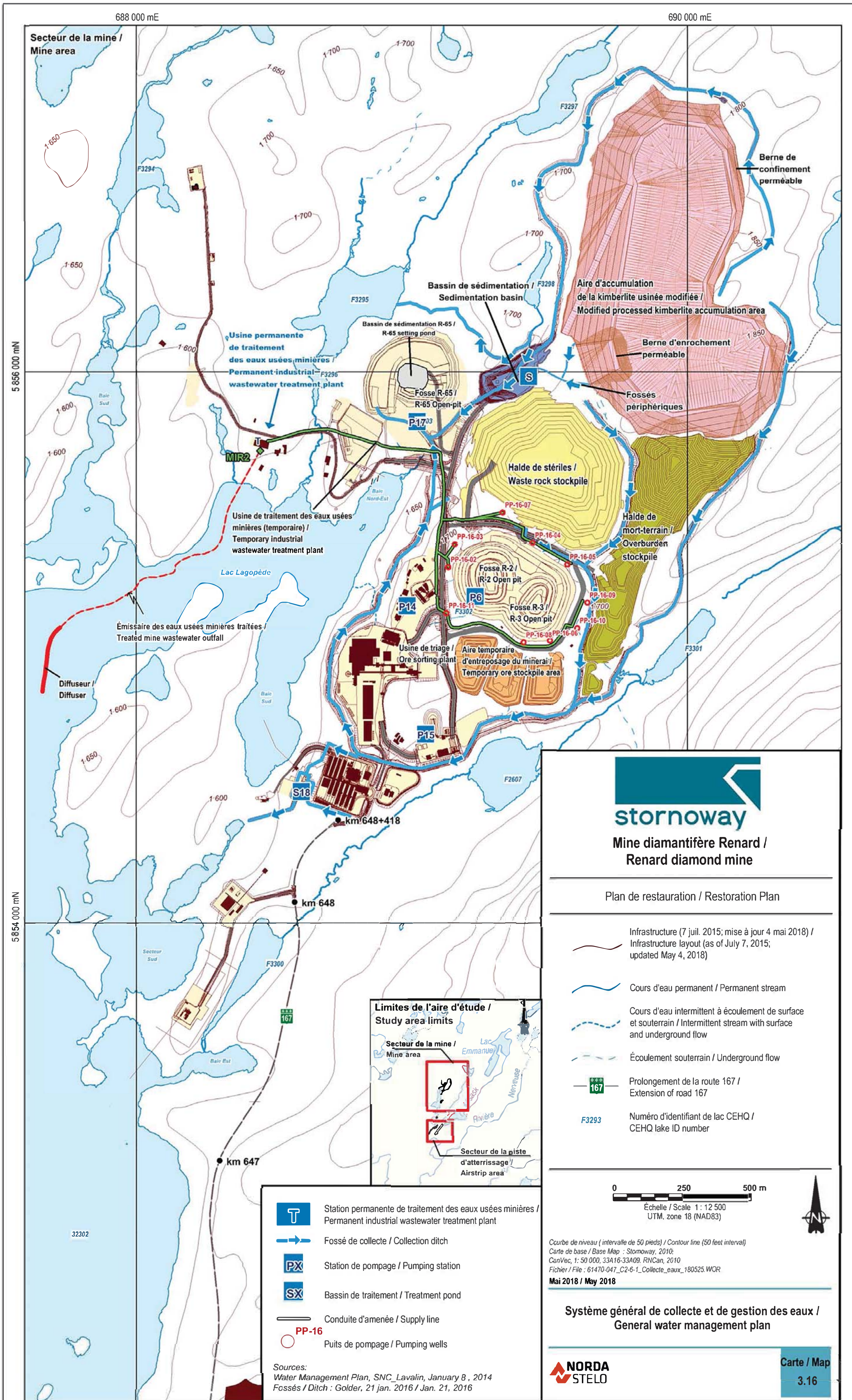
Finally, water level measurements at the TLS (Sector 4) point to some seasonal variations of about one metre depending on the monitoring campaign. The direction of flow in this sector is not however affected by these variations.

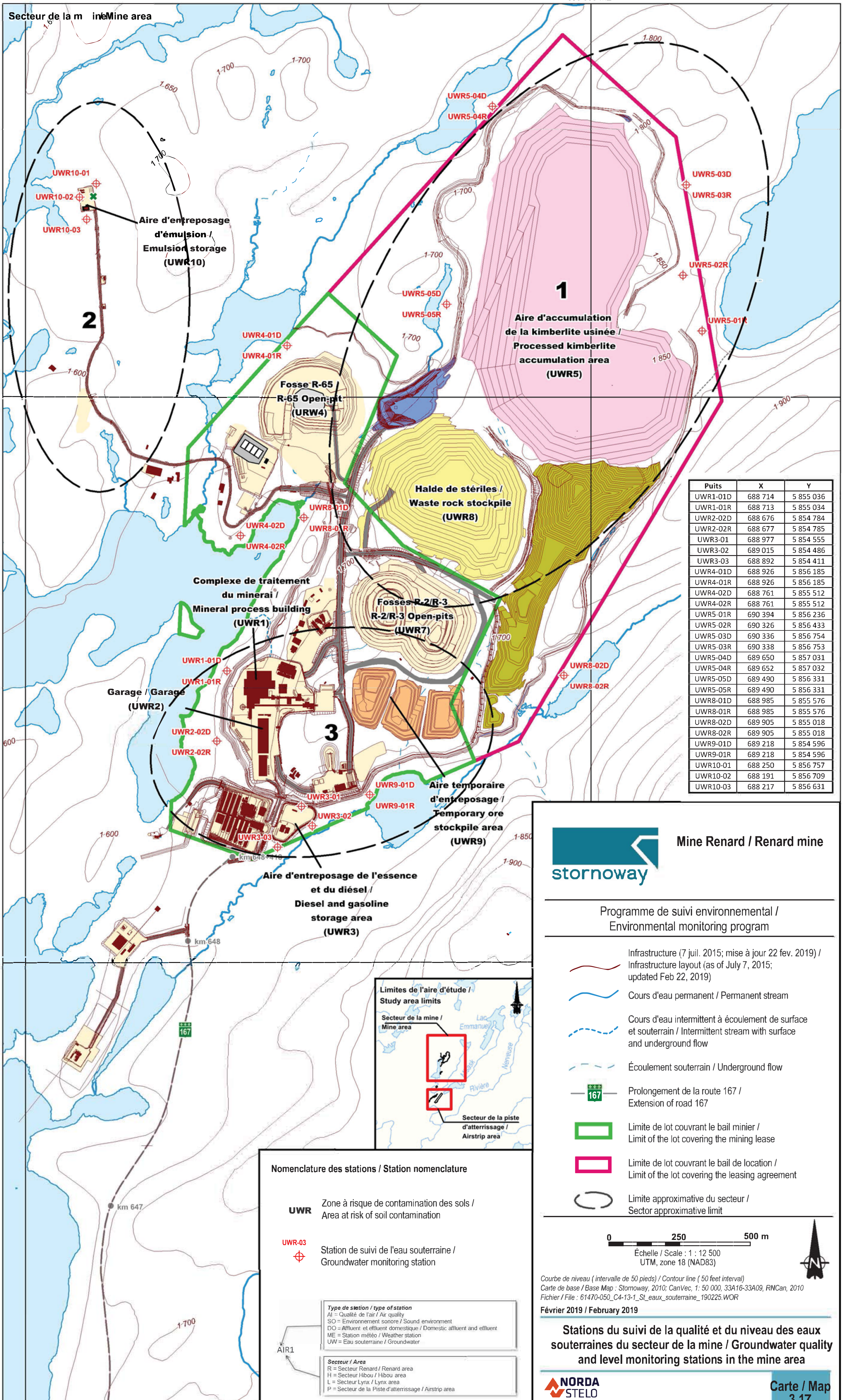
Piezometric water levels will continue to be monitored in 2020, so as to detect or validate whether they continue to be compliant and follow the trends modelled by Golder (2017).

3.14.4 2020 Monitoring

In 2020, the recommendations outlined below will improve the effectiveness of groundwater level and quality monitoring at the Renard mine, facilitate the processing and interpretation of the data collected, and detect the impacts of mine activities on groundwater more precisely (Norda Stelo, 2020). The recommendations are as follows:

- Change the location of the snow dump in Sector 3 to reduce soil disturbance during snow removal operations near the wells;
- Ensure the Renard mine ESMP is updated whenever changes to applicable criteria set out in the soil protection and contaminated site rehabilitation guide (Guide d'intervention – Protection des sols et réhabilitation des terrains contaminés) (Beaulieu, 2019);
- Pay special attention to quality assurance/quality control (QA/QC) during sample collection, especially at the TLS, regarding fecal coliform testing;
- Validate (or not) the assumption that the drop in piezometric levels in certain wells (UWR5) is tied to the winter low-flow period.


688 000 mE
690 000 mE
5 856 000 mN
5 854 000 mN
Secteur de la mine / Mine area
Bassin de sédimentation / Sedimentation basin
Aire d'accumulation de la kimberlite usinée modifiée / Modified processed kimberlite accumulation area
Berne de confinement perméable
Berne d'enrochement perméable
Fossés périphériques
Bassin de sédimentation R-65 / R-65 setting pond
Fosse R-65 / R-65 Open-pit
Usine permanente de traitement des eaux usées minières / Permanent industrial wastewater treatment plant
Halde de stériles / Waste rock stockpile
Halde de mort-terrain / Overburden stockpile
Usine de traitement des eaux usées minières (temporaire) / Temporary industrial wastewater treatment plant
Fosse R-2 / R-2 Open pit
Fosse R-3 / R-3 Open pit
Usine de triage / Ore sorting plant
Aire temporaire d'entreposage du minerai / Temporary ore stockpile area
Lac Lagopède
Émissaire des eaux usées minières traitées / Treated mine wastewater outfall
Diffuseur / Diffuser
MIR2
P17
P14
P6
P15
S18
S
km 648+418
km 648
km 647
167
PP-16-02
PP-16-03
PP-16-04
PP-16-05
PP-16-06
PP-16-07
PP-16-08
PP-16-09
PP-16-10
PP-16-11
F3294
F3295
F3296
F3297
F3298
F3300
F3301
F3302
F2607
32302
Baie Sud
Baie Nord-Est
Baie Est
Secteur Sud
Limites de l'aire d'étude / Study area limits
Secteur de la mine / Mine area
Lac Emmanuel
Rivière
Secteur de la piste d'atterrissage / Airstrip area
stornoway
Mine diamantifère Renard / Renard diamond mine
Plan de restauration / Restoration Plan
Infrastructure (7 juil. 2015; mise à jour 4 mai 2018) / Infrastructure layout (as of July 7, 2015; updated May 4, 2018)
Cours d'eau permanent / Permanent stream
Cours d'eau intermittent à écoulement de surface et souterrain / Intermittent stream with surface and underground flow
Écoulement souterrain / Underground flow
Prolongement de la route 167 / Extension of road 167
F3293
Numéro d'identifiant de lac CEHQ / CEHQ lake ID number
0
250
500 m
Échelle / Scale 1 : 12 500
UTM, zone 18 (NAD83)
Courbe de niveau (intervalle de 50 pieds) / Contour line (50 feet interval)
Carte de base / Base Map : Stornoway, 2010;
CanVec, 1: 50 000, 33A16-33A09. RNCan, 2010
Fichier / File : 61470-047_C2-6-1_Collecte_eaux_180525.WOR
Mai 2018 / May 2018
Système général de collecte et de gestion des eaux / General water management plan
NORDA STELO
Carte / Map
3.16
T
Station permanente de traitement des eaux usées minières / Permanent industrial wastewater treatment plant
Fossé de collecte / Collection ditch
PX
Station de pompage / Pumping station
SX
Bassin de traitement / Treatment pond
Conduite d'amenée / Supply line
PP-16
Puits de pompage / Pumping wells
Sources:
Water Management Plan, SNC_Lavalin, January 8 , 2014
Fossés / Ditch : Golder, 21 jan. 2016 / Jan. 21, 2016



Puits	X	Y
UWR1-01D	688 714	5 855 036
UWR1-01R	688 713	5 855 034
UWR2-02D	688 676	5 854 784
UWR2-02R	688 677	5 854 785
UWR3-01	688 977	5 854 555
UWR3-02	689 015	5 854 486
UWR3-03	688 892	5 854 411
UWR4-01D	688 926	5 856 185
UWR4-01R	688 926	5 856 185
UWR4-02D	688 761	5 855 512
UWR4-02R	688 761	5 855 512
UWR5-01R	690 394	5 856 236
UWR5-02R	690 326	5 856 433
UWR5-03D	690 336	5 856 754
UWR5-03R	690 338	5 856 753
UWR5-04D	689 650	5 857 031
UWR5-04R	689 652	5 857 032
UWR5-05D	689 490	5 856 331
UWR5-05R	689 490	5 856 331
UWR8-01D	688 985	5 855 576
UWR8-01R	688 985	5 855 576
UWR8-02D	689 905	5 855 018
UWR8-02R	689 905	5 855 018
UWR9-01D	689 218	5 854 596
UWR9-01R	689 218	5 854 596
UWR10-01	688 250	5 856 757
UWR10-02	688 191	5 856 709
UWR10-03	688 217	5 856 631

stornoway

Mine Renard / Renard mine

Programme de suivi environnemental / Environmental monitoring program

Infrastructure (7 juil. 2015; mise à jour 22 fev. 2019) / Infrastructure layout (as of July 7, 2015; updated Feb 22, 2019)

Cours d'eau permanent / Permanent stream

Cours d'eau intermittent à écoulement de surface et souterrain / Intermittent stream with surface and underground flow

Écoulement souterrain / Underground flow

Prolongement de la route 167 / Extension of road 167

Limite de lot couvrant le bail minier / Limit of the lot covering the mining lease

Limite de lot couvrant le bail de location / Limit of the lot covering the leasing agreement

Limite approximative du secteur / Sector approximative limit

Nomenclature des stations / Station nomenclature

UWR — Zone à risque de contamination des sols / Area at risk of soil contamination

UWR-03 — Station de suivi de l'eau souterraine / Groundwater monitoring station

Type de station / type of station
AI = Qualité de l'air / Air quality
SO = Environnement sonore / Sound environment
DO = Affluent et effluent domestique / Domestic affluent and effluent
ME = Station météo / Weather station
UW = Eau souterraine / Groundwater

AIR1

Secteur / Area
R = Secteur Renard / Renard area
H = Secteur Hibou / Hibou area
L = Secteur Lynx / Lynx area
P = Secteur de la Piste d'atterrissage / Airstrip area

0 250 500 m
Échelle / Scale : 1 : 12 500
UTM, zone 18 (NAD83)

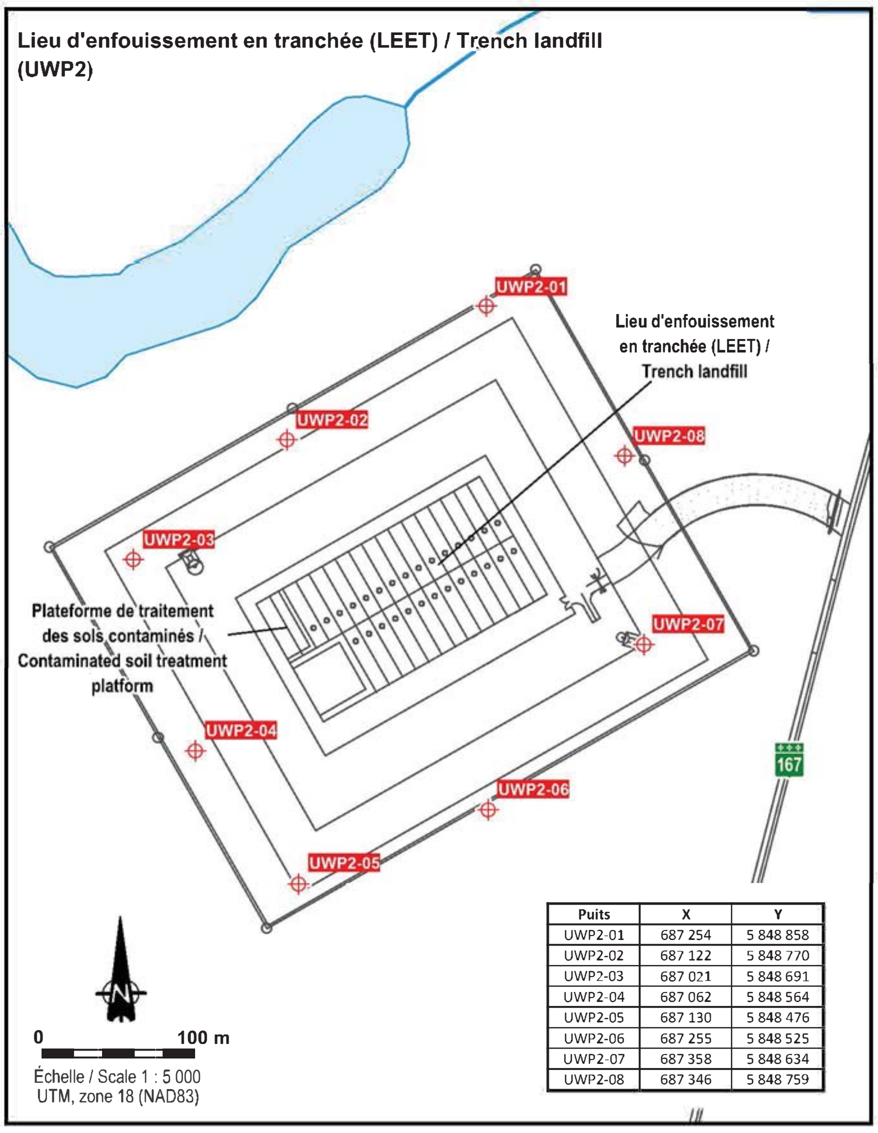
Courbe de niveau (intervalle de 50 pieds) / Contour line (50 feet interval)
Carte de base / Base Map : Stornoway, 2010; CanVec, 1: 50 000, 33A16-33A09, RNCan, 2010
Fichier / File : 61470-050_C4-13-1_St_eaux_souterraine_190225.WOR

Février 2019 / February 2019

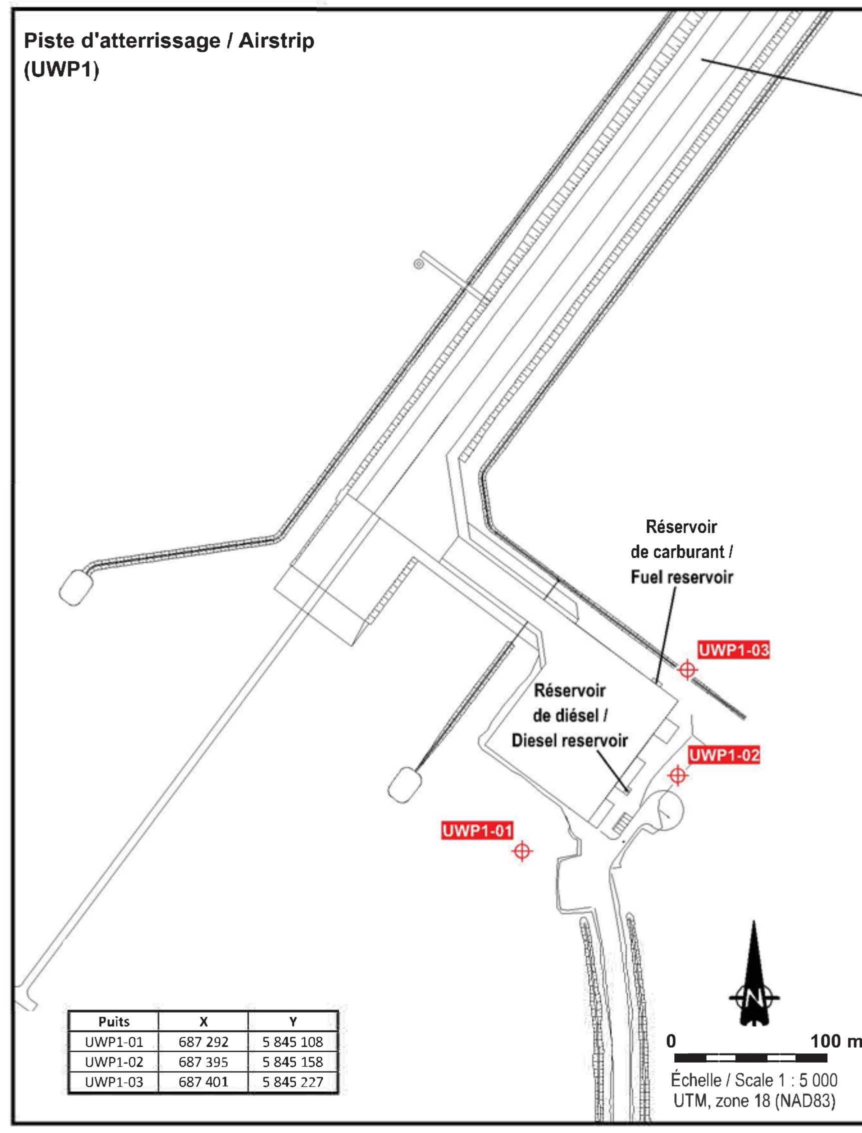
Stations du suivi de la qualité et du niveau des eaux souterraines du secteur de la mine / Groundwater quality and level monitoring stations in the mine area

NORDA STELO

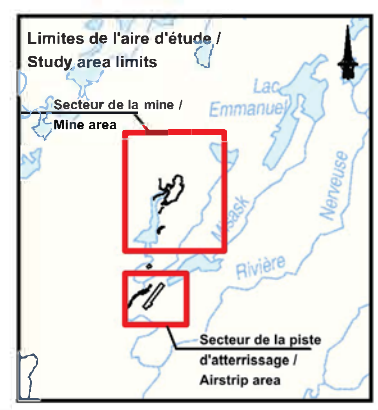
Carte / Map 3.17

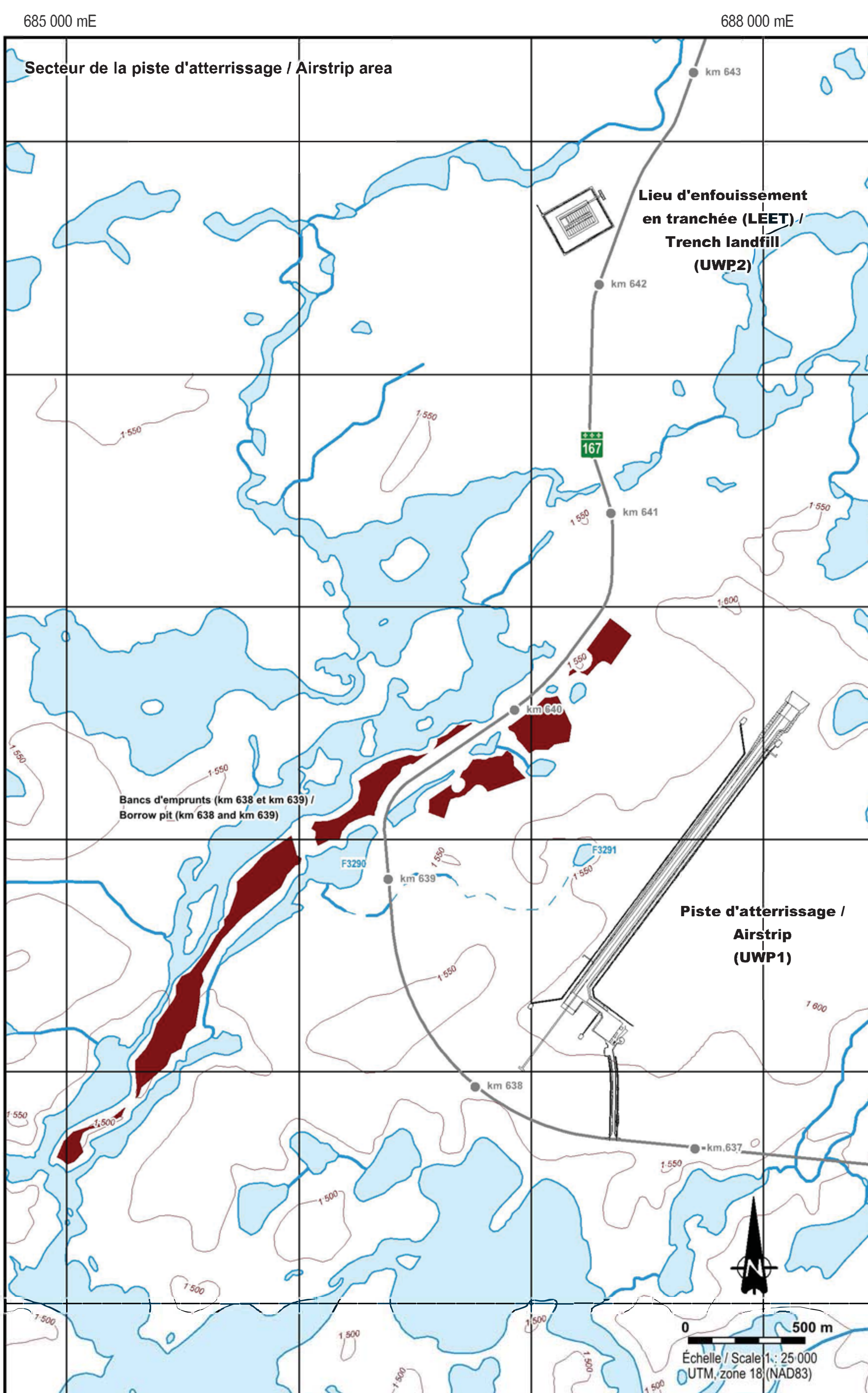


Puits	X	Y
UWP2-01	687 254	5 848 858
UWP2-02	687 122	5 848 770
UWP2-03	687 021	5 848 691
UWP2-04	687 062	5 848 564
UWP2-05	687 130	5 848 476
UWP2-06	687 255	5 848 525
UWP2-07	687 358	5 848 634
UWP2-08	687 346	5 848 759



Puits	X	Y
UWP1-01	687 292	5 845 108
UWP1-02	687 395	5 845 158
UWP1-03	687 401	5 845 227





stornoway

Mine Renard / Renard mine

Programme de suivi environnemental / Environmental monitoring program

Infrastructure (24 sept. 2014; mise à jour 15 jan. 2016) / Infrastructure layout (as of Sept. 24, 2014; updated Jan. 15, 2016)

Cours d'eau permanent / Permanent stream

Limite approximative du secteur

Nomenclature des stations / Station nomemclature

UWP — Zone à risque de contamination des sols / Area at risk of soil contamination

UWP1 — Station de suivi de l'eau souterraine / Groundwater monitoring station

AIR1

Type de station / type of station
AI = Qualité de l'air / Air quality
SO = Environnement sonore / Sound environment
DO = Affluent et effluent domestique / Domestic affluent and effluent
ME = Station météo / Weather station
UW = Eau souterraine / Groundwater

Secteur / Area
R = Secteur Renard / Renard area
H = Secteur Hibou / Hibou area
L = Secteur Lynx / Lynx area
P = Secteur de la Piste d'atterrissage / Airstrip area

Courbe de niveau (intervalle de 50 pieds) / Contour line (50 feet interval)
Carte de base / Base Map : Stornoway, 2010; CanVec, 1: 50 000, 33A16-33A09, RNCan, 2010
Fichier / File : 61470-050_C4-13-2_Loc st eau souter aero_190410.WOR

Avril 2019 / April 2019

Stations du suivi de la qualité et du niveau des eaux souterraines du secteur de la piste d'atterrissage / Groundwater quality and level monitoring stations in the airstrip area

NORDA STELO

Carte / Map 3.18

Table 3.19 Descriptive statistics for groundwater quality in Sector 1 (modified processed kimberlite containment facility) in 2019

Parameter	Unit	Sector 1 - Mine – Surface Deposits (n=13)			Sector 1 - Mine – Bedrock (n=18)		
		Applicable Standard	Source of Criterion (*)	Mean Concentration	Applicable Standard	Source of Criterion (*)	Mean Concentration
Organic Compounds							
Petroleum hydrocarbons (C_{10}-C_{50})	mg/L	2.8	R	<0.1	2.8	R	<0.1
Basic Physical-Chemical Characteristics							
Conductivity	µS/cm	-	-	136	-	-	130
pH	pH	-	-	5.61	-	-	6.37
Major Ions							
Bicarbonates (HCO_3)	mg/L-$CaCO_3$	50	F	6.2	94	F	24.4
Chlorides (Cl^-) (n=10)	mg/L	860	R	15.30	-	-	-
Sulphates (SO_4)	mg/L	19.2	F	5.07	51.2	F	5.70
Calcium (Ca)	mg/L	19.885	F	10.0	59.4	F	13.70
Magnesium (Mg)	mg/L	3.61	F	2.42	2.94	F	**3.00**
Potassium (K)	mg/L	5.865	F	0.83	109.6	F	2.25
Sodium (Na)	mg/L	10.6	F	8.42	52	F	5.96
Dissolved Metals and Metalloids							
Aluminium (Al)	mg/L	0.982	F	0.354	0.653	F	0.090
Silver (Ag)	mg/L	0.00049**	F	0.00006	0.00026**	F	<0.00004
Arsenic (As)	mg/L	0.34	R	<0.0005	0.34	R	0.0005
Barium (Ba)	mg/L	0.108**	R	**0.0055**	0.108	R	0.018
Chromium (Cr)	mg/L	0.0072	F	0.0011	0.048	F	0.0020
Copper (Cu)	mg/L	0.057**	F	**0.011**	0.009**	F	**0.015**
Iron (Fe)	mg/L	2.908	F	0.089	1.46	F	0.177
Manganese (Mn)	mg/L	0.6**	R	0.090	0.600**	R	0.066
Nickel (Ni)	mg/L	0.023**	F	0.007	0.025**	F	0.014
Lead (Pb)	mg/L	0.0044**	R	0.0002	0.0044**	R	0.0003
Zinc (Zn)	mg/L	0.078**	F	0.0167	0.017**	F	**0.0249**

* [R] Resurgence criteria (Beaulieu, 2019)
[F] Natural background values in target sector (Norda Stelo, 2017d)
** Criterion calculated using hardness of 10 mg/L of $CaCO_3$. (*Quality criteria for these metals varies with hardness of surface water with which groundwater merges*).
in bold Value exceeds applicable standard

Table 3.20 Descriptive statistics for groundwater quality in Sector 2 (explosives storage area) in 2019

Parameter	Unit	Sector 2 – Mine – Surface Deposits (n=6)			
		Applicable Standard	Source of Criterion (*)	Number of Values > Criterion	Mean Concentration
Organic Compounds					
Petroleum hydrocarbons (C_{10}-C_{50})	mg/L	2.8	R	0	0.115
Basic Physical-Chemical Characteristics					
Conductivity	µS/cm	-	-	0	291
pH	pH	-	-	0	5.39
Major Ions					
Bicarbonates (HCO_3)	mg/L-$CaCO_3$	57	F	0	7.2
Chlorides (Cl^-)	mg/L	860	R	0	3.68
Sulfates (SO_4)	mg/L	18	F	2	**24.72**
Calcium (Ca)	mg/L	12.7	F	2	**39.9**
Magnesium (Mg)	mg/L	2.7	F	1	**3.04**
Potassium (K)	mg/L	13.72	F	0	2.28
Sodium (Na)	mg/L	9.8	F	0	3.97
Dissolved Metals and Metalloids					
Aluminium (Al)	mg/L	1.135	F	0	0.432
Silver (Ag)	mg/L	<0.0001**	F	0	<0.00004
Arsenic (As)	mg/L	0.34	R	0	0.0009
Barium (Ba)	mg/L	0.108**	R	0	**0.085**
Chromium (Cr)	mg/L	0.0022	F	0	0.0022
Copper (Cu)	mg/L	0.04815**	F	1	0.010
Iron (Fe)	mg/L	37	F	0	1.740
Manganese (Mn)	mg/L	0.636**	F	0	0.107
Nickel (Ni)	mg/L	0.0067**	R	1	0.007
Lead (Pb)	mg/L	0.0044**	R	0	0.0003
Zinc (Zn)	mg/L	0.033**	F	0	0.0188

* [R] Resurgence criteria (Beaulieu, 2019)
[F] Natural background values in target sector (Norda Stelo, 2017d)
** Criterion calculated using hardness of 10 mg/L of $CaCO_3$. (*Quality criteria for these metals varies with hardness of surface water with which groundwater merges*).
in bold Value exceeds applicable standard

Table 3.21 **Descriptive statistics for groundwater quality in Sector 3 (gasoline and diesel fuel depot) in 2019**

Parameter	Unit	Sector 3 – Process Plant and Fuel Depot – Surface Deposits (n=12)				Sector 3 – Process Plant and Fuel Depot – Bedrock (n=6)			
		Applicable Standard	Source of Criterion (*)	Number of Values > Criterion	Mean Concentration	Applicable Standard	Source of Criterion (*)	Number of Values > Criterion	Mean Concentration
Organic Compounds									
Petroleum hydrocarbons (C_{10}-C_{50})	mg/L	2.8	R	0	<0.1	2.8	R	0	<0.1
Basic Physical/Chemical Characteristics									
Conductivity	µS/cm	-	-	0	289	-	-	0	320
pH	pH	-	-	0	6.29	-	-	0	7.06
Major Ions									
Bicarbonates (HCO_3)	mg/L-$CaCO_3$	62	F	1	42.1	74	F	2	55.3
Chlorides (Cl^-) (n=7)	mg/L	860	-	0	20.7	860	R	0	18.37
Sulphates (SO_4)	mg/L	9.3	F	8	**35.04**	27	F	2	**47.81**
Calcium (Ca)	mg/L	16.55	F	7	**24.9**	29.52	F	3	**37.7**
Magnesium (Mg)	mg/L	2.495	F	9	**4.1**	3.77	F	4	**5.45**
Potassium (K)	mg/L	2.89	F	6	**3.9**	14.76	F	0	2.68
Sodium (Na)	mg/L	7.16	F	6	**17.4**	31.05	F	0	12.84
Dissolved Metals and Metalloids									
Aluminium (Al)	mg/L	0.122	F	1	0.041	1.449	F	0	0.014
Silver (Ag)	mg/L	<0.0003**	F	0	<0.00004	0.0004**	F	0	<0.00004
Arsenic (As)	mg/L	0.34	R	0	0.0006	0.34	R	0	<0.0005
Barium (Ba)	mg/L	0.108**	R	1	**0.042**	0.108**	R	0	0.033
Chromium (Cr)	mg/L	<0.005	F	0	0.0013	0.009	F	0	0.0011
Copper (Cu)	mg/L	0.137**	F	0	0.003	0.075**	F	1	0.003
Iron (Fe)	mg/L	2.01	F	6	**7.22**	1.384	F	0	<0.07
Manganese (Mn)	mg/L	2.74	F	2	0.654	0.6**	R	0	0.073
Nickel (Ni)	mg/L	0.013**	F	2	0.008	0.045**	F	0	0.007
Lead (Pb)	mg/L	0.0062**	F	0	0.0002	0.0047**	F	1	0.0002
Zinc (Zn)	mg/L	0.09**	F	0	0.0046	0.078**	F	0	0.0048

*	[R]	Resurgence criteria (Beaulieu, 2019)
	[F]	Natural background values in target sector (Norda Stelo, 2017d)
**		Criterion calculated using hardness of 10 mg/L of $CaCO_3$. (*Quality criteria for these metals varies with hardness of surface water with which groundwater merges*).
in bold		Value exceeds applicable standard

Table 3.22 Descriptive statistics for groundwater quality in Sector 4 (trench landfill site) in 2019

Parameter	Unit	Sector 4 - Mine – Surface Deposits (n=24)			
		Applicable Standard	Source of Criterion (*)	Number of Values > Criterion	Mean Concentration
Organic Compounds (Integrating Parameter)					
Petroleum hydrocarbons (C_{10}-C_{50})	mg/L	-	-	0	<0.1
Basic Physical-Chemical Characteristics					
Conductivity (lab)	µS/cm	-	-	0	65
pH (lab)	pH	-		0	6.37
BOD_5	mg/L-O_2	<4	F	0	<2
COD	mg/L-O_2	65	F	0	<5
Major Ions and Nutrients					
Chlorides (Cl)	mg/L	250	M	0	1.38
Sulphates (SO_4)	mg/L	500	M	0	1.63
Total sulphides (S_2^-)	mg/L-S_2^-	<0.1	F	0	0.01
Total cyanides (CN)	mg/L-CN	0.2	M	0	<0.003
Ammonium nitrogen (N-NH_3)	mg/L-N	1.5	M	0	0.20
Nitrates-Nitrites (N-NO_3-NO_2)	mg/L-N	10	M	0	0.14
Sodium (Na)	mg/L	200	M	0	1.54
Metals and Metalloids					
Boron (B)	mg/L	5	M	0	<0.02
Cadmium (Cd) (n=23)	mg/L	0.01**	M	0	0.00002
Chromium (Cr)	mg/L	0.05	M	0	<0.0005
Copper (Cu)	mg/L	0.013**	F	0	0.001
Iron (Fe)	mg/L	0.3	M	0	<0.007
Manganese (Mn)	mg/L	0.114**	F	1	**0.137**
Mercury (Hg) (n=16)	mg/L	0.001	M	0	0.00001
Nickel (Ni)	mg/L	0.035**	F	0	0.0013
Lead (Pb)	mg/L	0.01**	M	0	<0.0005
Zinc (Zn)	mg/L	5**	M	0	0.01
Bacteriological					
Fecal coliforms	UFC/100ml	0	M	9	**5**
Volatile Organic Compounds					
Benzene	mg/L	0.005	M	0	<0.0003
Ethylbenzene	mg/L	0.0024	M	0	<0.0003
Toluene	mg/L	0.024	M	0	<0.001
Xylenes (o, m, p)	mg/L	0.3	M	0	<0.001
Phenol Compounds					
Non-Chlorinated					
o-Cresol	mg/L	-	-	-	<0.001
m-Cresol	mg/L	-	-	-	<0.001
p-Cresol	mg/L	-	-	-	<0.001
2,4-Dimethylphenol	mg/L	-	-	-	<0.001
4-Nitrophenol	mg/L	-	-	-	<0.001
Phenol	mg/L	-	-	-	<0.001

Parameter	Unit	Sector 4 - Mine – Surface Deposits (n=24)			
		Applicable Standard	Source of Criterion (*)	Number of Values > Criterion	Mean Concentration
Chlorinated					
2,3,4,6-Tetrachlorophenol	mg/L	-	-	-	<0.001
2,3,5,6-Tetrachlorophenol	mg/L	-	-	-	<0.001
2,3-Dichlorophenol	mg/L	-	-	-	<0.001
2,4 + 2.5-Dichlorophenol	mg/L	-	-	-	<0.001
2,4,5-Trichlorophenol	mg/L	-	-	-	<0.001
2,4,6-Trichlorophenol	mg/L	-	-	-	<0.001
2,6-Dichlorophenol	mg/L	-	-	-	<0.001
2-Chlorophenol	mg/L	-	-	-	<0.001
3,4-Dichlorophenol	mg/L	-	-	-	<0.001
3,5-Dichlorophenol	mg/L	-	-	-	<0.001
3-Chlorophenol	mg/L	-	-	-	<0.001
4-Chlorophenol	mg/L	-	-	-	<0.001
Pentachlorophenol	mg/L	-	-	-	<0.001
Total chlorinated phenolic compounds	mg/L	-	-	-	*<0.001*

*	[M] Limit values specified in Section 57 of the Regulation respecting the Landfilling and Incineration of Residual Materials (Chapter Q-2, r. 19) [F] Natural background level values in target sector (Norda Stelo, 2017d)
**	Criterion calculated using hardness of 10 mg/L of $CaCO_3$. (*Quality criteria for these metals varies with hardness of surface water with which groundwater merges*).
in bold	Value exceeds applicable standard

Table 3.23 Descriptive statistics for groundwater quality in Sector 5 (airstrip area) in 2019

Parameter	Unit	Sector 5 - Mine – Surface Deposits (n=6)			
		Applicable Standard	Source of Standard (*)	Number of Values > Criterion	Mean Concentration
Organic Compounds					
Petroleum hydrocarbons (C_{10}-C_{50})	mg/L	2.8	R	0	<0.1
Ethylene glycol	mg/L	-	-	-	<30
Propylene glycol	mg/L	-	-	-	<30
Basic Physical-Chemical Characteristics					
Conductivity	µS/cm	-	-	0	50.17
pH	pH	-	-	0	5.26
Major Ions					
Bicarbonates (HCO_3)	mg/L-$CaCO_3$	86	F	0	20.2
Chlorides	mg/L	860	R	0	3.58
Sulphates (SO_4)	mg/L	16	F	0	5.82
Calcium (Ca)	mg/L	8.35	F	0	3.2
Magnesium (Mg)	mg/L	3.025	F	0	0.97
Potassium (K)	mg/L	9.6	F	0	1.22
Sodium (Na)	mg/L	36.15	F	0	3.18
Dissolved Metals and Metalloids					
Aluminium (Al)	mg/L	0.722	F	1	0.230
Silver (Ag)	mg/L	<0.0003**	F	0	<0.00004
Arsenic (As)	mg/L	0.34	R	0	0.0010
Barium (Ba)	mg/L	0.108**	R	0	0.029
Chromium (Cr)	mg/L	0.0018	F	3	0.0026
Copper (Cu)	mg/L	0.0093**	F	1	0.006
Iron (Fe)	mg/L	15.95	F	4	10.5
Manganese (Mn)	mg/L	0.929**	F	1	0.580
Nickel (Ni)	mg/L	0.02**	F	0	0.006
Lead (Pb)	mg/L	0.0044**	R	0	0.0002
Zinc (Zn)	mg/L	0.052**	F	0	0.0117

* [R] Resurgence criteria (Beaulieu, 2019)
[F] Natural background values in target sector (Norda Stelo, 2017d)
** Criterion calculated using hardness of 10 mg/L of $CaCO_3$. (*Quality criteria for these metals varies with hardness of surface water with which groundwater merges)*.
in bold Value exceeds applicable standard

3.15 Containment Facilities Monitoring

3.15.1 Objective of Monitoring

Inspections of the modified processed kimberlite containment facility are carried out to control the integrity and hence stability of geotechnical structures, verify the application of the materials deposition plan, track changes in the structures over time, and identify any maintenance work required to ensure the structures are in good working order.

3.15.2 Use of Containment Areas

Every type of material produced as part of current operations at the Renard mine site is stored in designated containment areas, in compliance with the deposition plan (Map 3.20). These containment areas include ore stockpiles, the waste rock pile, the overburden stockpile and the modified processed kimberlite containment (MPKC) facility.

Ore is transported to the stockpiles south of pit R2/R3. These stockpiles are monitored and inspected to ensure their stability. Processed ore originates in the open pit, the underground mine as well as the stockpiles. Overburden is transported to the overburden stockpile northeast of pit R2/R3. This stockpile is monitored and inspected to confirm its stability

Waste rock is deposited on the waste rock stockpile north of pit R2/R3. It is monitored and inspected to ensure its stability. Some of the waste rock is also used to build berms at the MPKC facility, in addition to being used for road maintenance and civil engineering work. An estimated 100,000 tonnes of rock are crushed annually to meet these requirements.

Waste rock from the plant is transported by truck or pipeline to the MPKC facility. Coarse rock represents 65% of the material produced, whereas the fine fraction represents the remaining 35%. The coarse kimberlite fraction is used to build berms to contain the hydraulically deposited kimberlite.

3.15.2.1 Operational monitoring of tailings

In 2019, 7,000 tonnes of tailings were produced daily. The underground mine was in operation on a daily basis throughout the year, but the open pit mine was closed indefinitely in April 2019. Table 3.24 shows the quantities of materials extracted from the open pit and underground mines, along with the amount of processed ore and the materials transported to the MPKC facility The areas involved in these operations as well as the tonnage of material contained in each facility are presented in tables 3.24 and 3.25. The tailings produced during operations at the Renard mine site are considered low risk in compliance with Directive 019. There is in fact no metal leaching, which was confirmed in lab leachate testing results reported in the environmental and social impact assessment (Roche, 2011a).

The operating, maintenance and surveillance (OMS) manual for the modified processed kimberlite containment (MPKC) facility is updated annually. In 2019, the OES manual was updated to include the most recent references from the Mining Association of Canada (MAC). Various operational procedures were also developed or updated in keeping with the OES and the designer’s plans and specifications. These updates were read and understood by containment area operators.

3.15.2.2 Inspections and audits

The MPKC facility is subject to monitoring, audits and inspections to ensure the stability of the structure. Various monitoring and visual inspections are carried out on a weekly, quarterly and annual basis, and specific inspections are performed as required.

In 2019, two annual audits were carried out by the design consultant on May 27 and 28 (after snow melt), and on September 30 and October 1 (before snow fall). The audits confirmed the containment area was been managed and monitored appropriately. Various recommendations were issued and incorporated into the post-audit action plan, thereby ensuring gradual improvement in operational and monitoring components.

3.15.2.3 Containment berms

In 2019, work required to continue building containment berms was undertaken, including:

- Excavating the overburden;
- Extending pit F115;
- Cleaning the bedrock foundation; and
- Placing a transition layer of crushed rock between the stone material and the processed kimberlite in the berms.

The berm was therefore raised about 5 m in keeping with the increase in the hydraulically placed processed kimberlite. Quality control measures applied in the building of the structures confirmed compliance with design requirements, and corrective measures were put in place in the event any non-compliance was detected. Non-compliances were therefore corrected in 2019. The main issues involved isolated cases of high-water content in the materials deposited. A number of mitigation measures were put in place to reduce water content at source and facilitate water management on site.

In 2020, the height of the berm will be increased by 4.5 m. According to current estimates and projected production, MPKC facility #1 will be full by the third quarter of 2025. Construction on the second processed kimberlite containment facility should begin in the first quarter of 2024.

3.15.3 Instrument Surveillance

The surveillance performed by measuring instruments (piezometers and thermistors) has confirmed that the water table has remained below design limits. Also, monitoring the internal temperature of materials in the berm confirms that it is filtering properly, even in winter, because no freezing conditions were observed except in the case of two instruments near the surface that indicate thawing in summer. A few instruments were damaged during snow removal operations, and a replacement plan will be established in 2020. The damaged instruments have no impact for the moment since there are other instruments in place nearby.

3.15.4 Compliance with CA Requirements

The conditions set in the certificate of authorization (CA) with regard to the MPKC facility have been met. First, a one-metre freeboard was maintained at all times between the crest of the berm and the level of the hydraulically placed kimberlite (condition #11).

And second, four visual markers have been installed in compliance with condition #12 in the CA for the MPKC facility. The freeboard is colour coded as follows : green (= 3-m freeboard) ; yellow (= 2-m freeboard); red (= 1-m freeboard).

The stability study will be updated by the design consultant in 2021, i.e., in the fourth year of operation of the containment area, in compliance with condition #13.

In 2020, a geotechnical drilling campaign will be carried out to gather information on the fine and coarse PK deposited since the start of operations. The MPKC facility report and monitoring clearly satisfies condition #14. In addition, two sites are under study as candidates for the next tailings containment facility (Map 3.20).

3.15.5 Air Quality

In 2019, air quality monitoring results confirmed compliance with the standards. In addition, dust emission was minimized by watering roads on dry days. Regular visual inspections confirmed that filtered water from the permeable berm was clear. During operations, sediment-laden water is diverted to the peripheral ditches and then treated at the mine water treatment plant.

3.15.6 Spills

In 2019, there were no major oil spills recorded in the containment areas, just some minor leaks from mechanical failures that were immediately contained and recovered and did not have time to infiltrate the ground. The gradual closure of the slopes of the berm is scheduled to begin in 2020 since the final layer of the berm has not yet been placed.

Table 3.24 Tonnage of materials extracted and processed in 2019

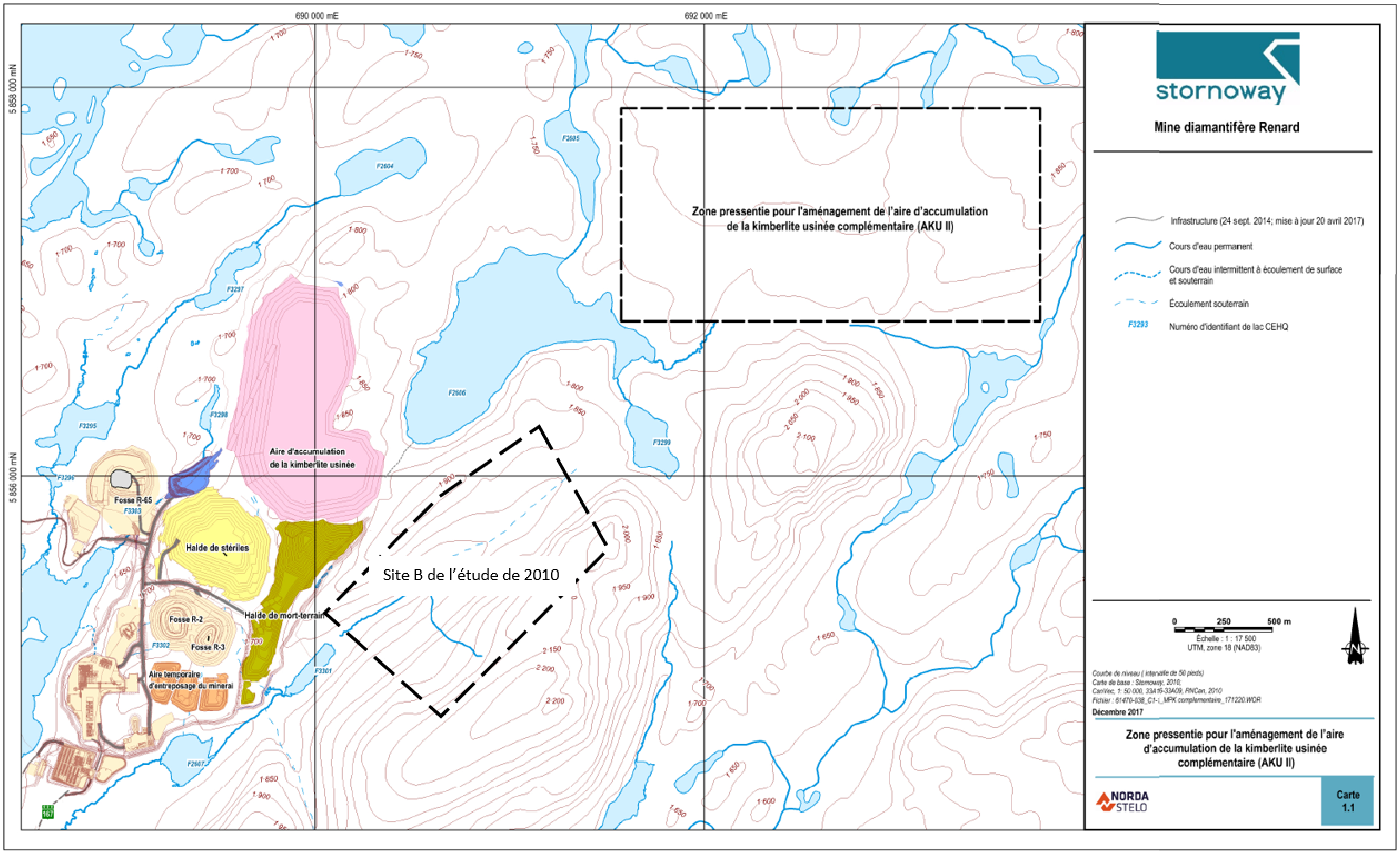
Description	Tonnage (kt)		
Materials Extracted	**Open Pit**	**Underground Mine**	**TOTAL**
Overburden	19	0	19
Waste rock	691	803	1,494
Ore	237	2,680	2,917
TOTAL	**947**	**3,483**	**4,430**
Ore Processed			**Tonnage (kt)**
Ore			2,556
Materials Stockpiled in the Modified Processed Kimberlite Containment Facility			**Tonnage (kt)**
Processed kimberlite transported by truck			1,566
Kimberlite (fine fraction) transported hydraulically			909
Sediment extracted from pit R65			0
Waste rock (pit + aggregate)			125
TOTAL			**2,600**

Photo 3.57 **Compressed-air cleaning of bedrock foundation, which had been stripped using an excavator.**

Photo 3.58 **Pool of fine processed kimberlite near a discharge point.**

Photo 3.59 **Placement and compacting of coarse PK to raise the layer downstream of the center line.**

Map 3.19 Sites under study for the next tailings containment facility at the Renard mine



FICHIER:S:\160 Engineering\4300 PKC\1 – MPKC Construction\2018\9 – SST et Environnement\Fin d'année 2018\Plan de superficie – Fin 2018

DESSINÉ PAR:	DATE:	PROJET:		NUMÉRO DE DESSIN:
A.Dorval	2019-01-21	MINE RENARD	Carte / Map 3.13	
APPROUVÉ PAR:	DATE:	TITRE:	stornoway	SUR - 00 - ENV - 000 - SUR - 01 - 04
A. Dorval		SUPERFICIES DES AIRES D'ACCUMULATION		SECTEUR / DISCIPLINE / DÉTAIL / DESCRIPTION / TRAVAIL / SÉQUENCE / RÉVISION
ÉCHELLE:	IMPRIMÉ:			
1:10 000	2019–03–28	VUE DE PLAN GÉNÉRAL		

4 Continuous Improvement in 2019

Federal Regulations

The new Environmental Emergency Regulations issued by Environment Canada (ECCC) came into effect on August 24, 2019, replacing the previous 2011 Regulations. Given that the Renard mine is subject to these regulations, it made the declarations in appendices 1 and 2 in 2019 with regard to substances that are defined as hazardous under the regulations (e.g., methane and propane) and are present on the mine site. In 2020, SWY will issue the declarations in appendices 3 and 4 with regard to the environmental emergency plan in place at the mine site, as required under the new regulations.

Provincial Regulations

SWY undertakes to deploy environmental management adapted as each mine phase, i.e., construction, operations and closure, progresses. The Renard mine's environmental and social management program (ESMP) was therefore created and implemented following the 2011 impact assessment (Roche, 2011a). Under the ESMP, environmental and biodiversity-related changes, either natural or mine related, are all measured, observed and documented, and compared with baseline conditions; the accuracy of environmental assessment is verified; and the effectiveness of mitigation measures is evaluated.

To ensure the monitoring program complies with regulatory requirements and Stornoway's commitments, and to incorporate changes made to the Global CA since the start-up of the mine in 2016, the ESMP was updated in 2019 and submitted to the MELCC in February 2019 (Stornoway, 2019d).

Since November 15, 2019, Stornoway has been subject to its first industrial depollution attestation under the *Regulation respecting industrial depollution attestations (RAAMI)*. This depollution attestation is a five-year renewable permit that applies specifically to industrial operations, whereas the global certificate of authorization (CA) is a statutory instrument that comes into force prior to project start-up.

The attestation includes operating conditions addressing discharges into water, atmospheric emissions, solid waste materials as well as the receiving environment. The application for a depollution attestation submitted by SWY in October 2016 was issued by the MELCC on November 15, 2019. It marked the launch of various validation studies within prescribed timelines.

Environmental and Social Management System

The environmental and social management system (ESMS) remained operational in 2019, and some improvements were made, including:

- The addition of an operational procedure for cleaning drinking water tanks;
- An update to lockout procedures at the water treatment plants (MWWTP, DWWTP and DWTP).

Mining Operations Management

Mining in the R65 open pit came to a close in early April 2019, and SWY focussed on developing level 450 in the underground mine.

Towards Sustainable Mining (TSM™)

In line with the TSM™ initiative, SWY conducted a self-assessment on the *water stewardship* protocol and continued efforts deployed about the *management of energy consumption and greenhouse gas emissions* in 2019. At the beginning of the year management set an objective of achieving a minimum of an A rating for each indicator in the seven protocols, and AA ratings were actually achieved, even exceeding the objectives. For a more detailed description of these results, see section 2.1 herein.

Water Management

A strategic water management plan was prepared to optimize water management at the mine site. Pumping wells were installed to intercept groundwater before it infiltrated the underground mine.

The use of water from the reclaimed water pond to meet ore processing plant requirements was optimized to prioritize this source of supply and hence maximize the re-use of water in the circuit.

Hazardous Materials Management

To ensure the continuous improvement of its environmental performance, SWY upgraded its permanent residual hazardous materials (RHM) management site. The new site is now compliant with all RHM management mitigation measures that were set out in the environmental and social impact assessment. In addition, quarterly inspections are carried out to ensure the RHM site remains compliant.

Control of Contamination Sources

With a view to controlling and reducing the risk of final mine effluent toxicity, an internal investigation is launched as soon as a weekly mine wastewater sample from underground mining operations shows an increase in:

- The ammonium nitrogen concentration;
- The C_{10}-C_{50} hydrocarbon concentration.

This internal procedure in place since 2018 enables SWY to determine the underlying cause of sources of contamination and apply appropriate preventive measures.

The investigation process triggered by an accidental spill of a contaminant was also strengthened and the investigation report form improved to standardize all such investigations.

Human Resources Management

SWY in 2019 continued to encourage the next generation. In summer 2019, the team brought two bachelor's level environmental interns on board to work closely with environmental technicians on:

- The environmental monitoring program;
- Sampling campaigns;
- Drafting reports on water quality monitoring campaigns and operational procedures;
- Entering environmental data.

A third college-level intern specializing in water treatment joined the team to assist water treatment technicians in operating the three treatment plants and monitoring water quality. In 2020, the Environment Department will once again host two environment interns as well as a water treatment intern.

Solid Waste Management

In August 2019, SWY partnered with the Centre technologique des résidus industriels (CTRI) in Rouyn-Noranda on a study to reclaim bales of wood. The goal was to optimize management of wood waste. A baling test was carried out and three bales of waste wood were sent to be reclaimed in August 2019.

SWY also worked on optimizing products that were initially stored to dehydrate waste sludge and used to treat phosphorus in domestic wastewater at the DWWTP. Treatment costs were as a result optimized and the total phosphorus concentration in domestic wastewater effluent was maintained under the MELCC's environmental discharge objective (<0.1 mg/L).

To reduce the quantity of solid waste, SWY developed a water fountain program with a view to gradually replacing single-use water bottles. Owing to budget constraints, however, the program had to be put on hold. SWY nonetheless followed through on best practices at the mine site by encouraging workers to use refillable bottles and conserve water consumption at the camp.

SWY drafted its first water stewardship plan under the MAC's Toward Sustainable Development initiative. The objective of the plan is to optimize water management practices in mining operations, by for example maximizing the annual mine water re-use rate.

Tailings Management

The operation, maintenance and surveillance (OMS) manual for the modified processed kimberlite containment (MPKC) facility was updated and a second edition was released.

Environmental Emergencies Management

The emergencies measures plan (EMP) was revised, and the 10th edition was published in 2019. This edition includes a specific section dedicated to the environment.

The environment dome or eco-center, where residual hazardous materials (RHMs) are stored, was upgraded with the installation of a concrete floor (Photo 4.1) along with a catchment trap. The upgrade is designed to limit and control potential contamination of the ground from accidental spills.

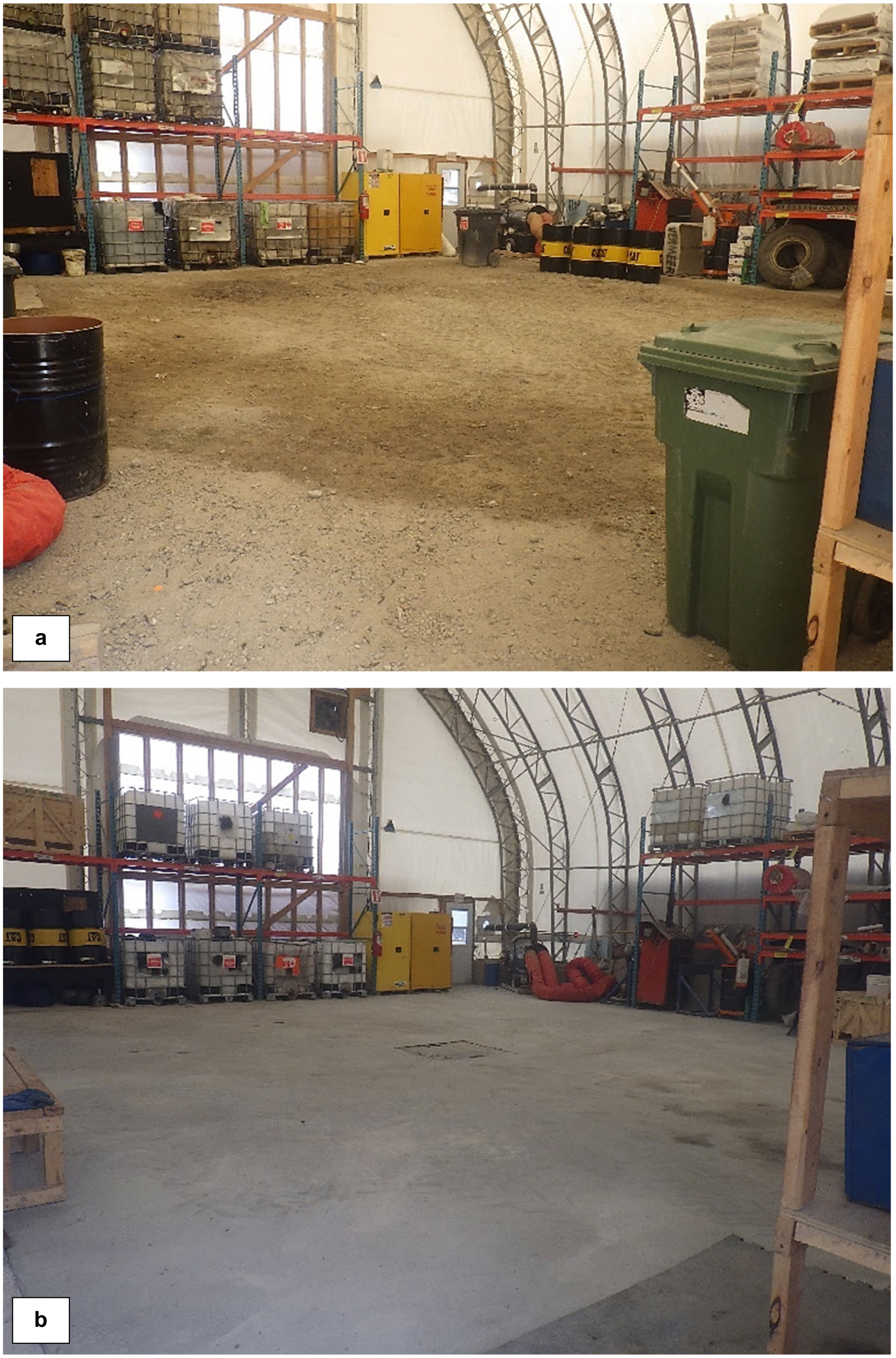


Photo 4.1 Environment Dome before (a) and after (b) the installation of a concrete floor

5 External Audits

Surveillance Activities

Since the start of mining operations, observations from the environmental surveillance program have been recorded in the IsoVision© system. Regular monitoring of the program ensures that any non-compliance is addressed immediately.

Environment technicians conduct a number of daily surveillance activities to ensure sound environmental management of the mine site. This surveillance includes:

- Inspections of work sites and workplaces;
- Site visits and inspections to ensure machinery is in good working order;
- Monitoring of authorized Eco-Permits and related mitigation and control measures.

Surveillance activities are recorded and flagged in IsoVision© by category, i.e., as a preventive action, compliant inspection, remedial action, an internal non-compliance and legal non-compliance.

Figure 5.1 provides a summary of measures that have been carried out by the Environment Department since 2015. A total of 216 surveillance activities were carried out in 2019, or fewer than in 2018 (453), which is due to construction ending in 2019.

The annual breakdown of observations raised during environmental surveillance activities is provided in Figure 5.2. In 2019, there were no legal non-compliances. The year was marked above all by an increase in the number of preventive actions. This means that in 2019 environmental management efforts on the mine site involved proportionally more preventive action than remedial action.

Surveillance activities in 2019 included 100 preventive actions, 60 compliant inspections, 40 remedial actions and 16 internal non-compliances. Also note that the number of internal non-compliances declined significantly in 2019 as compared with 2018.

These results illustrate the efforts made by SWY on the mine site, namely, sustained environmental surveillance and the application of internal requirements such as:

- Compliance of an ammonium nitrogen concentration in a mine wastewater sample from underground mining operations;
- Compliance of a basic mitigation measure or a procedure.

Non-compliance with these requirements automatically resulted in an internal non-compliance being reported, which would lead to an investigation. The drop in the number of internal non-compliances in 2019 is also tied to the closure of open pit mining operations in pit R65 as of April 2019.

Finally, no legal non-compliance was reported, specifically during the MELCC's annual inspection on September 15 and 16, 2019 (Photo 5.1). The authorities in fact congratulated the mine on its sound environmental management of the site. Table 5.1 provides a chronological list of the inspections and visits in 2019 at the Renard mine site.

Photo 5.1 Annual inspection by MELCC (September 2019)

Audits

SWY has had the information provided in the Renard mine's annual environmental monitoring report audited by an external consultant since 2015.

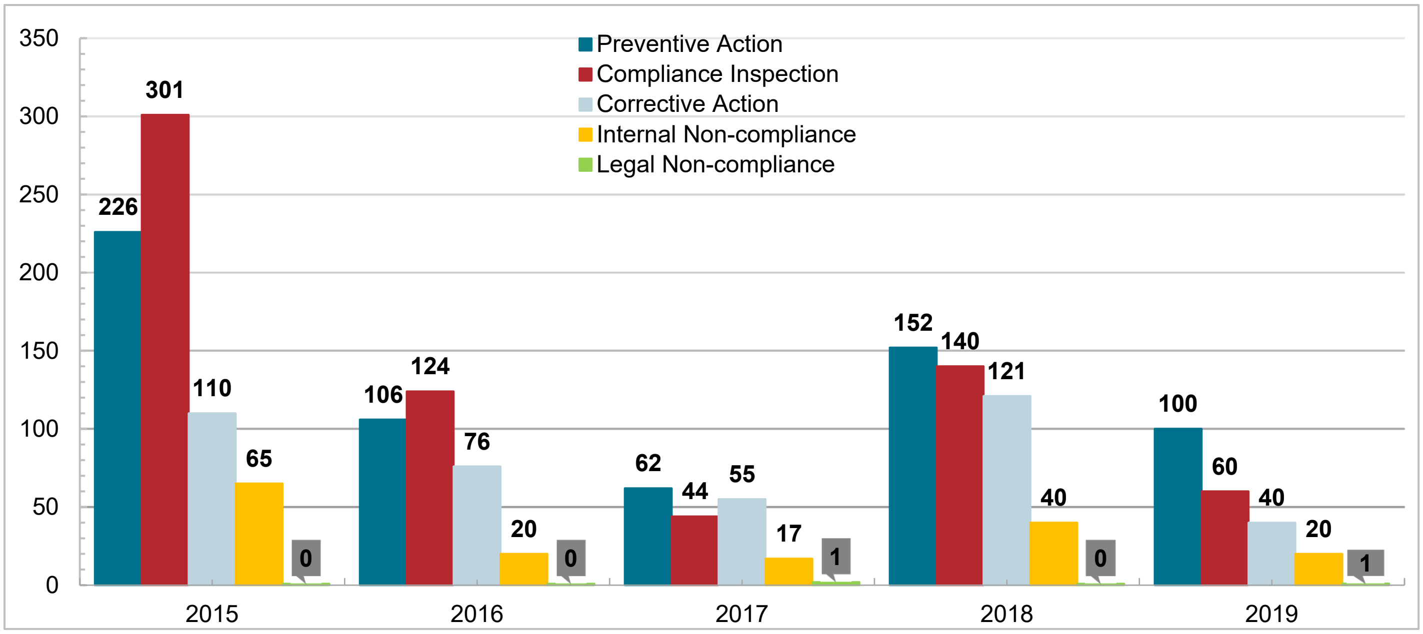


Figure 5.1 Summary of Environment Department operations since 2015

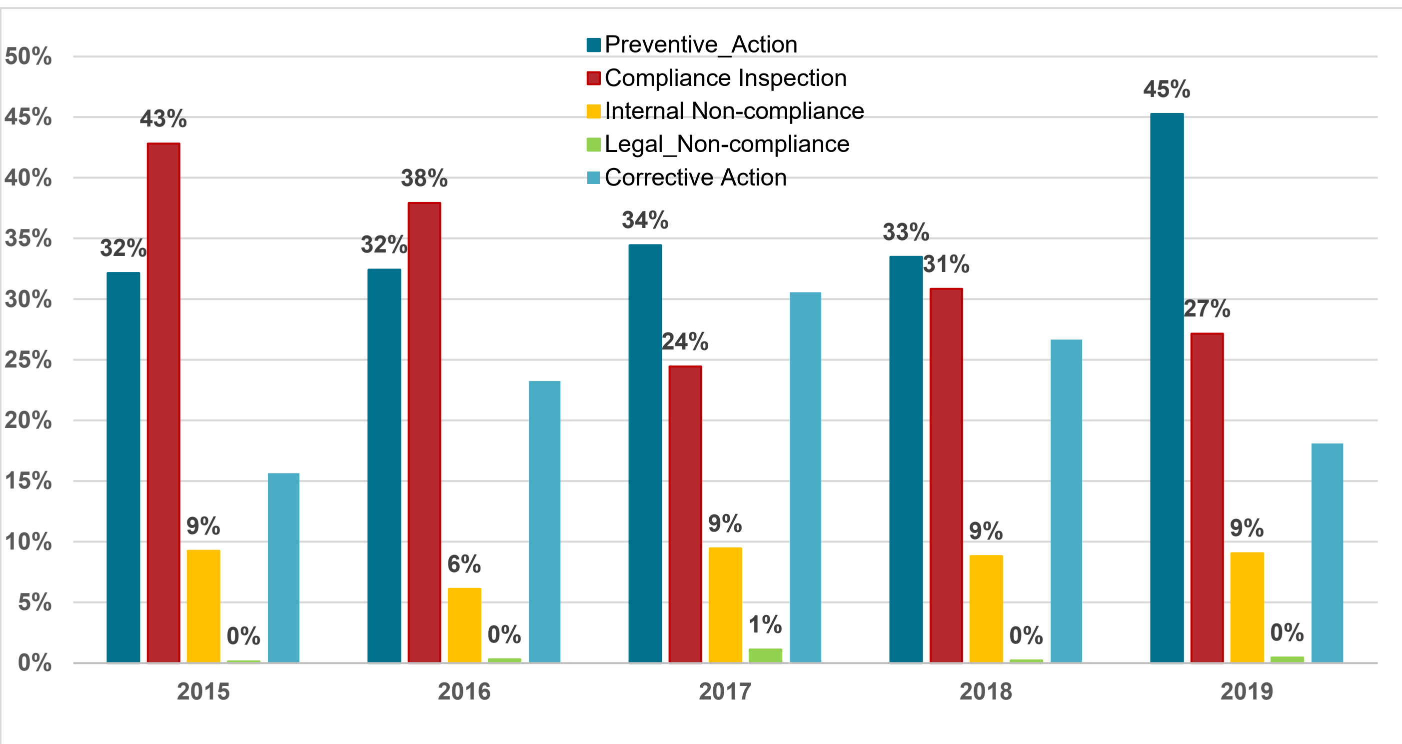


Figure 5.2 Annual breakdown (%) of observations during environmental surveillance activities on site since 2015

The review and validation of the annual monitoring report are appended to the report before it is submitted to stakeholders and the authorities, in order to comply with the regulatory framework.

With regard to environmental monitoring, SWY engaged the services of an external consultant to verify the GHG emissions reported in 2019 for the Renard mine (see Section 3.2.3 for further information).

Air quality and noise and vibration level monitoring was performed by specialized consultants in 2019, as is done every year. With this approach, the data collected by SWY are subject to an external audit (see sections 3.2 and 3.3 for further information).

In 2019, SWY also had the water level stations installed around Lake Lagopede inspected to ensure that the stations, which are used to track the water balance for Lake Lagopede, are in good working order. This external inspection is in addition to the operational water balance conducted by Golder on the volumes of water withdrawn from the lake and the volume of water re-used at the site (see Section 3.4 for further information).

SWY also engaged a consultant to inspect the flowmeters installed at the MWWTP and in the underground mine. With regard to wildlife monitoring, the MFFP visited the mine site in June 2019 to evaluate black bear management measures in place, and issued some corrective measures following the visit (see section 3.12 for further information). SWY also worked in partnership with the MFFP to survey woodland caribou populations in 2019. Under this agreement, SWY was authorized by the Ministry to present its wildlife monitoring data.

In the area of mine tailings, two audits were performed in May and October 2019 by the design consultant to inspect the stability of the MPKC facility (see Section 3.15 for further information).

Finally, every year SWY organizes a visit by MELCC inspectors to confirm compliance of the mine site's environmental management facilities, as well as to answer questions from the Ministry. In 2019, the MELCC visited the site on September 16 and 17.

Table 5.1 Inspections and visits at Renard mine site in 2019

Date	Entity	Reason for Visit
May 27 to 28, 2019	Golder	Spring audit of MPKC facility by the design consultant
September 3 to 5, 2019	Site visit by Renard mine environment committee	Third regular meeting of committee members Visits and environmental monitoring, mine site facilities
September 16 to 17, 2019	MELCC	◗ Control inspection: ◗ Meeting: ANC/SAP monitoring, Directive 019 annual report, environmental report (DÉE), restoration plan (MERN), compensation plan (Icon Sullivan) ◗ MPKC facility – pumping line – concentrator pumps ◗ New sorting circuit ◗ Pit R65 ◗ MWWTP – ASDR ◗ Groundwater pumping wells ◗ Waste rock and overburden stockpiles – east pit ◗ New ore stockpiles – near ramp and R4 ◗ RHM depot. ◗ General site tour.
September 30 to October 1, 2019	Golder	◗ Fall audit of MPKC facility by design consultant.

6 Gradual Restoration

Mine Site

In 2019, no dismantling work was carried out at the mine site, but some revegetation work was done.

Plant Regrowth

In 2019, in light of the monitoring of plant regrowth in 2018, only two areas were targeted for manual reseeding. The area near the beach of the MWWTP and the area that was revegetated in 2018 south of the Swallow-Fournier garage, were reseeded in summer 2019 (see Section 3.7 for further information).

Borrow Pits

A majority of the borrow pits were closed in 2014 once road construction ended. Some sections of the borrow pits however remain open for Route 167 maintenance and are currently being gradually restored. The open borrow pits entail non-exclusive leases for the exploitation of mineral substances at

- km 561.4;
- km 572.5;
- km 586.8;
- km 597.3;
- km 618.5.

Closure of the borrow pits means that every area where surface mineral substances (SMS) were extracted has to be completely restored, with plant regrowth monitored as required by the *Regulation respecting pits and quarries*.

The restoration work or natural regeneration involves stabilizing the slopes by reducing the inclines on the perimeter of the borrow pits and replanting the area with native shrub species.

An environmental technician inspected the borrow pits in August 2017 and identified areas to be replanted either because the area was no longer in operation or previous replanting efforts had failed. A follow-up in 2018 confirmed that the plantations had been successful.

In 2018, 14,000 seedlings were planted (photos 6.1 and 6.2) on the borrow pits at kilometre 639 and kilometre 639.8. The seedlings were divided up between the two borrow pits and a few small sectors at the mine site (Map 3.9).

In 2019, borrow pits BE639 and BE639,8 along Route 167 North were monitored on June 23. The seedlings planted in July 2018 were inspected to determine their survival rate (Table 3.14). Survival rates of 92% and 100% were observed respectively for BE639 and BE639,8, which is considered to be excellent given that the seedlings were initially planted in soil with no plant matter. Plant regrowth seems to demonstrate the effectiveness of the gradual restoration activities.

A minimum of three seasons is generally required to assess the quality of regrowth. Monitoring in 2020 will mark the three-year period for confirming seedling growth. SWY will continue to monitor restoration until the MELCC specifies that the restoration of the borrow pits is satisfactory and meets quality criteria for the company to be released from the lease on the land in the domain of the State

Photo 6.1 Plant storage at km 639 borrow pit (August 2018)

Photo 6.2 Monitoring of plant regrowth on the borrow pit at km 639 (June 2019)

7 Environmental Incident Management

Commitments

SWY is committed to respecting and protecting the environment where the mine is located. Environmental risks have been taken into consideration as of the design phase.

To ensure it fulfills its commitment, and complies with applicable laws and regulations, SWY put in place a procedure to deal with accidental spills and leaks. As in 2018, the Environment Department held training sessions to promote best practices at the mine site, among workers in every department, and thereby minimize equipment failures. All new workers including contractors on site undergo training as part of the onboarding process.

The first step in environmental incident management involves preventive measures designed to control pollution at source using mitigation measures set out in the impact assessment (Roche, 2011a). These measures are specified in every Eco-Permit issued prior to the start-up of new work on site.

Facilities

Fuel farms at the Renard mine site are designed to be safe and prevent accidental leaks or spills. Fuel tanks (diesel, gas, etc.) are all double walled and are equipped with a fire protection system with hydrants on the perimeter of the fuel farm.

The mine site is also equipped with a modern fuelling station operated with electronic cards and a level control system at each pump. In addition, the fuelling station has a leak detection and recovery system in place.

Type of Incidents

Environmental incidents are divided into two categories, i.e., spills and near misses. A spill occurs when a contaminant spreads out or unintentionally comes into contact with the environment. A near miss happens when the spill is immediately contained and recovered before it seeps into the ground or comes into contact with the natural environment.

This type of incident does not constitute an accidental spill as defined in the regulations and does not need to be reported to the authorities.

All near misses however are considered and may be subject to an internal investigation. This management practice helps detect anomalies and prevent the recurrence of similar accidents in an unprotected environment that lead to serious environmental damage.

Tracking this type of incident makes it feasible to record their impact. In 2019, 100% of near misses occurred in locations (such as on a concrete surface) and in quantities that did not lead to seepage of the contaminant in the ground.

Incident Report

When an environmental incident occurs, SWY is required to protect the environment by containing and recovering the contaminants in a timely manner.

Then as prescribed in sections 8 and 9 of the *Hazardous Materials Regulations* (Q-2, r.32 of the *Environment Quality Act*), SWY is legally obligated to report accidental spills to Urgence-Environnement (MELCC).

SWY is also required to recover all the contaminated soil and dispose of contaminated materials at an MELCC-accredited site. An incident report must be prepared for each event and remedial measures applied to prevent the recurrence of similar incidents.

Containment Recovery Operations

Recovering contaminants is initiated immediately regardless of the type of spill, so as to comply with the regulations and prevent any long-term environmental risks.

More specifically, contaminated soil recovered from an incident is transported to an MELCC-accredited treatment center depending on the type of soil, and the concentration or type of contaminant.

To reduce response time in the event of a spill on the mine site, spill containment and recovery kits have been placed in strategic locations on site.

SWY also has a mobile environmental emergency unit or trailer that can be moved rapidly to a major spill site (Photo 7.1). The mobile unit contains the equipment and materials needed to respond appropriately to an environmental emergency. An inventory of the equipment in the trailer is performed every month.

Photo 7.1 Environmental emergency unit

Incident Summary Reports

In 2019, there were a total of 126 environmental incidents, as compared with 144 in 2018. More specifically, 104 spills were reported, representing a steady decline from 2017 (149) and 2018 (132) (Figure 7.1).

This ongoing reduction in the number of spills is attributable to the strengthening of investigations of environmental incidents. Fundamental causes were correctly identified and the appropriate corrective measures put in place in 2018 were maintained in 2019.

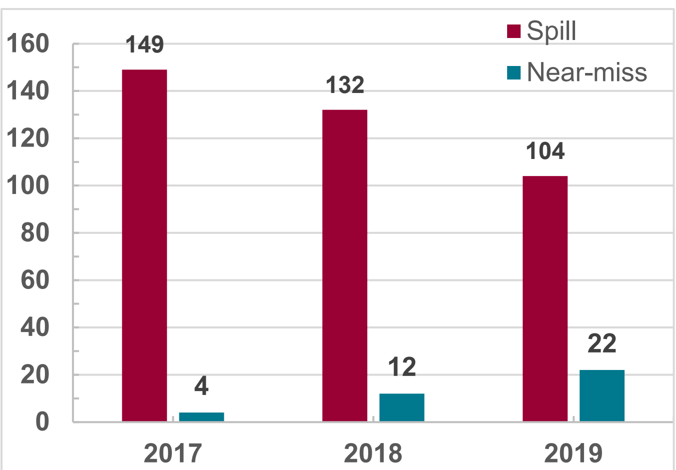


Figure 7.1 Environmental incidents since 2017

The improvements made in 2019 clearly made a significant contribution to this positive outcome, i.e., a 21% decrease in the number of spills as compared with 2018. In addition, since 2016, all new hires, contractors and visitors to the site undergo training on best practices in the event of a spill and everyone's shared environmental responsibilities. Everyone is responsible for rigorously applying the spill procedure at the mine. This process continued throughout 2019.

Causes

In 2019, the recurring factors regarding accidental spills are mechanical failures and human error, as in 2018. Figure 7.2 illustrates the breakdown of spills by causal factor. About 17% of spills were the result of human error. Human error is defined for example as the use of improper replacement parts or poor handling.

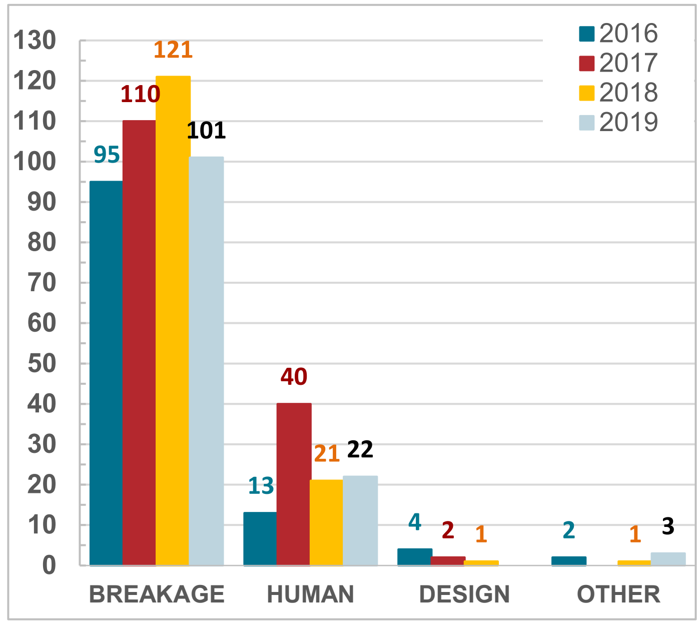


Figure 7.2 Comparison of causal factors of spills since 2016

More precisely, in 2019, about 80% of spills were caused by mechanical failures, including 56% directly attributable to hydraulic hose failures (Figure 7.3).

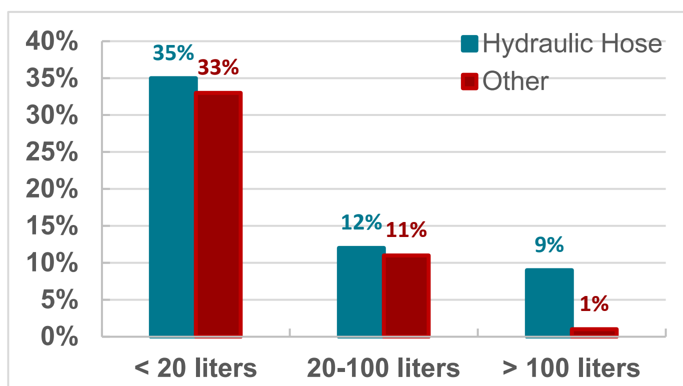


Figure 7.3 Proportion of spills caused by hydraulic hose failures

To reduce the risk of mechanical failures on machinery, SWY put in place a preventive maintenance program to track the number of hours each piece of equipment is used.

Volumes

In terms of volume, of the 104 spills reported in 2019 (Figure 7.3):

- 47 involved volumes less than 20 litres;
- 45 involved volumes between 20 and 100 litres;
- 12 involved volumes greater than 100 litres.

The number of spills greater than 20 litres and those greater than 100 litres decreased in 2019 as compared with 2018 (Figure 7.3).

Investigations

As in 2018, all environmental incidents in 2019 whose cause was determined to be human error automatically led to an in-depth investigation of the underlying cause, with a view to applying appropriate preventive and corrective measures.

Efforts made to develop operational procedures within the organization in 2018 and 2019 contributed to decreasing the number of incidents caused by human error. This applies to large spills (>100 litres) as well as small spills (<20 litres) (Figure 7.4).

In 2020, the Environment Department will focus on improving the quality of the investigations, corrective measures and monitoring of the corrective measures.

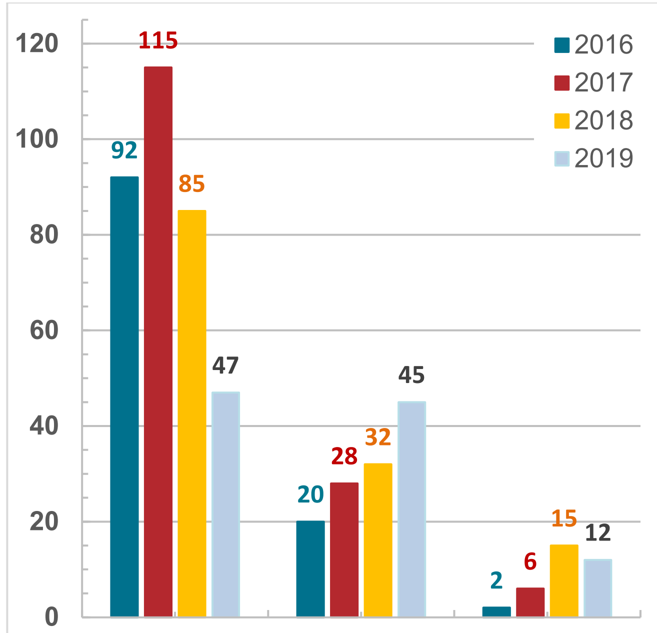


Figure 7.4 Number of environmental incidents by volume class since 2016

8 Social Monitoring Program

8.1 Scope of Social Monitoring

As specified in the Environmental and Social Monitoring Program initially submitted to government authorities in July 2015 and updated in October 2016 and in 2019, this monitoring concerns the social component of the Renard mine operation phase for the year 2019.

The monitoring program involves the Crees from the Mistissini community (including trapline M-11 family members) as well as Crees from other Eeyou Istchee communities. Certain aspects of this monitoring also apply to the Chibougamau and Chapais communities and by extension to all James Bay communities.

More specifically, the Social Monitoring Program was prepared in response to conditions 5.1, 5.2 and 5.3 in the Global Certificate of Authorization (CA) granted to Stornoway on December 4, 2012, and subsequently amended to reflect changes in the project

In addition to the conditions set out in the CA, the Social Monitoring Program included the commitments Stornoway specified in the Environmental and Social Impact Assessment (ESIA) (Roche, 2011a) as well as those in the documents answering COMEX questions and comments (August 2012).

The Social Monitoring Program is also based on the commitments made by the signatories to the following: documents:

- Mecheshoo Agreement in March 2012 (signed by Stornoway, the Cree Nation of Mistissini and the Cree Nation Government (CNG));
- Partnership Declaration dated July 2012 (signed by Stornoway, Chibougamau and Chapais).

The monitoring covers:

- Recruitment, including job types and number;
- Cree worker integration;
- Land use by M-11 trapline users (including conditions governing Cree use of Lake Lagopede's natural resources);
- Local and regional economic spinoffs (including goods and services contracts awarded to local companies);
- The integration of Cree workers.

This report therefore describes results for 2019 and observations arising from the main monitoring undertaken with regard to:

- Recruitment and the type and number of jobs;
- The integration of workers from Cree communities as well as Chibougamau-Chapais communities;
- The retention of workers from Cree communities as well as Chibougamau-Chapais communities;
- Use of M-11 trapline;
- Regional economic spinoffs.

8.2 Recruitment, Job Types and Numbers

8.2.1 Scope

As specified in sections 8.3 and 8.4 of the Environmental and Social Impact Assessment (ESIA), Stornoway anticipated in 2011 that the Renard project would have a positive impact on employment for the Crees of Mistissini and other Cree communities.

To enhance these positive spinoffs, Stornoway made a number of commitments to train Cree individuals and develop their aptitudes and skills. These commitments were confirmed in the Mecheshoo Agreement, which establishes general employment-related objectives.

Condition 5.1 of the Global CA indicates that the proponent is required to "monitor recruitment, types and number of jobs created by category of employee and the opportunities for advancement for the Crees of Mistissini and other Cree communities and hold a discussion on the factors that contribute to the results achieved."

Condition 5.2 of the Global CA further specifies that the proponent is required to "publish mine employment opportunities in Cree communities, regionally and elsewhere."

Going beyond the conditions specified in the Global CA, Stornoway opted to extend certain aspects of the monitoring program to the communities of Chibougamau and Chapais, and by extension to all James Bay residents, in compliance with the desires expressed by the two communities that signed the July 2012 Partnership Declaration.

The objectives of monitoring recruitment, job types and numbers are as follows:

- Document the dissemination of information about mine employment opportunities to Cree communities, both regionally and elsewhere;
- During the construction, operation and closure phases, document the job category and changes in jobs created by the Renard diamond project for the Crees of Mistissini (including the M-11 trapline family members), on the one hand, and Crees from other communities on the other hand;
- During the construction, operation and closure phases, document the type (job category) and changes in jobs created by the Renard diamond project for residents of Chibougamau and Chapais, on the one hand, and for all James Bay residents on the other hand;
- During the operation phase, document the advancement of Cree workers within the company;
- Document the participation of Crees, and more specifically the M-11 trapline family members, in the various environmental monitoring activities;
- Validate the employment objectives achieved among the Cree in construction (short term) and operations (long term) as adopted by the Renard Committee under the Mecheshoo Agreement;
- Document the effectiveness of recruitment and training measures applied by the company and its Cree partners;
- Identify the determining factors for the results achieved (successes and failures) as well as any remedial measures.

Dissemination of Monitoring Results

Under the Mecheshoo Agreement, relevant documents are filed and submitted to the Renard project Training and Employment Committee, as well as the Renard Liaison Committee formed under the Partnership Declaration signed with Chibougamau and Chapais.

In compliance with the instructions to the proponent in Condition 5.3 of the Global CA (MDDEFP, 2012), the recruitment results, job types and numbers will also be distributed to interested project stakeholders.

Finally, Cree and non-Cree regional and local organizations whose objectives are to promote local, regional and provincial employment through training will also be informed of these results.

8.2.2 Recruitment and Information Sessions

- In 2019, Stornoway organized or participated in a number of regional job information and recruitment sessions as noted below:
- March 19, 2019 – Career Fair – Cree Elementary School in Ouje-Bougoumou;
- April 12, 2019 – Visit to ore processing facilities run by the Minopro-Cree Resources Inc. (a leasing and training company) in Chibougamau;
- April 26, 2019 – SWY participated in interviews to select winners of the Excel scholarship – Graduates from the La Porte-du-Nord High School in Chibougamau;
- May 7, 2019 – Excel awards ceremony in Chibougamau;
- June 3, 2019 – Open House – Environment and training in Mistissini;
- June 4, 2019 – Open House – Environment and training in Chibougamau;
- September 25, 2019 – Launch of ''Learning Management System'' at the Renard mine;
- September 25 and 26, 2019 – *Apatisiiwin* Career Fair in Mistissini;
- September 26, 2019 – Implementation of a procedure with the Apatisiiwin to submit Cree applications electronically to SWY site in Mistissini;
- October 30, 2019 – Presentation at COMEX – Achievements in 2019 and 2020 objectives for committees under the Mecheshoo Agreement and the Partnership Declaration in Longueuil;
- November 5, 2019 – Presentation by SWY at Mistissini's Voyageur Memorial High School;
- November 21, 2019 – Meeting with the Apatisiiwin – Cree employee integration program in Mistissini;
- November 27, 2019 – Participated in Cree business discussion session in Val-D'Or.

These recruiting and information events raised the Renard mine's visibility and helped promote job opportunities at the mine site (Figure 8.1)

Even though recruitment remains a real challenge among Cree candidates, setting up a job application procedure at the Apatisiiwin office in Mistissini facilitated the process.

The ongoing support the Apatisiiwin provided Cree candidates in Mistissini, i.e., helping candidates fill out the job application and ensuring they had the required documentation, was definitely instrumental in boosting the number of applications.

Photo 8.1 Career Fair – Ouje-Bougoumou, March 2019

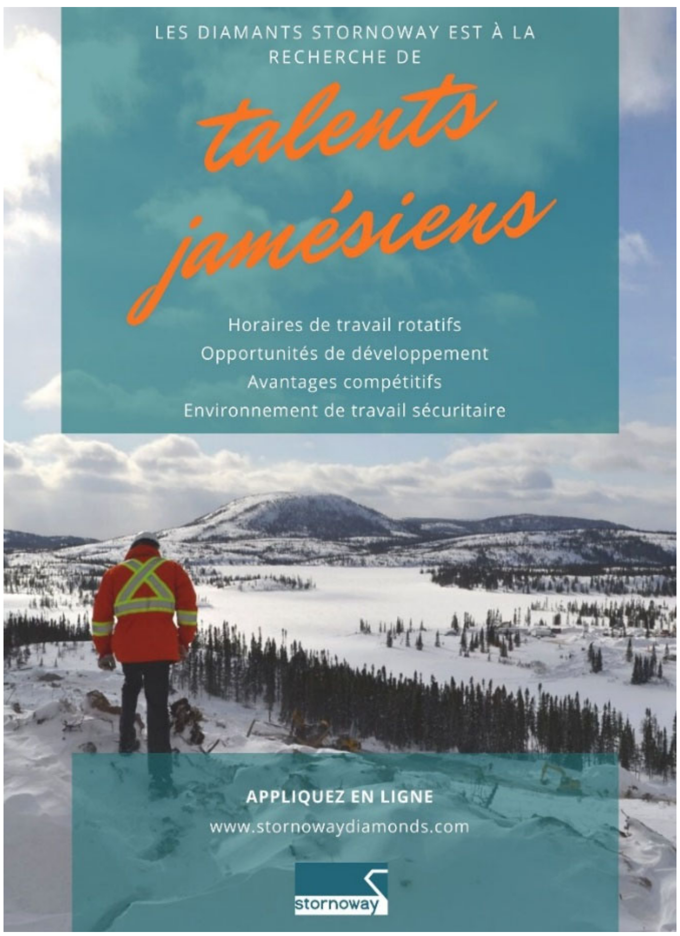


Figure 8.1 Advertising poster for regional recruiting in 2019

The involvement of the integration and diversity coordinator both at the mine site and within the Mistissini community, as well as the involvement of the organizational development and community relations director in Mistissini, Chibougamau and Chapais communities also helped facilitate recruiting.

8.2.3 Recruiting Details

Career Day – Cree Elementary School in Ouje-Bougoumou

This Career Day was held on March 19, 2019, in the Cree community of Ouje-Bougoumou (Photo 8.2). The event was organized by the Cree School Board and the Council of the Cree Nation of Ouje-Bougoumou to inform young students of future career opportunities in the mines (Figure 8.2). It is generally agreed that career counselling needs to begin in primary school.

Photo 8.2 Career Fair – Elementary School in Ouje-Bougoumou, March 2019

As indicated on page 45 of the Québec Education Program for Preschool and Elementary Education (2001), "*In elementary school, students become more aware of their tastes, interests and strengths, and also become familiar with various aspects of the education system and the world of work. They imagine projects and make the choices required to carry them out. They learn about occupations, businesses and trades in their community. This activity helps them perceive the connections between their interests and aptitudes, school subjects and occupations.*"

Figure 8.2 Advertising poster for Career Day in Ouje-Bougoumou, March 2019

Career Days in Mistissini

The *Apatisiiwin Skills Development* event was held on September 25 and 26, 2019. The event was designed as a forum to exchange information among educational institutions (i.e., universities and colleges), Cree and non-Cree businesses, the Cree School Board, the Cree Health Board and the Cree Nation of Eeyou Istchee.

Visitors had the opportunity to take in presentations and discussions with the exhibitors on education, jobs and contracts (Photo 8.3).

Photo 8.3 Career Day – Apatisiiwin, Mistissini, September 2019

Open Houses in Mistissini and Chibougamau

On June 3 and 4, 2019, residents of Mistissini and Chibougamau and Chapais had the opportunity to learn more about Stornoway's various functions and activities as regards the environment and training (Photo 8.4; Figure 8.3).

Photo 8.4 Open House – Mistissini, June 2019

Figure 8.3 2019 Open House poster - Chibougamau

Chibougamau-Chapais Excel Foundation Scholarship

Stornoway is involved every year in the award of the Chibougamau-Chapais Excel Foundation scholarship (Photo 8.5). A student qualifies for this scholarship under the following conditions :

- Completed Secondary V at La Porte-du-Nord High School in Chibougamau;
- Excelled academically;
- Achieved a passing grade in every subject in the last three years of secondary school;
- Excelled socially;
- Been involved the community;
- Shown an aptitude to continue their studies;
- Be a resident of Chibougamau or Chapais.

Photo 8.5 Excel Foundation scholarship awards ceremony – Chibougamau, May 2019

In 2019, Stornoway was involved in selecting the winners as well as being part of the Excel scholarship awards ceremony. On November 5, 2019, Stornoway's integration and diversity coordinator delivered a presentation on the company to secondary students in Mistissini and answered their questions.

Moreover, on November 7, 2019, following a meeting with Curtis Bosum, the president of Minopro-Cree, the integration and diversity coordinator obtained a list of employees who were originally trained by Miopro-Cree and had been laid off by a mining company operating on Eeyou Istchee James Bay territory.

In addition, Stornoway's presence at various conferences such as Québec Mine, Xplor2019 and PDAC as well as in other Eeyou Istchee James Bay communities, such as, Lebel-sur-Quévillon, is yet another element that helps attract regional talent.

At a Career Day held in Lebel-sur-Quévillon on November 19 and 20, 2019 (Photo 8.6).

Photo 8.6 Career days – Lebel sur Quévillon, November 2019

Stornoway was able to hire seven employees from the James Bay region in various underground mining, supply chain and processing plant trades. Such events facilitate recruiting not only in our host communities of Mistissini, Chibougamau and Chapais but also in other James Bay communities.

Stornoway also uses local print and radio media to advertise our job postings and extend our reach to the largest number of potential candidates.

Various job search sites and social media such as Facebook and LinkedIn are preferred methods for disseminating employment opportunities (Figures 8.5 and 8.6).

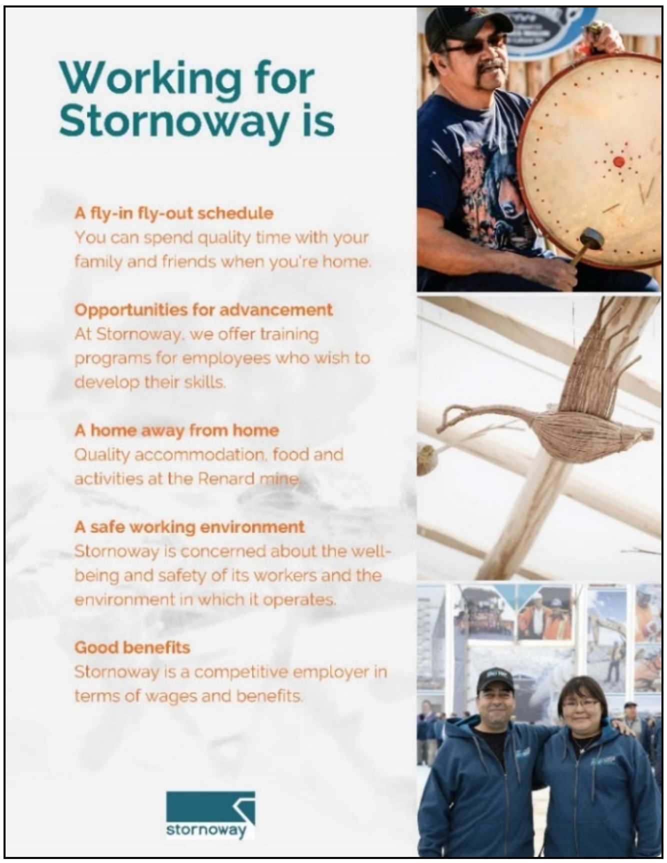


Figure 8.4 Promotional material for Stornoway

Furthermore, Stornoway informs all its partners, including Apatisiiwin, Emploi-Québec, the Comité sectoriel de main-d'œuvre de l'industrie des mines (CSMO Mines), the various committees associated with agreements as well as its own employees, about employment opportunities and events organized to hire regional talent.

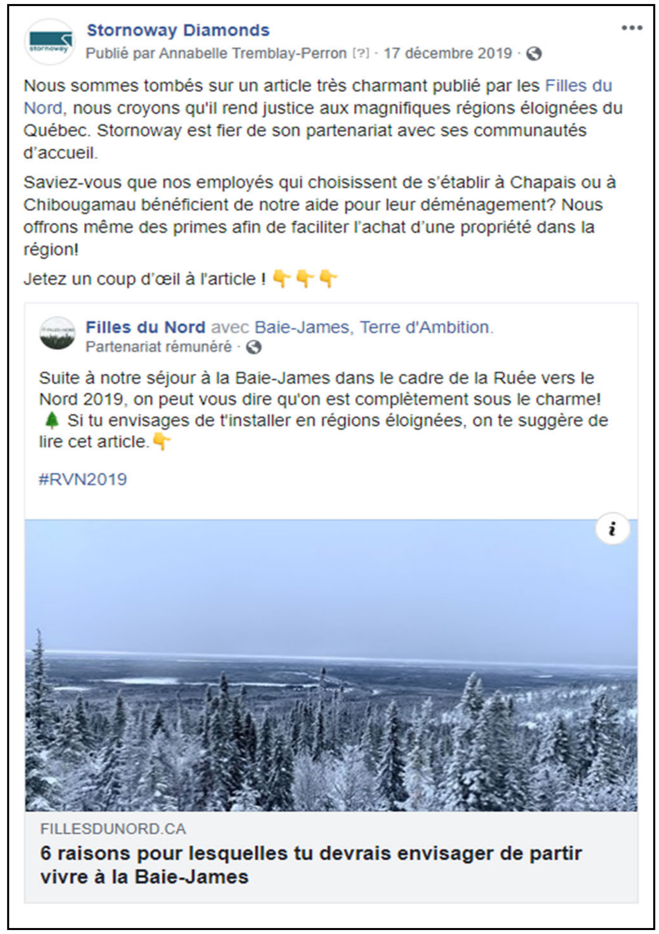


Figure 8.5 Advertising shared on social media – *Northward Bound,* December 2019

Figure 8.6 Promotional material

Stornoway's Values

Stornoway follows best hiring practices and is well aware that the onboarding step is essential to new employees understanding their role and effectiveness in the organization.

Onboarding also represents an opportunity to describe working conditions, employee benefits, procedures and rules set out in the Human Resources Management Manual. One of the five values underlying Stornoway's operations is teamwork.

> ***"Confidence is the invisible cement that binds a team together."***
>
> Bud Wilkinson – American football player, trainer, broadcaster and politician

At Stornoway, our people are our strength. Stornoway strives to be an exemplary employer, one who :

- Sustains equitable, fluid relationships;
- Establishes and facilitates stakeholder committees;
- Provides a working environment that is conducive to integrating cultural minorities;
- Communicates proactively and transparently;
- Promotes and develops skills and competencies;
- Listens to the needs of its workforce with a view to improving labour relations;
- Equips itself with analytical tools that are used to incorporate agreements into the decision process;
- Instills its managers with Stornoway values and agreements so that in their daily tasks they become vectors of Stornoway's philosophy.

Stornoway focuses on recruiting the most talented people in the industry, people with the greatest potential. The company is also committed to hiring and developing residents from the Cree, Chapais and Chibougamau communities.

Our focus is on developing talent on the job through in-house coaching by experienced employees and a rotation through similar positions. This approach forges a sense of belonging to the various groups, develops a sense of duty and solidarity, and motivates employees. Employees come to fully understand quality and performance requirements, inherent constraints, and company rules, values and culture, and learn a new language. Immersion in the work environment helps develop self-reliance and an awareness of one's responsibilities within the team in achieving the sector's objectives.

The company is proud that our stakeholders consider Stornoway to be engaged and fully invested in regional development. Our efforts in this regard are evident in day-to-day operations and are pivotal to our management approach.

Recruiting Results

Recruiting in 2019 greatly contributed to hiring success. Although a number of workers left the company in 2019, between January 1 and December 31, 2018, Stornoway brought 237 new employees on board, increasing the total number of employees to 538, including the Chibougamau, Mistissini and Longueuil offices (Table 8.1).

As of December 31, 2019, of the 538 employees who made up Stornoway's total active workforce in 2019, 502 worked at the Renard mine (Figure 8.7). And about 19% of employees were from Chibougamau and Chapais. About 59 additional employees (12 %) are from Cree communities, primarily Mistissini. These workers are divided among various trades (Figure 8.8).There are also 50 employees who work as kitchen or janitorial staff and are employed by our supplier *Kiskinchiish Camp Services.*

Stornoway's Total Workforce

Stornoway is operating Quebec's first diamond mine with support from its host communities: Mistissini, Chibougamau and Chapais. For this reason, regional hiring is a priority for us. In addition to the employees from our host communities, we have workers from throughout Québec, primarily from Abitibi-Témiscamingue, Saguenay-Lac-Saint-Jean, other Quebec communities, Montreal and Quebec City.

Owing to the drop in diamond prices, 2019 was a year spent on restructuring our mining methods and procedures. Our annual workforce plan was as a result revised downward in May (Figure 8.9).

To enhance the effectiveness and coherence of community engagement and regional sustainable development activities, Stornoway draws inspiration from the following principles:

- Build trust in relationships by communicating clearly, openly and honestly with our host communities, governments, partners and other stakeholders;
- Understand, promote and defend basic human rights in our actions, while respecting traditional rights and cultural heritage;

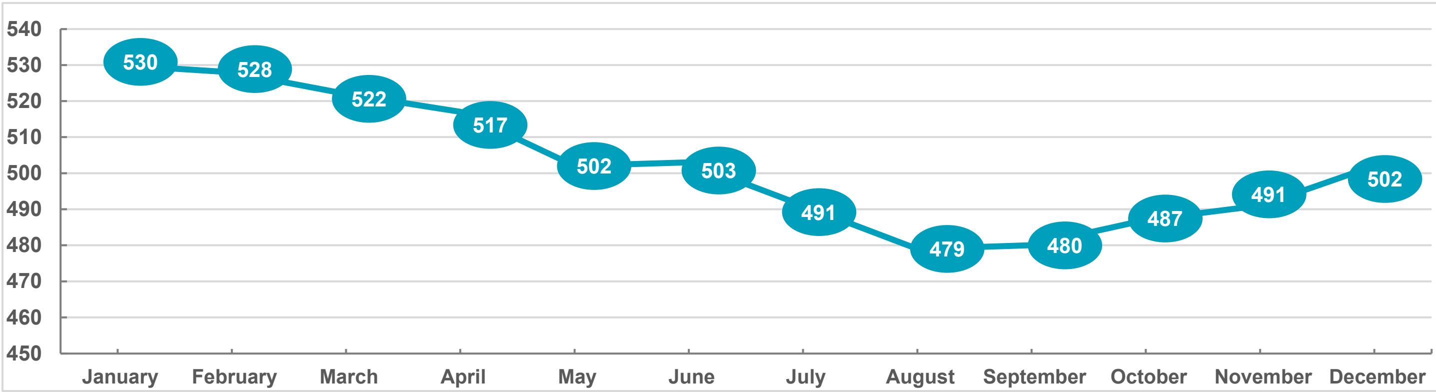


Figure 8.7 Deployment of Renard mine workforce from January to December 2019

Table 8.1 Breakdown of active workforce as at December 31, 2019 (°C)

Active Workforce as at December 31, 2019	*Number of Employees*	*Cree (%)*	*Chibougamau/Chapais (%)*
Development team – Head office and regional office			
Operations	36	0 (0%)	1 (3%)
Projects and development	0	0 (0%)	0 (0%)
TOTAL	***36***	***0 (0%)***	***1 (3%)***
Renard Mine			
Operations	501	59 (12%)	97 (19%)
Projects and development	1	0 (0%)	0 (0%)
TOTAL	***538***	***59 (11%)***	***98 (18%)***

Department	Total Employees
Supply Chain	
Warehouse clerk Cl4	1
Sust Development	
Water Treatment Technician	1
Finance Management	
Diamond Sorter	1
Mine	
Production Blaster UG Cl.1	1
Production Driller UGCl1	2
Junior Geologist	1
UG Labourer Cl3	2
Ground Service Labourer Cl3	2
Mobile Equipment Mechanic Cl1	1
Mobile Equipment Mechanic Cl3	1
Scoop Operator Cl1	1
Truck Driver Cl3	2
Boom Truck Operator Cl4	1
Surface Truck Operator Cl3	1
Loader 988 Operator Cl1	1
Compactor Operator Cl2	2
Grader Operator Cl4	1
Grader Operator Cl2	1
Backhoe Operator Cl4	1
Surface Truck Operator Cl4	1

Department	Total Employees
AD60T Truck Operator Cl2	2
AD60T Truck Operator Cl3	7
AD606T Truck Operator Cl4	7
Concrete Operator Cl4	1
Crawler Tractor Operator Cl2	2
Crawler Tractor Operator Cl4	1
Support to the Development Cl3	1
Support to the Production Cl3	1
Asset Protection	
Asset Protection Officer Cl2	1
Site Access Coordinator	1
Human Ressources	
Integration & Diversity Officer	1
Process Plant	
Administrative Assistant	1
Process Apprentice Cl4	3
Primary Crusher Operator Cl1	1
Primary Crusher Operator Cl3	2
LDR, Air & Circulation Operator Cl2	1
Recovery Operator Cl1	1
General Total	**59**

Figure 8.8 Positions held by our 59 Cree employees as at December 31, 2019

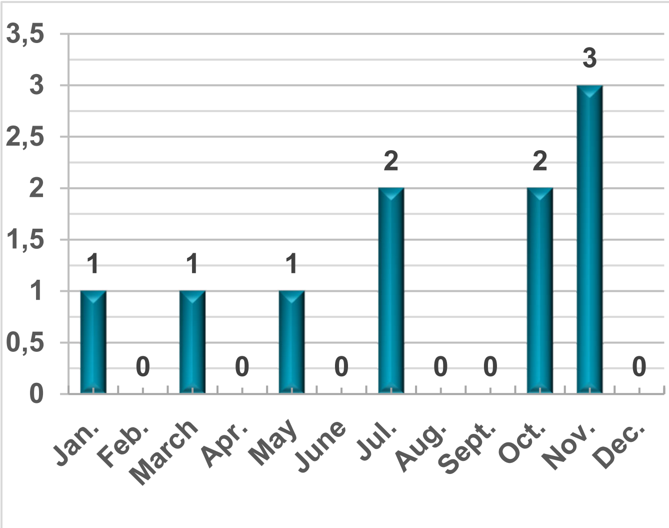


Figure 8.9 Number of Cree new hires in 2019

- Monitor the emergence of new issues with the help of the monitoring committees and deal with issues as needed and as amicably as possible;
- Monitor social and economic impacts in order to possess the necessary information to track successful, transparent integration;
- Endeavour to minimize our operations' undesirable social and economic impacts on communities.

Consequently, Stornoway took the host communities' concerns into consideration when structuring the Renard mine's operations. In 2017, the Cree apprentice integration program was introduced at the ore processing plant to support workforce development.

This program has generated positive results and in 2019 it was extended to other Renard mine departments, including the underground mine, mechanical, electrical and building maintenance, the environment department, and the power plant.

In fact, this integration program has a number of benefits for both employees and Stornoway, in that it:

- Promotes mixing of employees from different cultures and origins to encourage integration;
- Offers advancement opportunities to young, inexperienced candidates;
- Tracks the hours worked on each type of equipment to make it easier for the employee to have prior learning recognized by the Ministry of Education;
- Standardizes work methods and improves equipment availability;
- Helps supervisors with employee relations;
- Cultivates versatility and a workforce that can replace absentees, thereby reducing costs.

Cultural diversity is an integral part of Stornoway's corporate identity. Stornoway in fact has many employees from around the world. We have skilled people from over 30 countries in Europe, Africa, Asia, Latin America and Canada. Multiculturalism is an asset we need to cultivate as a source of communication, innovation and creativity.

Figure 8.10 shows the origin of employees working at the Renard mine site as at December 31, 2019. The operations workforce includes 97 residents from the municipalities of Chapais and Chibougamau, along with another 11 employees from other Northern Quebec communities (Figure 8.11). A total of 151 employees come from the Eeyou Istchee James Bay region (Figures 8.12 and 8.13).

Figure 8.10 Place of origin of Stornoway employees

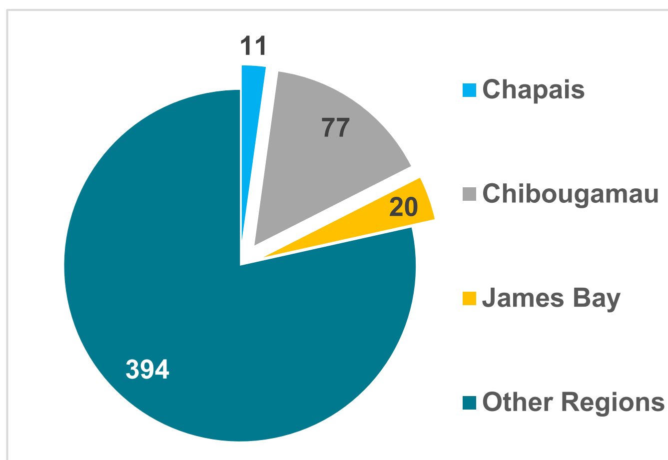
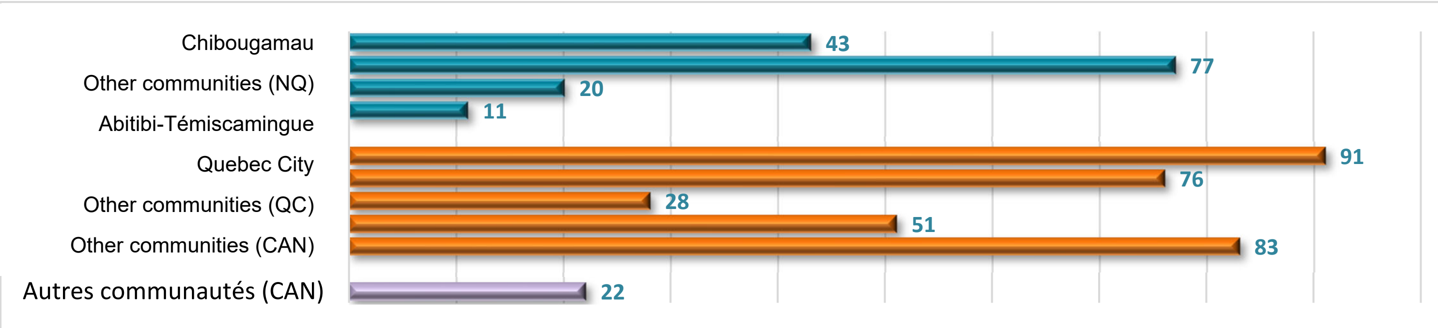


Figure 8.11 Regional breakdown of Renard mine workforce (n=502) by place of origin, excluding Cree personnel



30% Northern Quebec – 65% other Quebec regions – 4% other provinces

Figure 8.12 Regional breakdown of workforce at the Renard mine (n=502) as at December 31, 2019

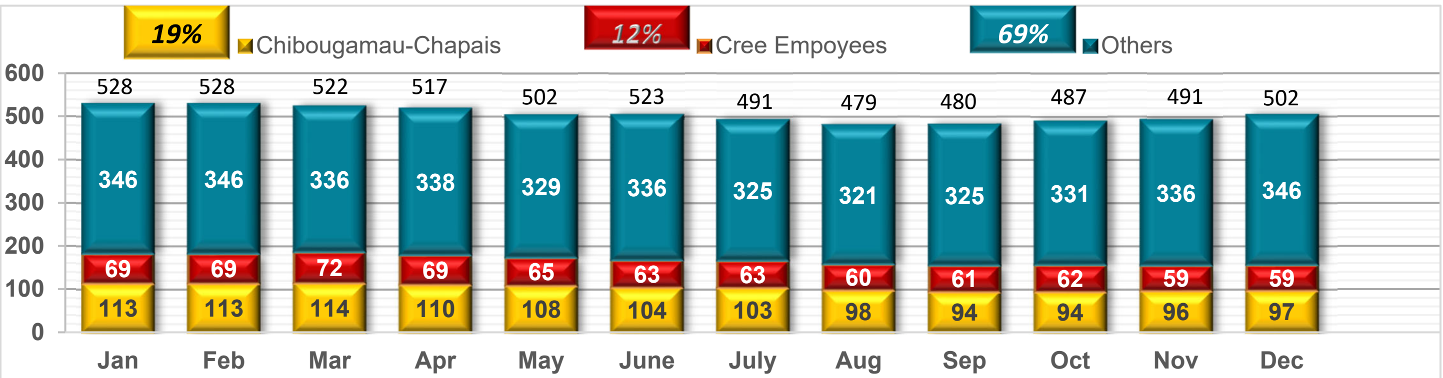


Figure 8.13 Regional breakdown of Renard mine employees by month in 2019

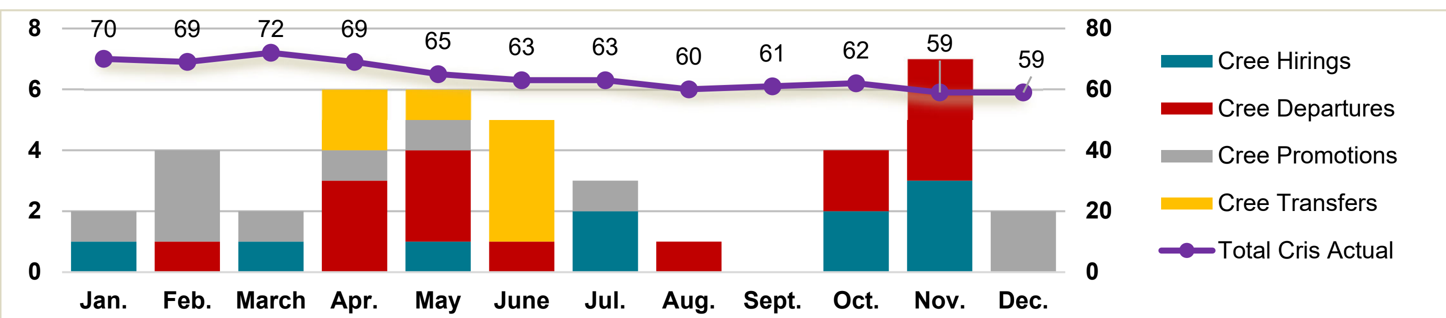


Figure 8.14 Monthly history of Cree employment dynamics in 2019

Building a Strong Team to Maintain Growth

The Renard mine has been in operation for over three years. At the end of 2019, Stornoway had 502 employees working in many types of jobs in order to meet growth objectives.

Although the region has always been a mining area, it experienced a significant decline when almost all of the mines closed, with the resulting exodus of talent to places with better job security.

This meant that new mines in the area had to reconsider their hiring requirements and count on a regional workforce that often-had little experience in complex underground operations. This required modern, up-to-date training programs with teams of trainers and experienced instructors.

Development and Advancement Program

Stornoway's human resources strategic planning focuses on permanent improvement of its workforce and on skills development. Employees gain expertise, become more productive, and can envisage a career path within the company. The development and advancement program, introduced in 2016, was fully deployed in 2017.

Owing to its success, Stornoway has adapted the program for all of its operations and employees. In 2018-2019, this program enabled the smooth transfer of a number of Cree workers from the open pit to the underground mine. The underground mine enabled employees from the open pit and other areas to test their skills by choosing to work in underground operations. All the transfers were supported by the training team.

> ***"A person is made up of their past, present and future. None of these times is more important than the others and shouldn't be."***
>
> Marie-Thérèse, Cree School Board employee

Employee Training

Stornoway has also built a team of experienced trainers who have laid sound groundwork for workforce development and state-of-the-art training in all aspects of health and safety, in line with Stornoway's values. A total of 22,901 hours was devoted to professional development of Renard employees and 50% of that on health and safety.

As a result of the training, many employees were promoted to coveted jobs, a feeling of belonging was cultivated, and inexperienced Cree workers were integrated into experienced teams. And through employee development, Stornoway has been able to generate many other benefits: a feeling of belonging took hold immediately and employees had the opportunity not only to learn about a new culture and language, but also to acquire new skills and competencies.

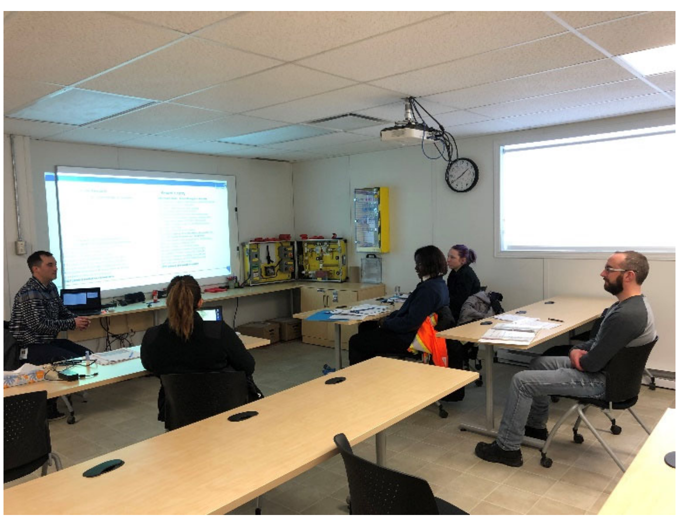


Photo 8.7 Group of new hires attending onboarding session

In all, 56 promotions and transfers were granted in every sector of the mine to Cree workers and employees from Chibougamau and Chapais. A total of 124 promotions and transfers were awarded at the Renard mine in 2019.

Note that 45% of the promotions and transfers involved 31% of the workforce, which is the portion represented by Cree employees (12%) and workers from Chibougamau and Chapais (19%).

> ***"Success is not the key to happiness. Happiness is the key to success. If you love what you are doing, you will be successful."***
>
> Albert Schweitzer

Figure 8.15 shows that 17 promotions and transfers were awarded to Cree personnel in various operations departments.

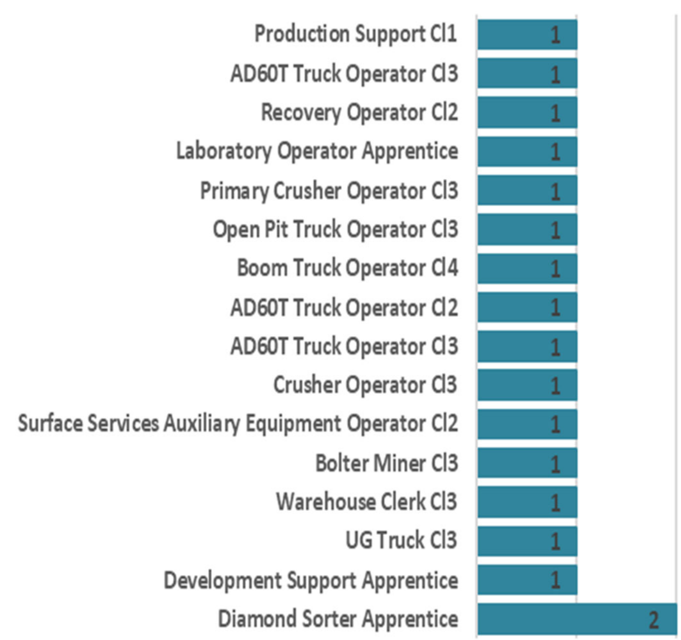


Figure 8.15 List of functions associated with promotions and transfers (17) involving Cree personnel in 2019

Note that, under the development and advancement program, every employee who moves to a higher position must first receive a certificate from the training department following a general evaluation involving the supervisor, superintendent of the department concerned and/or the sector manager, as well as the training coordinator and the trainer (Photo 8.8).

This certificate confirms that the employee has successfully completed all the required courses in the program relevant to the job and, if needed, can occupy the certified position and receive the wage for the hours worked in that function. This internal development helps workers continue to grow on the job.

Cree employees received 3,133 hours of training, 70% of which involved internal development (Figure 8.16). Personnel from Chibougamau and Chapais) received 5,787 hours of training, of which 61% was devoted to their development (Figure 8.17) and resulted in 39 promotions and transfers (Figure 8.18).

The promotions in and transfers to the underground mine for Cree and James Bay personnel bears witness to the success of our employee training program.

Photo 8.8 Jeremiah Longchap (center) receives his miner's certification, flanked by Sébastien Marcotte, Captain (left) and René Mercier, Senior Underground Trainer (left)

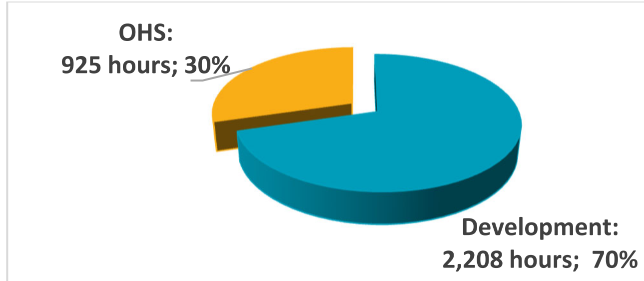


Figure 8.16 Internal development and training for Cree personnel at Renard mine (3,133 hours)

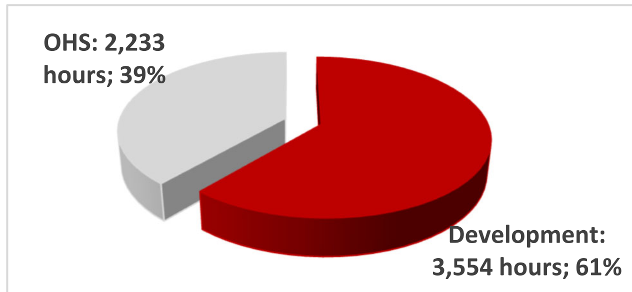


Figure 8.17 Internal development for personnel from Chapais and Chibougamau (5,787 hours)

A number of professional development tools were deployed, including apprenticeship booklets for each trade, e-learning for various health and safety related elements, and the award of attestations and certifications upon successful completion of exams or reviews by an evaluation committee (Photo 8.9). These tools together provided a constructive and rewarding learning experience.

Photo 8.9 Diplomas in hand, Johnny Jolly (center left), Underground Instructor, and Nikamoon Mitchell (center right) Apprentice Miner

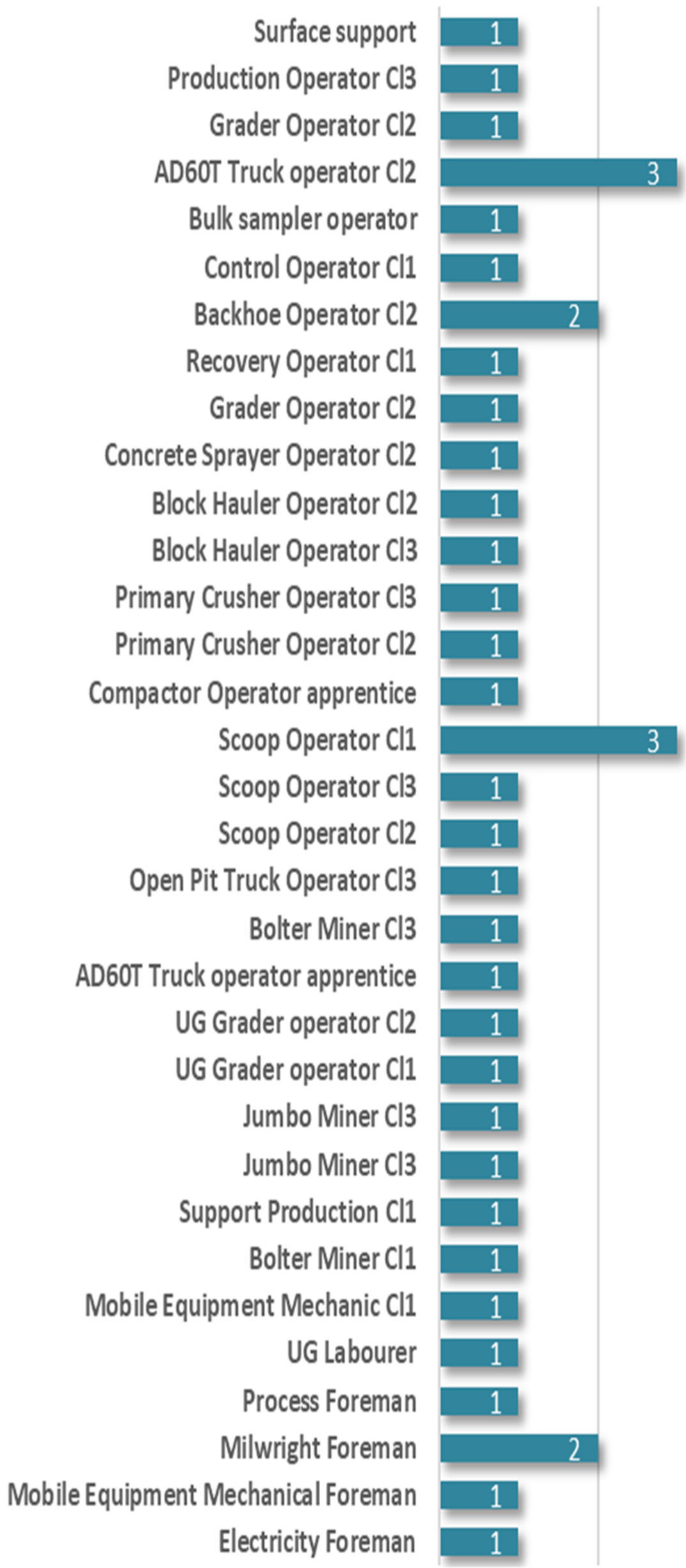


Figure 8.18 Promotions and transfers (39) involving James Bay personnel in 2019

Relocation Policy

In 2017, Stornoway set up and promoted its relocation policy (Figure 8.19). The policy provides employees who relocate to Chapais or Chibougamau with financial benefits. Moving expenses up to a total of $10,000 are reimbursed and a bonus amounting to 15% of the employee's base salary is paid to the employee. The objective is to attract new residents to the region and retain the mine's workforce, which is generally more easily accomplished if people live locally. The policy addresses the need to build the population in Stornoway's host communities Chapais and Chibougamau, in addition to maintaining a stable workforce for Stornoway.

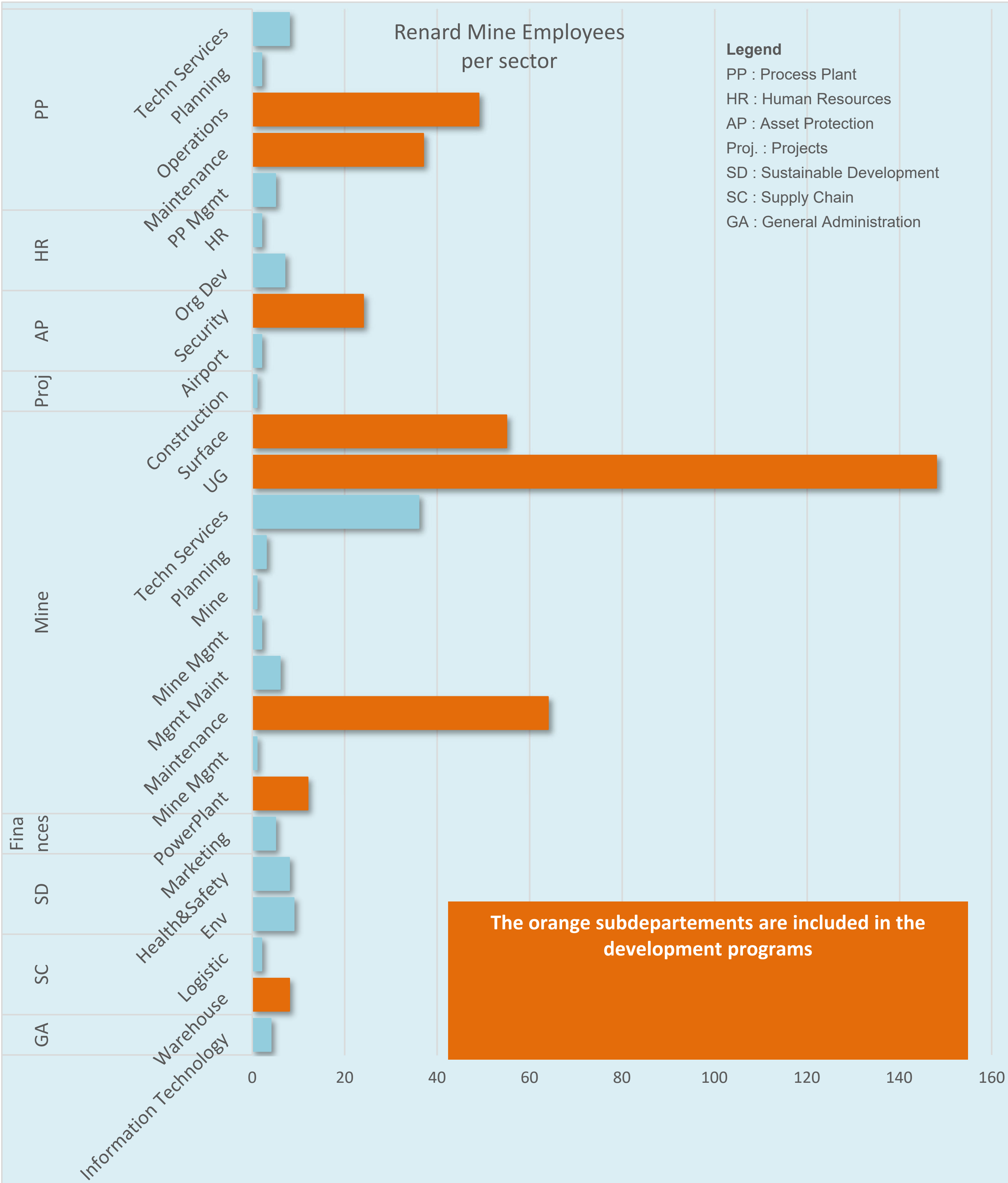


Figure 8.19 Number of employees by sector involved in internal development programs in 2019

Figure 8.20 Poster featuring Chapais and Chibougamau relocation program

8.3 Agreements

8.3.1 Provisions of the Mecheshoo Agreement and the Partnership Declaration

To monitor the implementation of the Impacts and Benefits Agreement (IBA) or the Mecheshoo Agreement, and the Partnership Declaration, four committees were formed when the agreements were signed:

- The Renard Liaison Committee, which manages the agreement overall (including municipal representatives from Chapais and Chibougamau, and Stornoway representatives);
- The Renard Committee (including employees from the Cree government, the Mistissini Cree Nation, and Stornoway), which oversee two sub-committees :
  - the Training and Employment Committee, which focuses on maximizing Cree employment opportunities;
  - the Environment Committee, which oversees environmental issues.

These committees track the implementation of agreements that address social and environmental impacts, economic spinoffs tied to employment and company development, to the environmental protection and to biodiversity.

The Partnership Declaration for its part includes a monitoring committee that manages all employment and contract issues and the mayors of Chibougamau and Chapais sit on this committee.

The various monitoring committees meet at least once quarterly to discuss the issues specific to the respective committees and go over regional benefits generated by the Renard mine, along with issues and concerns expressed by regional stakeholders (Table 8.2).

Table 8.2 Meetings of Renard mine monitoring committees held in 2019

Renard Project Committee	2019
Renard Committee (Mistissini & GCC (EI))	5
Training and Employment Committee (Mistissini & GCC (EI))	4
Environment Committee (Mistissini & GCC (EI))	7
Renard Liaison Committee (Chibougamau & Chapais)	4

In 2019, members of the Environment Committee (Mecheshoo Agreement) met on various occasions for training sessions, specifically with regard to the environmental monitoring program, the design of the modified processed kimberlite containment (MPKC) facility and the development of mine site restoration plans, which included a visit to restored mine sites in Abitibi-Temiscamingue (Photo 8.10).

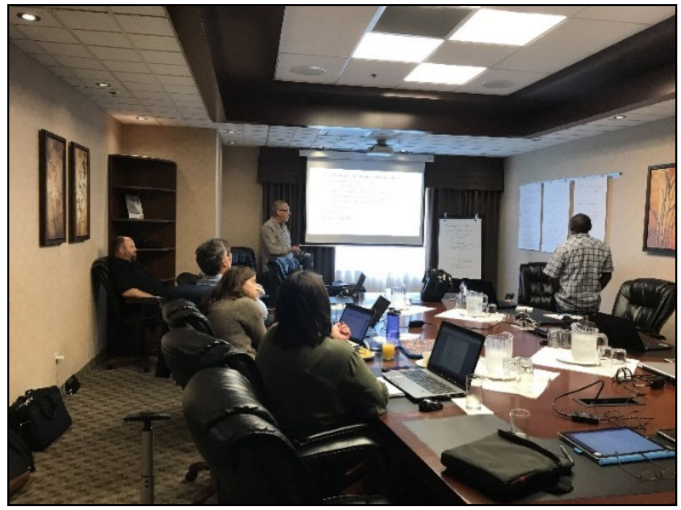


Photo 8.10 Training on developing mine site restoration plans

8.3.2 Monitoring Committee Achievements

In 2019, Stornoway undertook a number of community-related actions, including:

- Exercise to strengthen commitment to implementing the agreement as a joint responsibility;
- Approval of Training and Employment Committee's request to increase percentage of Cree employees from 12% (in January 2018) to 20% within three years;
- Approval of fund management rules (business development fund, training fund, and social and cultural fund);
- Approval of three new Mistissini projects with funding from the Business Development Fund;
- In response to requests from the committees, the Cree Nation of Mistissini now delivers the FMTM modular training program for mine workers in the Mistissini community;
- A $1.5 million grant awarded to Stornoway by Apatisiiwin Skills Development (which is part of the Renard Committee) in 2019 to assist Stornoway in training Cree apprentices in every department;
- Continuation of the Cree Skills and Employment Partnership program;

- Efforts made to influence the creation of mining industry training within the Cree School Board and the Minopro Group, thereby promoting mining jobs within Cree communities;
- Efforts made to promote the agreements within the host communities;
- Efforts made to attract and retain families in Chapais and Chibougamau developed;
- Annual meetings organized to discuss future contract requirements that will enable regional business to compete.

8.3.3 Committees for Implementing and Monitoring Agreements

The committees are instrumental in ensuring Stornoway's host communities and employees become familiar with the agreements, building the basis for collaboration, setting up enhancement, integration and development programs, and in ensuring the social environment and Stornoway employees benefit from the success.

Photo 8.11 Peggie Petawabano and Philip Percey, *Apatisiiwin Skills Development* employees in Mistissini

Photo 8.12 Stornway Environment Department's meeting with the Council of the Cree Nation of Mistissini in 2019

8.4 Cree Worker Integration

8.4.1 Scope of Monitoring

Experience on other projects in the James Bay territory (e.g., the Troïlus mine [Inmet], Eastmain-1-A and Sarcelle power plants and Rupert diversion [Hydro-Québec]) drew attention to the challenges associated with integrating Indigenous workers in the working environment. Indigenous workers face a number of adjustments in terms of language, mentoring, work scheduling and cultural habits that can lead to difficulties adapting. Also, Chibougamau-Chapais (which have been mining towns from the outset) were faced with the exodus of talent during the downturn in the mining sector from 2006 to 2015 and had to rely mostly on the forestry industry while they waited for the mining industry to recover.

The smooth integration of workers in the work environment is vital in that it has a significant impact on their health status. To accomplish this, the Mecheshoo Agreement sets out a number of integration and retention measures for Cree personnel at the mine. The objective is to ensure Cree employees continue working for the company for as long as possible, and that they enjoy the same benefits of advancement as other workers. In addition to measures associated with working conditions, the recommended measures take into consideration cultural specifics and the maintenance of family ties.

Condition 5.1 of the Global CA specifies that the proponent is required to "monitor the integration of Cree workers and how they are adapting to the work schedule."

8.4.1.1 Adapting to work schedule

It was clear in 2019 as it was in 2018 that our workforce, including the Cree workforce, appreciated the 14 on/14 off rotation. Furthermore, Stornoway is fully aware of the importance of employees having time off during the holiday season, and every year it adjusts the 14 on/14off work schedule to 7 days on/ 7 days off during that time. Employees all appreciate this schedule because they'll be off for at least one of the holidays. Also, employees with more than one year of service are entitled to 160 or 168 hours of vacation depending on their schedule and can take some of this vacation time during the holiday period.

Since the Cree are all strongly attached to their ancestral culture, we needed to set up schedules that would allow them to continue practising traditional activities, such as berry picking, foraging, fishing, hunting, trapping, canoeing, pow-wows, hiking and so forth. These activities enable families to connect with the past and the traditional way of life. They require work schedules that provide flexibility and a balance between working life and the traditional way of life.

Although most of our Cree employees appreciate the staggered working hours, some parents with young children find it difficult to achieve a work/life balance and end up quitting after a few weeks. Compared to previous years, however, the situation does seem to have greatly improved. This improvement we expect is due to the fact that Stornoway is becoming increasingly well known within the communities, as well as to our partners' involvement in raising local people's awareness of how the company operates and the various mitigation measures in place.

8.4.1.2 Cree worker integration

As required, in response to Question QC-12 from COMEX, it was decided that "under the monitoring program, the integration of Cree workers would be monitored in early 2017, in compliance with the provisions of the social monitoring program (ENVS-3.1.3). The proponent will be required to indicate whether semi-directed interviews had in fact been carried out as planned. If so, the proponent is required to provide a summary of the interview methodology and results. If not, the proponent must explain why the interviews had not happened, and then reschedule them."

During the construction phase, the project was delayed, and commercial production and mine start-up had to be postponed until January 2017. A majority of the Cree-integration-related management programs were therefore launched in 2017 and 2018. These programs have evolved with ongoing monitoring and analyses and have been revised as needed.

Based on our past experience in multicultural environments, we have learned that semi-directed exit interviews are the ideal way of obtaining a true picture of job satisfaction from employees, along with their suggestions for improving the way we manage diversity in a multicultural setting (tables 8.3 to 8.5). In addition, online exit interviews provide employees who are leaving an opportunity to provide their comments.

Table 8.3 Choice of reasons for leaving - interview

Exit Interview Questionnaire (Reasons)
Work-life balance
Lack of career advancement
Work environment
Employee benefits
Excessive workload
Salary conditions
Conflicts with co-workers
Company culture
Work hours
Lack of management leadership
Promotion opportunities offered by new company
Responsibilities/tasks not aligned with my skills
Career transition
Returning to school
Retirement
Offer of annual vacation

Table 8.4 Questions pertaining to reasons for leaving

Other Questions
What will your role be in the new organization?
What could Stornoway have done to retain you?
What areas could Stornoway improve upon?
What positive aspects will you retain regarding your time at Stornoway?
Do you have any suggestions for improving less positive points?
Would you agree to return to work at Stornoway?
Would you recommend Stornoway to a friend?

Table 8.5 Selection of proposed answers

Selection of Answers
Employee onboarding and integration
Employee benefits
Workload
Clear role and responsibilities
Internal communications
Work-life balance
Equipment – tools required for the job
Pay equity
Continuing education
Performance management
Career advancement opportunities
Recognition of my skills
Work relationships and environment
Compensation
Support from my supervisor

In 2019, 15 Cree employees left the company, ten left voluntarily and five involuntarily. Nine of the voluntary departures involved a new job primarily in Mistissini so as to achieve a better work-life balance, and the tenth person left to return to school.

According to the interviews, the Cree employees appreciated career opportunities available to them, ongoing training, the onboarding program and the integration systems and work schedules. One employee indicated that compensation was an area Stornoway could improve upon.

Stornoway believes that employee retention is closely tied to successful integration, and that is especially true for Cree workers. Various programs have been set up and have achieved considerable success. From the outset, it has been clear that our efforts combined with the support of our partners have been instrumental in achieving the expected outcomes: ***Integrating employees is key to retention!*** A number of steps were taken in 2018 and 2019, including*:*

- Re-evaluating hiring criteria and improving development programs;
- Encouraging internal promotions by linking them to the professional development system;
- Developing partnerships with Cree organizations to mentor new employees;
- Setting up internal programs to learn more about the culture;
- Organizing sports activities to encourage well-being among employees;
- Organizing information sessions on health-related issues;
- Reviewing exit interviews for information that could help the company improve human resources and intercultural relations practices, and hence enhance employee retention.

8.4.1.3 Language of communication

We needed to address language-related issues. Although a clear language policy was in place, applying it in the work environment, especially the underground mine, proved difficult, which led to an exhaustive review of how the policy was applied.

We worked on ensuring that a number of Cree employees were part of all production teams and set up English language courses for supervisors who needed to improve their English language skills. And there were some Cree employees who enrolled in French language classes.

In 2019, we set up external e-learning programs based on the participants' availability. In addition, the diversity of the work teams meant there were more opportunities to learn the two working languages used at the Renard mine.

8.4.1.4 Cree skills and employment development partnership

In 2018, at the request of our Cree personnel, Stornoway set up a program in partnership with Apatisiiwin Skills Development to facilitate effective integration of Cree employees in their new working environment. The program to promote skills development and employability launched in 2018 also continued in 2019. The objective of this three-year program is to retain Cree workers by having a job coach on hand to provide support daily. Cree Human Resources Development (CHRD) announced in 2019 that it would be changing its name to Apatisiiwin Skills Development (ASD) as of April 1.

ASD coach Philip Piercey works in partnership with Stornoway's human resources department taking on various roles with a view to increasing retention rates, including :

- Working with new employees, as well as employees who are having trouble performing their work or who are at risk of being terminated;
- Helping workers improve the process of preparing for work, such as arriving on time to catch a flight, understanding zero-tolerance policies and developing communication skills;
- Assisting supervisors with training and integrating Cree workers, especially helping them develop effective communication skills and increasing their understanding of key aspects of Cree culture such as family responsibilities;
- Developing individual training plans in collaboration with our training and development team for each Cree employee based on their skills and training opportunities.

8.4.1.5 Cree culture awareness program

As we all know, the Cree have a long history in Eeyou Istchee (James Bay and Northern Quebec) territories. They are a dynamic and diversified people whose population is growing quickly. The Cree are proud of their culture and most of them are keenly aware of their ancestral origins. For the Cree, preserving their cultural identity is essential, and has become a major, visible part of the Quebec landscape.

The Cree cultural awareness program "*The road ahead*…" (Figure 8.21) depicts real life as experienced by the Cree, who currently represent 12% of Stornoway's workforce. The program delves into the Cree's historical and contemporary characteristics, and encourages an openness toward cultural differences, and a positive updated vision of the Cree universe of yesterday and today.

It implicitly combats prejudices and nurtures a more critical approach to prevailing ideas about the Cree people while fostering closer ties among the various cultures.

The program looks at the history of the Cree in addition to:

- The Indian Act;
- Values and beliefs;
- Rites and ceremonies;
- Teachings;
- Gestures and language;
- Regional political and administrative structures;
- The Mecheshoo Impact and Benefits Agreement (IBA) negotiations;
- Contents of the agreement;
- Thoughts on enhancing understanding of the Cree culture.

The program launched in 2018 provides managers with pointers on integrating Cree employees into the team. It was completely revised by the organizational development team to ensure it fit in with daily realities and it takes into consideration the needs expressed by employees and supervisors with regard to the inclusion of cultural minorities.

From the outset, about 40% of the workforce has taken part in the program and we intend to deliver the program to everyone in 2020. To ensure all new employees are trained, this program will be accessible via videoconferencing as well as on a video. Sessions are offered to all employees including new hires.

8.4.1.6 Promote integration and management of cultural differences

It is a known fact that the first step in integrating and managing cultural differences is to deconstruct prejudices and stereotypes.

In addition, since managers are the standard-bearers of a company's mission and values, it is clear that we need to train our supervisors on the art of integrating and managing cultural differences within their groups.

Stornoway therefore ensures:

- Minority groups are represented on teams;
- The soundness of its employment systems, including policies, decision processes and the practices that impact every aspect of people's careers in the company;
- The development of a culture that values integration: behaviours including communication, informal social relationships, decision-making practices, standards, and so forth.

Stornoway has had a positive influence over its managers by:

- Putting integration-oriented logistics in place;
- Strengthening policies and procedures aligned with its integration values;
- Using training, which is at the heart of integration;
- Applying management and supervisory systems that focus on individual behaviours;
- Focussing on group strengths because groups influence individual behaviours at every level of the organization;
- Strengthening managers' buy-in for our values because that's what shapes our corporate culture;
- Prioritizing mixed teams to forge bonds among the various cultural groups;
- Conducting exit interviews to learn what can be done to improve employee integration, development and retention.

Onboarding Program

The onboarding program was reviewed in 2018 to mobilize new employees and help them develop a sense of belonging to Stornoway (Figure 8.22). A mechanism was put in place to transmit essential information to new hires.

In this regard, one of the tasks of HR'S Community Relations Division is to work with the Renard mine's development team on integrating employees.

The Community Relations team is actively involved in recruiting, works on helping Cree workers understand the workings of the mine, interfaces with the tallymen, and informs employees about the Mecheshoo Agreement. It has become clear that a structured onboarding and integration approach impacts length of employment, employee involvement and their level of engagement with company values.

Figure 8.21 Cree culture awarenss program

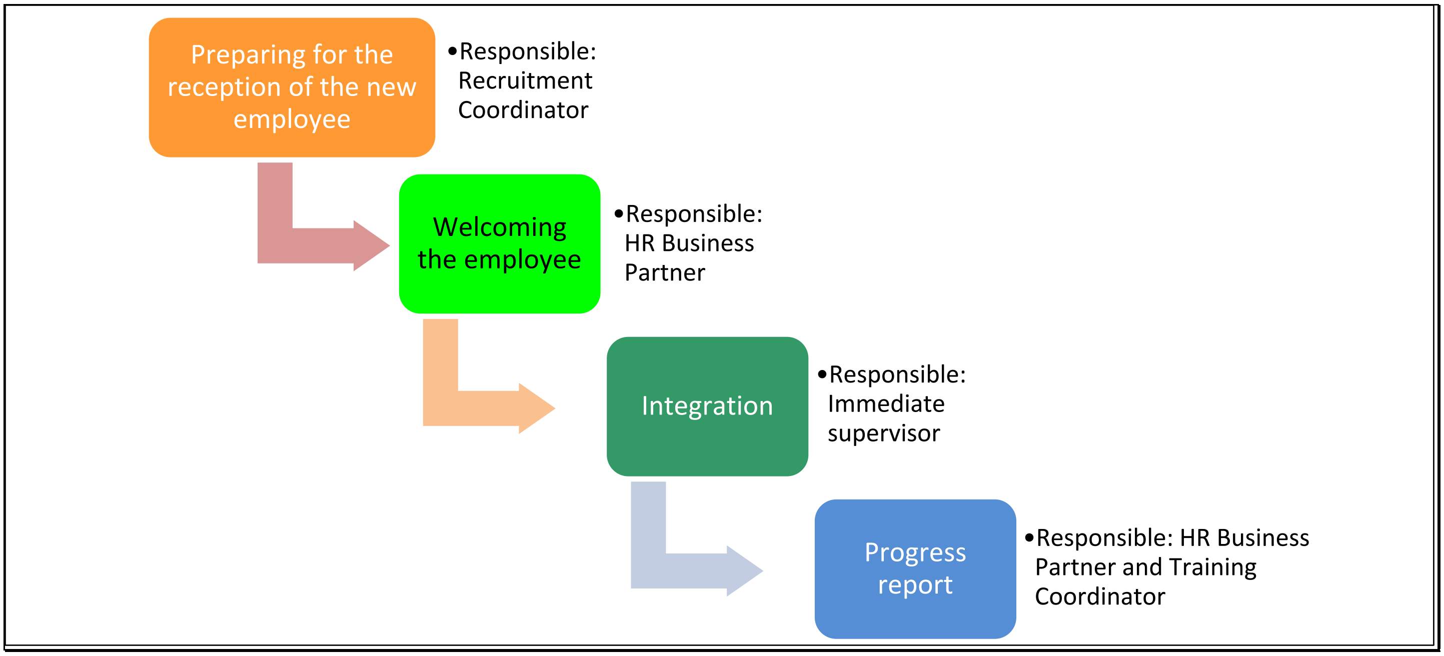


Figure 8.22 Basics with regard to the Renard mine's onboarding program for new hires

We have observed that the more structured the onboarding process, the faster the new employee whether Cree or non-Cree reaches a satisfactory level of performance. Rodney Petawabano has held the position of Integration and Diversity Coordinator since October 2018 (Photo 8.13), and Diane Marois, Director, oversees organizational development and host community relations (Photo 8.14).

The Integration and Diversity Coordinator works closely with the main managers at the mine and oversees integration and integration project monitoring efforts including mentoring programs.

He monitors mentoring, apprenticeship booklets, development activities and special diversity-related projects. He ensures inclusion strategies are aligned with company responsibilities while providing advice, guidelines and support for managers with a view to developing a better understanding of Cree culture.

He is also called upon to deliver general presentations to employees to promote best practices, and in collaboration with managers, develop initiatives to encourage employee training and advancement.

The role of the officer is to evaluate minority representation in the organization and create a plan to increase the number of employees in these groups. He works with all employees but especially with minorities in the organization so as to address any concerns they may have.

The Host Community Relations Sector within Human Resources is also involved in exit interviews so as to gather information that would help improve the management of community and intercultural relations.

Photo 8.13 Rodney Petawabano – Integration and Diversity Coordinator

Photo 8.14 Diane Marois – Director, Organizational Development and Host Community Relations

Development Program

To build a culture that promotes integration and diversity, Stornoway has sought inspiration in the history of the Northern Quebec region and drawn on lessons learned by diverse mining companies in the area, including the Troïlus mine, a mine that is a prime example of a successful integration of Cree workers and has served as an inspiration for Stornoway.

The Northern Quebec economy is primarily driven by natural resources including mining, forestry and hydroelectricity, the basis of economic activity in the region. The Crees and Jamesians share the territory and have been able to combine modern technologies and ancestral practices, making the region a unique place to live.

Over the years, the mines in the region have faced workforce recruiting and retention hurdles along with recurring fluctuations in metal prices, which naturally trigger rationalization of personnel.

The mining industry has had to deploy a number of tools and incentives along with integration and development systems for the acquisition, development and retention of their employees. Decades later these issues remain.

Considering this, Stornoway has established structures to promote a culture of integration and diversity through a continuous education or mentoring system that:

- Provides experienced people opportunities to become instructors;
- Puts employees from different cultures and age groups into contact (multicultural and multigenerational);
- Offers young inexperienced people opportunities for advancement;
- Engenders unparalleled pride in both experienced personnel and young employees in belonging to a group and working in close proximity;
- Solidifies common values;
- Credits hours worked on each piece of equipment or in each function toward the Ministry of Education's "prior learning assessment."

Applied on a daily basis this strategy helps:

- Integrate cultural communities with life at a remote mine camp;
- Train employees on a number of specific mining trades;
- Develop greater flexibility among instructors, trainers and their student-employees;
- Apply innovative teaching methods adapted to our environment that help develop desire for learning, life skills and a forward-looking approach.

This strategy prepares and thoroughly trains the workforce both academically and practically to work in a mining context. It also aims to attract a multicultural and diversified clientele. It innovates by twinning education and mining industry requirements.

> ***"It's not sufficient to reap the benefits of knowledge and expertise or harvest the fruit of people skills and transferable skills, we also need to share our knowledge and skills so that we all grow together!"***
>
> Jacques Salomé, Psychologist, Scientist and Sociologist

Multi-Disciplinary Integration

The hierarchy of skills (soft skills, hard skills, and transferrable skills) help ensure operational effectiveness and sustainability. Stornoway and the Training and Employment Committee are extremely proud to partner with organizations that train young people to take on tomorrow's trades in the region. Supporting education is a cherished value for the Stornoway team.

Starting from the principle that on-the-job training is an investment that benefits both the employee and the company, Stornoway has established and maintained a learning-and development-oriented culture. As of March 2015, Stornoway has gradually built up an ongoing training system offering continuous improvements.

The system promotes efficient, continuous and sustainable growth of the workforce. And the training team is proud of the results achieved to date.

To obtain an accurate picture of employee needs, exit interviews were initiated when production began, and the process was reviewed in 2019 in an effort to make the interviews more flexible and better adapted to the context.

It was also determined that the success of efforts to integrate our Cree personnel is enhanced when employees serve as instructors. Based on past experience and comments made during exit interviews, the community relations team and trainers in partnership with managers of the major departments at the mine have worked on training Cree employees for instructor positions.

Stornoway has put in place a management culture that promotes complementarity among communities, by taking different profiles and cultures into consideration.

It has also sought to ensure sound advancement for all employees through a development program that enables employees to choose the training they'd like on the basis of their profile, their past experience, their career aspirations, available opportunities and their personal objectives within Stornoway. Exit interviews have in fact shown that employees want the opportunity to learn new functions and achieve their career goals within Stornoway

Indeed, it would appear that employees all have common goals: they seek to keep on growing and sharing what they've learned, be part of the decision process and be kept in the loop. It should be noted that since the launch of production in 2017, we have observed that promoting Cree employees to key positions has eased the integration of many others into underground training programs and to joining the team of miners!

This strategy has resulted in free-flowing communication between Cree and non-Cree employees, promoted retention through the twinning of cultures and generations, and has helped employees cope better with the new aspects of their work environment, optimize their performance, promote synergy among coworkers, and achieve or exceed expected productivity levels.

Overall, in 2019, our Cree personnel earned 17 promotions and transfers, and two of them assumed responsibility for being underground instructors. Stornoway instructors assume an essential responsibility. They enable Cree employees in training to learn better because the Cree instructor explains aspects of the trade in greater depth in the Cree language. They make it easier too for non-Cree employees in training to fit in with the blended team. Stornoway is therefore proud to confirm that there were 17 promotions and transfers awarded to Eeyou Istchee James Bay personnel in 2019 through these improvements.

Dissemination of Monitoring Results

In compliance with the instructions relayed to the proponent under condition 5.3 of the Global CA (MDDEFP, 2012), the results of the monitoring of Cree workers are distributed to project stakeholders.

Under the Mecheshoo Agreement, relevant documents are filed and submitted to the Training and Employment Committee. Local and regional Cree organizations, whose objective is to promote local (Mistissini) and regional (Eeyou Istchee) employment, are also kept informed of developments.

8.4.1.7 Funding provided by Stornoway and the Cree to support training and projects implemented through the Mistissini/Renard Joint Training and Employment Fund

One of the features of the Mecheshoo Agreement is a joint fund for Cree workforce training. The objective of the fund is to establish a qualified workforce that meets Stornoway's and the mining industry's expectations.

Funding of the Cree Workforce Inclusion Plan was arranged as a first step under an agreement by Stornoway and the Council of the Cree Nation of Mistissini to each invest $200,000/year for three years, a joint investment of $1.2 million.

Following this joint commitment, members of the Cree Training and Employment Committee pursued efforts to obtain additional funding from various institutions. Several millions of dollars were therefore collected to support training associated with future job opportunities at the Renard mine, as well as in the industry in general. This approach illustrates the Crees' commitment to ensure the success of the Renard project and their strong desire to integrate a qualified workforce that meets the needs of the mining industry.

In addition, through various regional programs offered by *Apatisiiwin Skills Development*, Stornoway was awarded $4.7 million in 2017, 2018 and 2019. To promote the hiring of Cree apprentices, the funds were re-invested in their development via the continuous development system. As a result, about 100 Cree employees who were hired and retained have been able to pursue their careers and in a number of cases move up to the positions to which they aspired.

Stornoway and Cree members of the Training and Employment Committee set up the Cree Workforce Inclusion Plan in 2014. Under this plan, Stornoway and the Council of the Cree Nation of Mistissini jointly committed to funding (up to a maximum of $200,000 each) efforts by *Apatisiiwin Skills Development* and the *Cree School Board* (CSB) in support of Cree training.

Students from the three groups on the different training programs offered under this Plan were largely from the Mistissini community. They were primarily young adults who had completed Secondary 3 (the minimum requirement).

The committee's collaborative spirit led to the creation and implementation of the Cree Workforce Inclusion Plan. In this regard, the committee clearly continues to live up to its commitments under the Mecheshoo Agreement.

8.4.1.8 Recreational, social, cultural and sports programs

In winter 2019, workers at the Renard mine were able to enjoy hockey, one of their favourite wintertime activities. In 2017, a permanent rink was in fact setup in the mega dome so that employees could play ice hockey in winter and deck hockey in summer. Hockey is immensely popular among the Cree as well as many employees at the mine, and it's an activity that brings workers together.

Included among the many other social and sports events organized in 2019 were:

- Christmas party (for each shift);
- National Aboriginal Day;
- Sugaring-off meal;
- Breast cancer fund raiser;
- Participation of the Minoune snowmobile team in Festival Folifrets in Chibougamau;
- Sports events broadcast on large screen in the TV common room;
- Presentation of Renard mine diamonds to employees;
- Summer evening featuring traditional music;
- St-Jean Baptiste Day celebrations;
- Canada Day celebrations;
- Participation in Stornoway's fitness center points to increased interest in getting fit.

Use of Cree Cultural Center

In the Mecheshoo Agreement, Stornoway committed to building and maintaining a cultural center on site where employees could store and prepare their traditional foods for personal use as well as traditional activities.

The Roderick Swallow Cree Cultural Center (known as the "long house" among employees) was built in the fall 2015 and now serves as a gathering place for sharing cultural activities and celebrations (Photo 8.15). A winter and summer walking trail on the periphery of the mine site was created in 2017, with the trail head at the Cree Cultural Center, which has increased the visibility of the Center.

Employees of *Kiskinchiish Camp Services*, most of whom are of Cree origin, are the most frequent users of the Cultural Center. They organize traditional meals, particularly on weekends, in the *Long House*. Every year, the Center hosts National Aboriginal Day activities (Photo 8.16).

French and English Language Courses

One definite way of achieving a friendly multi-cultural working environment is to offer French and English language courses.

It is well known that poor communication is a source of stress, tension, even conflict. To ensure employees can communicate easily, French and English language courses are offered. These phone training sessions are offered on an ongoing basis to interested employees.

In 2019, a total of 103 courses (in both English and French) were delivered to nine employees from different operations departments at the Renard mine. To improve the program and increase enrollment among our employees, it will be revised in 2020.

Transportation System

Cree employees are happy with the transportation system in place. They are flown from the Chibougamau airport to the Renard mine and at the end of their rotation they are flown back to the Chibougamau airport. Flights to and from Chibougamau operate three times a week on Mondays, Tuesdays and Thursdays.

Photo 8.15 Cree Cultural Center at the Renard mine

Elections and Polling Stations

Under the Mecheshoo Agreement, Stornoway committed to accommodating polling stations at the mine site so that Cree employees could vote during local and regional Cree elections and referendums. This measure is possible provided that Stornoway is given sufficient advance notice and that the voting does not interfere with the mine's normal operations. The elections need to take place in compliance with Stornoway's Renard mine visitor's policy.

Telephone Communications and Internet Access

Under the Mecheshoo Agreement, Stornoway took steps to ensure that phone calls from the mine site to the Mistissini community were local calls.

Photo 8.16 Dinner at the Cree Cultural Center

Phones are available in every room in the accommodation complex and outgoing long-distance calls are free of charge for users. High-speed internet access is also available free of charge throughout the accommodation complex. Most workers use the internet to communicate with their family and friends on various platforms. Whenever the internet is temporarily down, it becomes abundantly clear the extent to which the service is used and appreciated by all the workers.

Finally, for security reasons, internet access is not available on the mine site outside the accommodation complex.

Bereavement and Other Types of Leave

In the Mecheshoo Agreement, Stornoway committed to establishing policies and provisions under which bereavement leave would be granted to employees in the event of the death of an immediate family member. In the case of Stornoway's Cree employees, immediate family by definition includes family members from traditional adoptions.

Bereavement leave therefore also applies in the case of the death of a member of the extended family, if the person is considered to be a parent or child, who was adopted traditionally, as defined in Stornoway's policy.

This policy is generally applied on a case-by-case basis and Stornoway's understanding of bereavement for family members adopted under the traditional system seems to be working well and is greatly appreciated.

Quick Response to Emergency Situations

In the event of a death or tragic situation, employees go home to their family on the first flight out. If the death or situation occurs on a Wednesday, Friday, Saturday or Sunday, the employee will be driven by road to Chibougamau.

Employee Manual, an Essential Tool for All Employees

The employee manual, which has been continuously updated since it was first released in 2015, covers Stornoway's profile, values and mission, working conditions, internal policies and procedures, along with related procedures.

In addition to applicable Quebec laws and regulations, it incorporates commitments made under the Mecheshoo Agreement and Stornoway's Chapais and Chibougamau Partnership Declaration to ensure there is consistent understanding and respect for these commitments by everyone in their day-to-day activities.

The manual was revised in 2019 in line with amendments made to the Act respecting Labour Standards (CNESST) (Figure 8.23 ; *only available in french*).

The following came into effect as of January 1, 2019 :

- Days of paid absence;
- Right to refuse to work;
- Number of weeks of annual leave;
- Leave for a birth or adoption;
- Number of days leave for a death;
- Protection against psychological or sexual harassment in the workplace.

The following came into effect retroactively in 2019:

- Rights of the victims of domestic or sexual violence;
- The choice of taking holiday pay or compensatory leave;
- Staggering work hours;

The Employee Manual is available in paper or electronic format at any time from Human Resources. To ensure the Manual complies with labour standards, it is revised from time to time, and employees are all informed of any amendments to the Manual.

Figure 8.23 CNESST labour standards

8.4.2 Raising Awareness of Mining-related Jobs

8.4.2.1 Primary school presentations

Stornoway representatives delivered a presentation on the mining industry and Stornoway's operations to primary school students at the Ouje-Bougoumou elementary school in Mistissini (Photo 8.17).

The objective of the presentation was to pique their interest in a career in the mining industry, possibly at the Renard mine.

8.4.2.2 Excel Foundation scholarships

The Excel Foundation conducted a fund-raising campaign in 2019 to achieve the objectives set when it became a not-for-profit organization. Its goal is to promote excellence in education in the schools in Chapais and Chibougamau by awarding annual scholarships to young people who are pursuing post-secondary education. The Foundation has in fact awarded some 160 scholarships over 32 years (Photo 8.18). Stornoway has been a proud Excel Foundation partner for seven years.

Photo 8.17 Conference room where the primary school presentations took place

Photo 8.18 Recipients of the Excel Scholarship 2019

8.4.2.3 Ongoing communication between the Chief of the Cree Nation of Mistissini and the Mayors of Chibougamau and Chapais

Communicating our progress is vital to improving and maintaining an open dialogue with our stakeholders. Along with the quarterly meetings held by the committees monitoring our agreements, a number of informal communication sessions have been held. In addition, monthly reports have been submitted to the committees as wall as municipal authorities, not to mention random presentations explaining issues and seeking advice and recommendations.

Through these means of communication, our partners obtain the latest statistical information in relation to acquisitions, development, talent retention, current contracts and our environmental performance.

Staying abreast of our partners needs helps us realign our security actions as needed.

In 2019, for example, a presentation on the diamond situation was delivered to employees, the Council of the Cree Nation and the Renard committee and the Renard liaison committee (Photo 8.19). In addition, the Training and Employment Committee's actions and results were presented to the Chief and Council of the Cree Nation.

In October 2019, a meeting was held with COMEX members to inform them of the achievements of the committees set up under the agreements (Figure 8.24). Other presentations were also made to the Chief and Council with regard to various environmental issues (Photo 8.20).

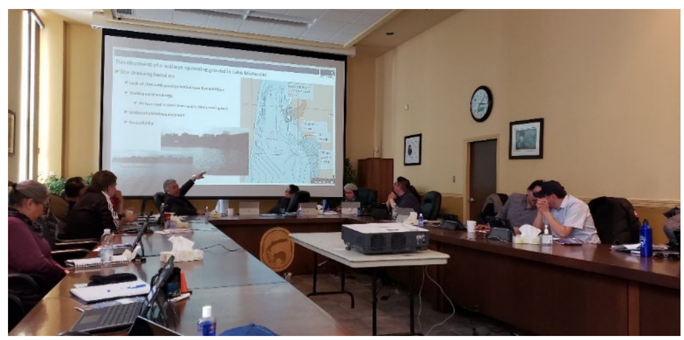


Photo 8.19 Presentation on the diamond market situation to the Chief and Concil of the Cree Nation

8.4.2.4 Long-term strategy

In addition to activities already under way, Stornoway is currently working on developing a long-term strategy aimed at getting young people of various ages interested in careers in the mining industry.

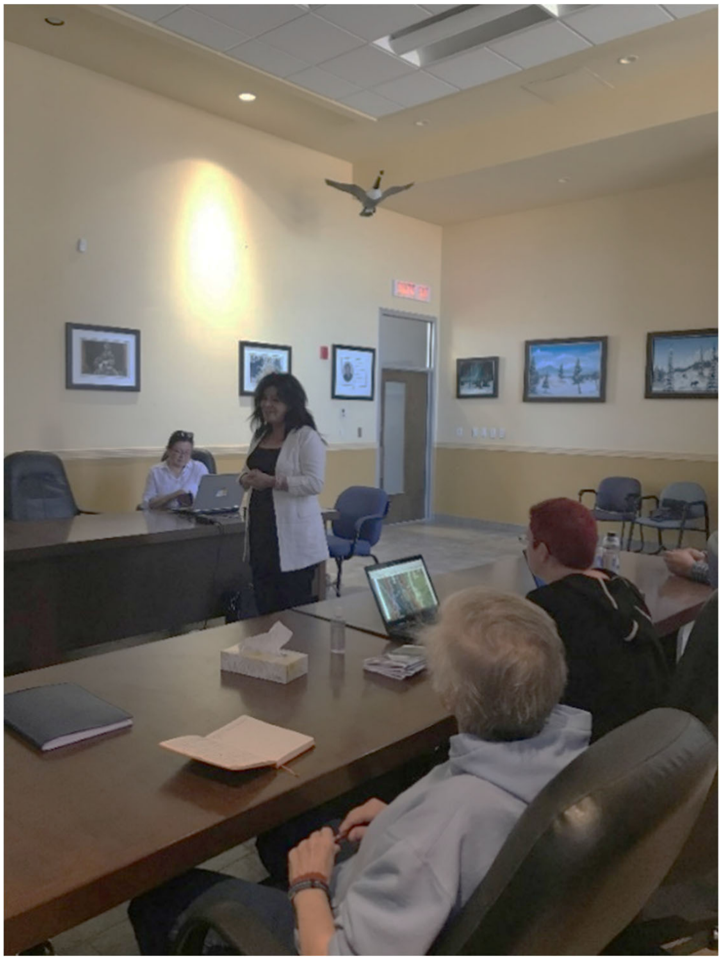


Photo 8.20 Presentation of committee achievements to the Chief, Council and guests of the Cree Nation,

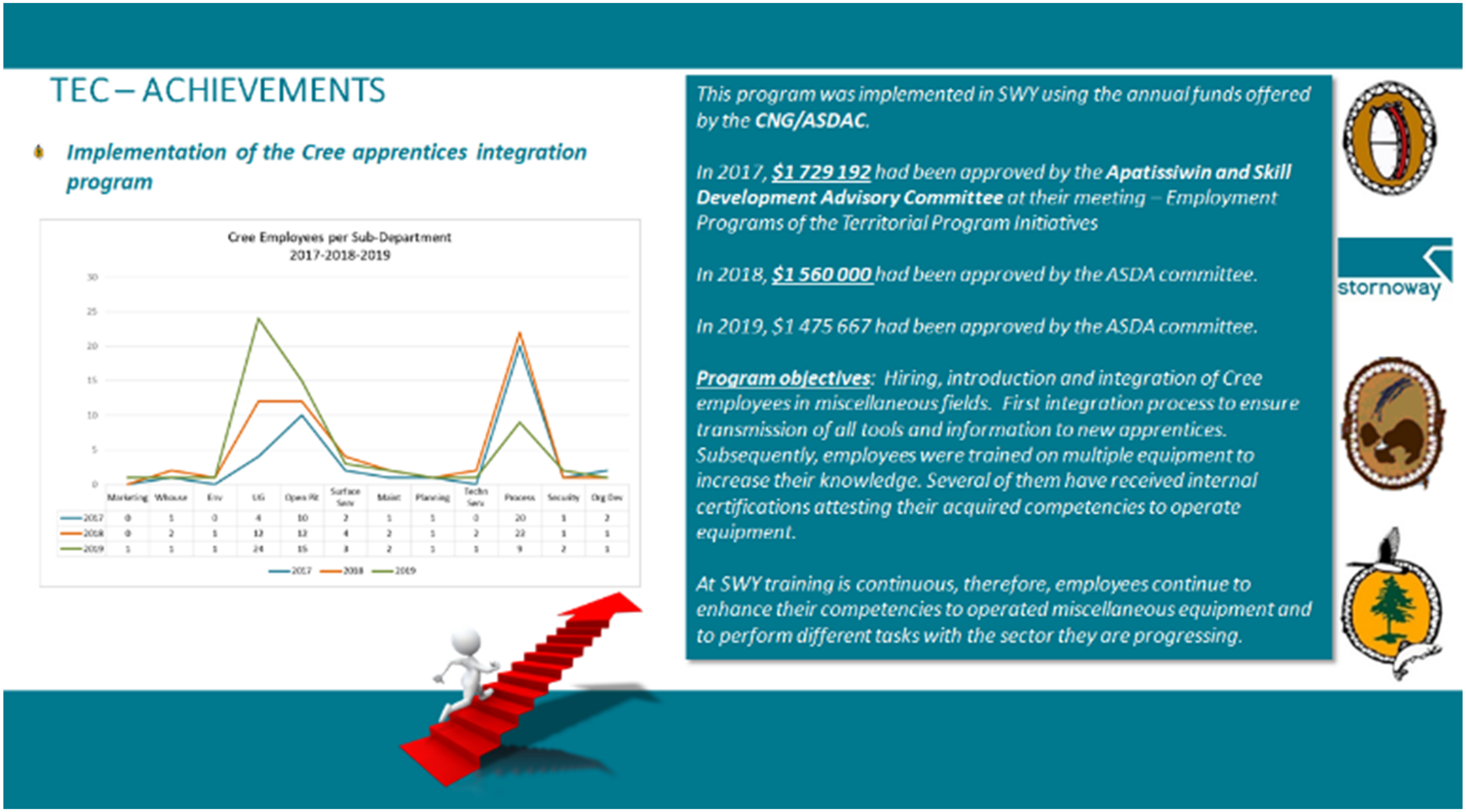


Figure 8.24 Presentation to COMEX on the committees' various achievements

8.5 Land Use by M-11 Trapline Users

8.5.1 Scope of Monitoring

Mine site preparation and development work had the effect of making part of the territory unavailable for natural resources harvesting by M-11 trapline users.

As indicated in the impact assessment, a number of activities had the potential of causing nuisances that would make some animals avoid the construction and mine site, while causing inconvenience for land users. Monitoring big game and land use was therefore undertaken. Cree land users needed to alter their hunting, fishing and trapping habits by avoiding the mine area given the 1 km safety perimeter established around the mine and airport facilities.

Finally, Stornoway also committed to staying in constant communication with the tallymen to avoid seriously obstructing their traditional activities and to making any necessary arrangements to compensate for any potential or actual disturbances. The mitigation measures in place primarily aim to reduce the negative impacts on M-11 trapline users' traditional activities.

Condition 5.1 of the Global CA specifies that the proponent is required to "monitor land use by M-11 trapline users" and "monitor conditions under which Cree use Lake Lagopede resources."

The objectives of monitoring land use are to:

- Update data collected before the construction and implementation of the Renard project (EBS and ESIA) regarding M-11 trapline users' hunting, fishing and trapping activities;
- Validate the impacts of construction work and mining activities on the hunting, fishing and trapping activities described in the ESIA;
- Apply indicators to document changes made by the project to facilities and activities tied to the use of M-11 trapline and Lake Lagopede;
- Identify the main reasons for any changes;
- Document discussions between the proponent and M-11 trapline users concerning mitigation measures, including those promoting the gradual re-use of the mine site by the Crees;
- Record users' assessment of the various mitigation and enhancement measures applied by Stornoway to enable them to practise their traditional activities;
- Gather information on users' perception of the impacts along with their concerns and comments regarding the project and mining operations.

Distribution of Monitoring Results

The results of monitoring land use by M-11 trapline users are presented to these trapline users at meetings of the Swallow family members. Information that can be distributed more widely will be identified at these meetings.

Under the Mecheshoo Agreement, relevant documents are filed and presented to the Environment Committee. Finally, in compliance with the instructions to the proponent in Condition 5.3 of the Global CA (December 4, 2012), some land use monitoring results for which consent has been granted by the M-11 trapline users may be distributed to other interested project stakeholders.

Meetings with Tallymen

Regular meetings (13) were held in 2019 with trapline M 11 tallymen and some of their family members. A total of about 12 formal meetings were held in addition to many phone calls throughout the year (photos 8.21 and 8.22).

A range of topics were discussed including:

- Updating SWY's environmental monitoring activities at the Renard mine;
- Discussions on big game management;
- Contract renewals;
- Fish habitat monitoring;
- Study of large mammals or big game;
- Wildlife and the Renard mine (helicopter visit)

Photo 8.21 Meeting between a tallyman and environmental consultants regarding big game monitoring

Photo 8.22 Information session with tallymen regarding fish habitat and big game monitoring

The objective of the meetings and calls is to keep the members of the Swallow family informed regarding progress on the work, fish habitat compensation projects (Photo 8.23; Figure 8.25) and Renard mine operations, in addition to answering their questions and discussing their concerns (Photo 8.24).

Most of these meetings were held at Stornoway's offices in Mistissini (Figure 8.25).

Photo 8.23 Presentation on fish habitat compensation program to Mistissini community

Photo 8.24 Swallow family tallymen – Discussion on fish habitat

8.5.2 Land Access

Route 167, which was built by people from the region, is a vital link for the delivery of goods such as concrete, steel, fuel, piping, materials, mining vehicles many other components that are indispensable to Renard mine operations.

The Route 167 extension built jointly by the MTQ (143 km) and Stornoway (97 km) has become a public road that everyone can use up to the mine gatehouse, the boundary of the area strictly controlled for safety reasons.

Other than the 1-km no-hunting zone around the mine and airport sites, members of the Swallow family can practise their traditional activities throughout the territory including along the road between the mine and the airport.

A Route 167 joint committee was set up by MTQ in 2014, a cooperative endeavour that made the highway safer and boosted emergency response on the road. To enhance awareness among stakeholders, Stornoway for its part, published notices regarding the safe use of the mine road in the media (Figure 8.26).

In the event of an incident, Stornoway immediately contacts local authorities to advise them of the situation so that they can convey the information to residents by way of radio broadcasts and social media. This process works well and helps prevent delays for land users.

Figure 8.25 Poster featuring fish habitat compensation program on display in the Mistissini community in 2019

IMAGE 2 FORMAT PDF Letter Landscape


stornoway
FISH HABITAT
COMPENSATION
PROGRAM 2019
WALLEYE SPAWNING
AREA DEVELOPMENT

Figure 8.26 Safety announcemnet

8.5.3 Comments, Perception of Impacts and Project-related Concerns

Stornoway has always taken care to keep Sydney and Emerson Swallow, the two M-11 trapline tallymen, informed and to be responsive to their concerns.

As set out in the Mecheshoo Agreement, Stornoway is working on encouraging the development of Cree businesses, particularly the firms run by the tallymen's families.

In this regard, Stornoway is proud to have the following companies involved at the Renard site:

- Kiskinchiish Camp Services (Sydney Swallow), which provides cafeteria and janitorial services;
- Swallow-Fournier (Emerson Swallow), which is actively involved in civil construction work (modified processed kimberlite containment facility and sorting plant).

The involvement of Kiskinchiish Camp Services is aligned with the philosophy Stornoway advocated in the Mecheshoo Agreement. As the primary service provider, this company delivers essential services for the mine and has members of the Swallow family in its employ.

In 2019, Kiskinchiish served three meals a day to on average 286 workers on site. Kiskinchiish operates with about 80 employees, 80% of whom are Crees primarily from the Mistissini community.

Like Stornoway, Kiskinchiish has to contend with a significant turnover rate and hence faces staff retention issues. Stornoway is working closely with Kiskinchiish to minimize the impact of these issues. Stornoway is extremely proud of the entrepreneurship sustained by the family and the success of this family business. For Sydney Swallow, this represents a long-term opportunity for family members as well as people from the community.

8.6 Local and Regional Economic spinoffs

8.6.1 Scope of Monitoring

As indicated in the ESIA, during the operation phase, annual expenses to operate the Renard diamond mine were expected to be significant and most were to be incurred in the region and province.

To maximize regional economic spinoffs, and particularly local benefits (Mistissini, Chibougamau, Chapais), Stornoway with input from Cree and James Bay residents put in place various employment, training and contract-related terms and conditions as set out in the Mecheshoo Agreement signed with the Cree, and the Partnership Declaration signed with the Chibougamau and Chapais communities.

Condition 5.1 of the Global CA specifies that the proponent is required to monitor “the local and regional economic spinoffs” and “the goods and services contracts awarded to local firms.”

The specific objectives of monitoring local and regional economic spinoffs are to:

- Use available information to update the portrait of the Cree and James Bay economy through changes in the main economic indicators;
- Describe the type and level of economic activities generated by the Renard diamond project;
- Establish the significance of economic spinoffs generated by the project, particularly in local and regional communities;
- Establish the significance of goods and services contracts awarded to local businesses;
- Evaluate the effectiveness of measures to maximize economic spinoffs described in the ESIA and proposed in the Mecheshoo Agreement or developed during the course of the project

Distribution of Monitoring Results

In accordance with the instructions to the proponent set out in Condition 5.3 of the Global CA (December 4, 2012), results from local and regional economic monitoring activities are filed and submitted to the Renard Committee, as well as the Renard Liaison Committee formed under the Partnership Declaration signed with Chibougamau and Chapais.

The results are also distributed to the Environment Committee, Environment Exchange Group, and local and regional Cree and non-Cree organizations whose objectives are to promote local, regional and provincial economic development.

Finally, they were also published in Stornoway’s 2019 Sustainable Development Report, a copy of which was distributed earlier this year to every household in Mistissini, Chibougamau and Chapais.

Employment-related Benefits

In terms of regional benefits, 156 Stornoway employees from our host communities (including 59 Cree employees) contributed, as at December 31, 2019, to generating annual benefits of more than $15.4 million in salaries for Mistissini, Chapais and Chibougamau.

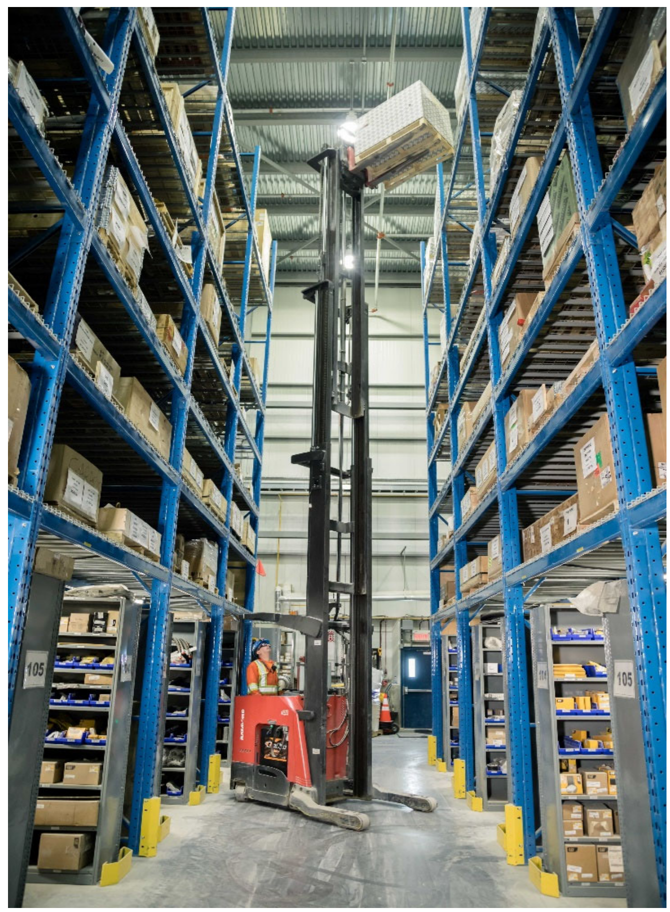


Photo 8.25 Warehouse at the Renard mine

8.6.2 Goods and Services Contracts

In March 2018, Stornoway completed construction work at the Renard mine site. Despite the many challenges faced in 2019, Stornoway managed to stay the course keeping it objectives well in sight.

Having strategically optimized expenses, purchasing volume in 2019 was significantly reduced.

We did, however, strengthen our commitment toward local suppliers in the impacted communities with a 12% increase in acquisition value as compared with 2018. The total value of purchases for the towns of Chibougamau-Chapais as well as the towns of Mistissini and Eeyou Istchee (James Bay) amounted to $37.9 million, or 31% of the total purchasing value in 2019 (Figure 8.27).

Stornoway is therefore proud to have solidified its local procurement commitment with James Bay merchants and suppliers. More than ever this year, in addition to having helped enhance the competitiveness of our operations, they stood by us through a difficult, but promising journey.

Aligned with its approach to sustainable development, Stornoway made a point of awarding goods and services contracts to competitive local companies.

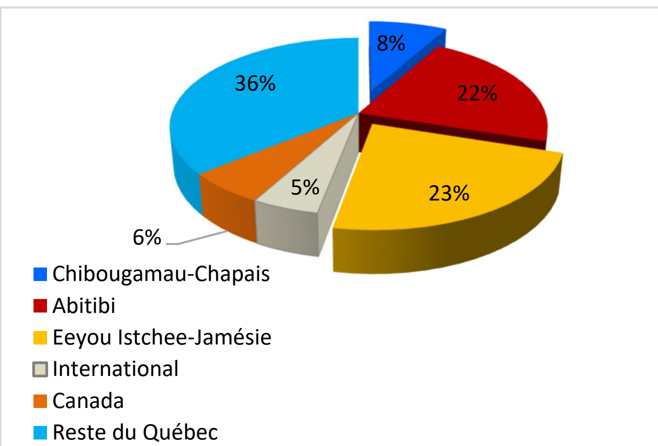


Figure 8.27 Breakdown of suppliers by monentary value in 2019

Dividing the contracts and negotiating certain contracts directly with the supplier proved to be greatly beneficial for both local businesses and the Renard mine. Stornoway is indeed very proud to have relied extensively on its business partners for the development and operation of the Renard mine, which in turn had a positive impact on the growth of the host communities.

Throughout 2019, the daily workforce at the mine site amounted on average to 286 workers, including both Stornoway and contractor employees, 17% of which were Cree workers (Figure 8.28). The number of workers on site peaked in March and April with respectively 322 and 330 workers on site each day (Table 8.3).

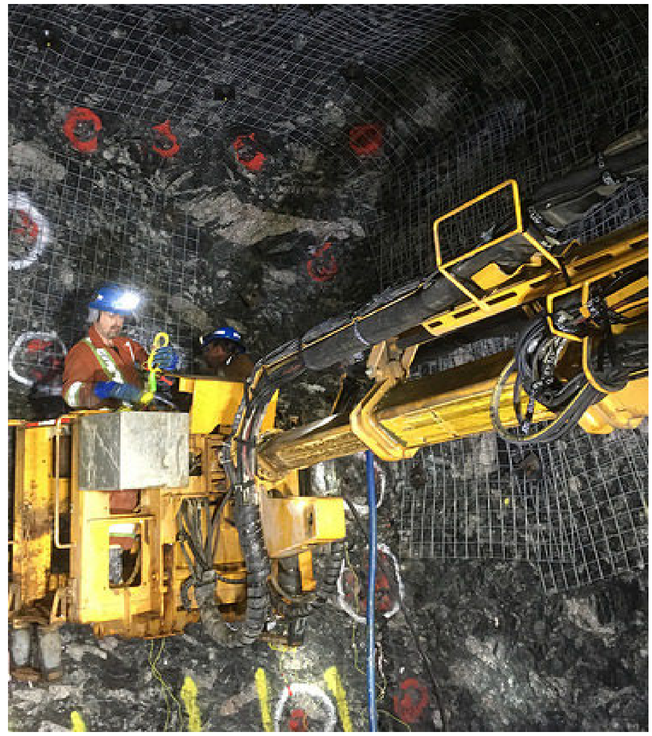


Photo 8.26 Renard mine employees

8.6.3 Projects funded by the Mistissini / Renard Business Development Fund

Under the Mecheshoo Agreement, the Business Development Fund was set up when commercial production at the Renard mine began, i.e., as of January 1, 2017.

Every year Stornoway and Mistissini contribute equally to the Mistissini/Renard Business Development Fund established to support the start-up and development of Mistissini Cree businesses. The funding can be used to support the start-up or development of businesses in any sector of activity. Funding applications are submitted directly by the applicants to the Mistissini Band Council, which manages the Fund.

The Renard Committee then makes recommendations with regard to the award of funding to the various applicants. In 2019, a total of $147,254 (maximum of $100,000 per partner) was awarded to three projects submitted to the Council of the Cree Nation of Mistissini.

A policy with regard to this program was put in place by the Mistissini community to establish a formal process for the applications. In addition, a communications plan was deployed in 2019 to inform Mistissini residents about the Mistissini/Renard Business Development Fund.

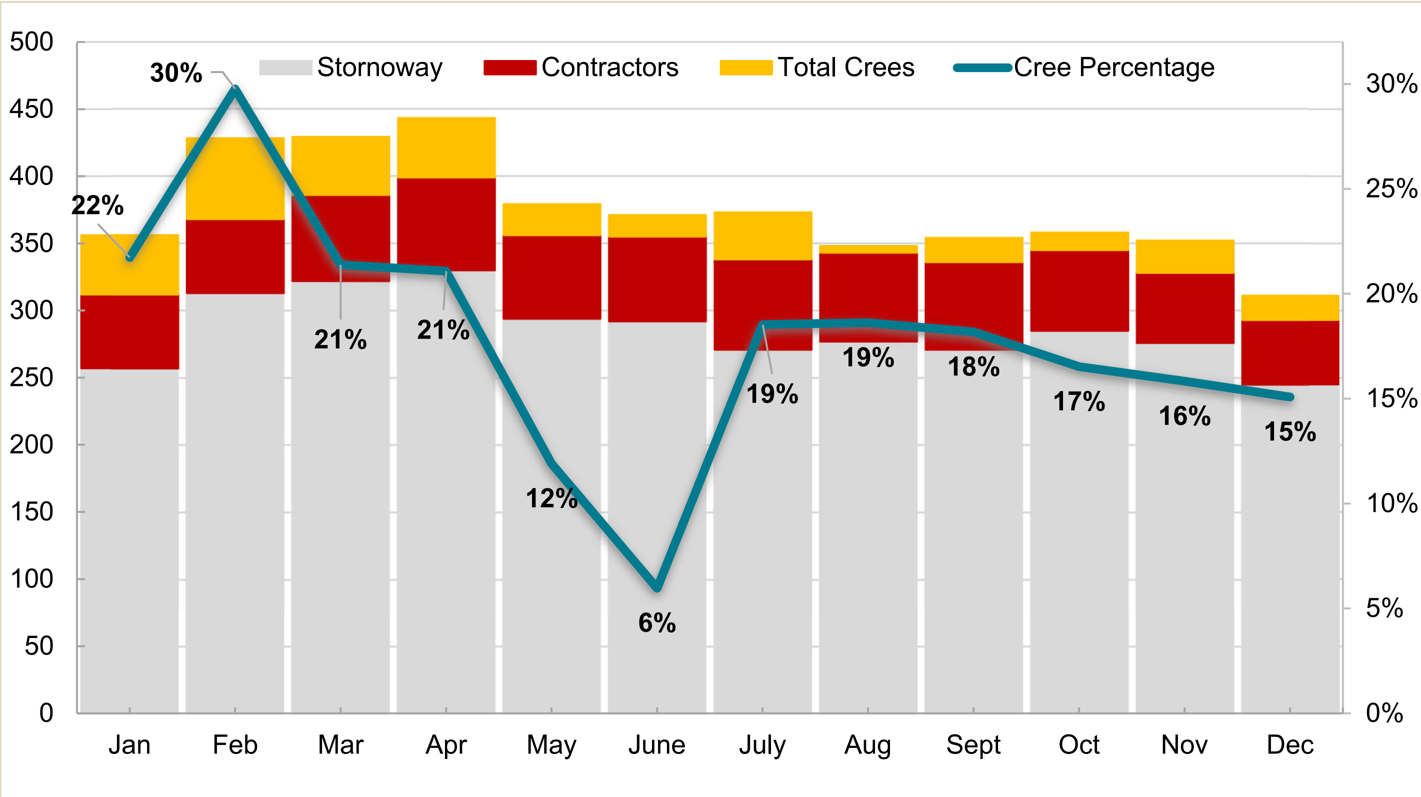


Figure 8.28 Average monthly workforce (by category) at Renard mine site in 2019

8.7 Communications

Every year Stornoway reviews its communications plan on the basis of the needs and issues that arose during the year.

The objective of the communications plan is to consolidate support from the local communities and decision makers and maintain their respect.

The plan is also a tool for reassuring regional stakeholders regarding Stornoway's commitment to maximizing local benefits generated by the project while minimizing environmental impacts. The plan aims to keep stakeholders well informed and minimize any possible misunderstandings while managing expectations appropriately

Finally, the plan is designed to be responsive to concerns expressed by M-11 trapline. It was designed primarily to target stakeholders who are particularly influenced by mining activities (Figure 8.29).

Communications are therefore directed toward tallymen and their families, Renard mine employees and members of various committees set up under the Mecheshoo Agreement with the Cree, and the Partnership Agreement signed with Chibougamau and Chapais.

Included among the communications activities organized during this reporting period are:

- Quarterly meetings with the three Mecheshoo Agreement committees (Renard Committee, Education and Employment Committee, Environment Committee);
- Quarterly meetings with the Partnership Agreement Liaison Committee;
- Annual presentation of Renard mine project activities to members of the Council of the Cree Nation of Mistissini;
- Visit by the Mecheshoo Agreement Implementation Officer to the Stornoway offices in Mistissini to answer questions and address expectations by community members and ensure maximum employment-related benefits;
- Annual open house in Mistissini and Chibougamau to keep participants informed (mine, plant, environment and human resources);
- Information meetings and presentations for employees at the mine site;
- Internal information channel on screens at the mine;
- Stornoway's *Annual Sustainable Development Report* mailed to Chibougamau, Chapais and Mistissini households;
- Regular meetings (13 in 2019) with tallymen as well as some members of their family, to keep them informed about the status of construction work and address their concerns and questions;
- Job opportunities and upcoming community events/activities broadcast on the local radio station in Mistissini;
- Reports on the status of construction work, local benefits and job opportunities broadcast on the local radio station in Chibougamau;
- Presentation on the Renard mine at local events (Mining Week, recruiting activities, open houses, etc.);
- Organization of National Aboriginal Day festivities held at Renard mine to share Cree culture.

The spirit of the Mecheshoo Agreement is based on a cooperative effort by the partners, and project implementation is the joint responsibility of Stornoway, Mistissini and the Eeyou Istchee Cree government.

Achieving the objectives, we have set together is contingent upon showing cultural respect, sharing differences and working together. Stornoway is proud to be contributing to the growth of the Mistissini community, the Crees of Eeyou Istchee and the Chibougamau and Chapais communities, by creating a hopeful future for young people in the community and making a difference for local families.

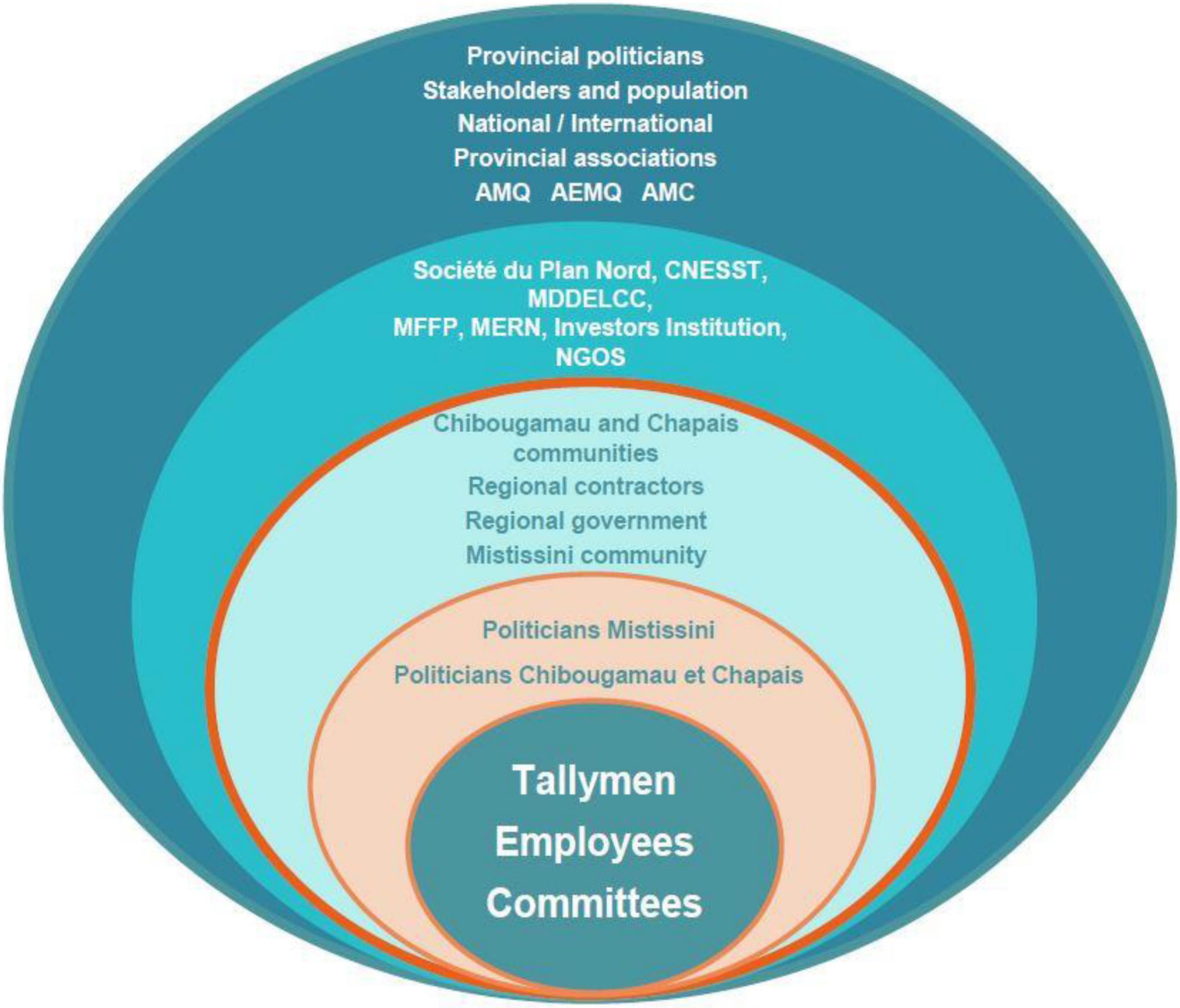


Figure 8.29 Communications between Stornoway and stakeholders

9 References

ACÉE, 2013. *Rapport d'étude approfondie.* Projet de mine de diamants Renard – Mai 2013. ISBN: 978-0-660-20861-9. 83 p.

Beaulieu, 2016. *Guide d'intervention – Protection des sols et réhabilitation des terrains contaminés*. MDDELCC, ISBN 978-2-550-76171-6, 210 p.

CEAQ, 2014 Centre d'expertise en analyse environnementale du Québec, Détermination du carbone organique total dans les solides: dosage par titrage, MA. 405 – C 1.1, Rév. 1, Ministère du Développement durable, de l'Environnement et de la Lutte contre les changements climatiques. Déc. 2014, 9 p. http://www.ceaeq.gouv.qc.ca/methodes/pdf/MA405C11.pdf [page consultée: 2020-09-03]

Consulair, 2020. *Suivi de la qualité de l'air ambiant.* Année 2019. Version finale, rév. 1. Mars 2020. Projet n°19-5681. Les Diamants Stornoway Canada Inc. Mine Renard – Québec. 33p. et annexes.

CCME, 2003. *Code de recommandations techniques pour la protection de l'environnement applicable aux systèmes de stockage et à la manutention de produits pétroliers et de produits apparentés* (PN 1327).

Englobe, 2017. *Modélisation du rejet de l'émissaire des eaux usées minières à la suite de l'interception et du pompage d'eaux souterraines.* Mine Renard – Juin 2017. Rapport final. N° projet 046-P-0012925-0-01-004. 36 p.

Englobe, 2016. *Rapport de mission hiver 2016 et synthèse 2010-2016 relative aux restrictions horizontale et verticale dans le bassin nord du lac Lagopède*. Projet Mine Renard – Relevés hydrométriques. N/Réf: P-0009855-0-01-003-01. 43 p. et annexes.

Englobe, 2015. *Rapport de mission: Caractérisation de l'état de référence – Hydrologie. Relevés estivaux 2015*. Les Diamants Stornoway (Canada) Inc. Projet diamantifère Renard - 7 déc.2015. N/Réf.: 046-P-0009147-0-01-001-03-EN-R-001-00. 16 p. et annexes.

Environnement Canada, 2012. *Guide technique pour l'étude de suivi des effets sur l'environnement des mines de métaux.* Bureau national des études de suivi des effets sur l'environnement. ISBN 978-1-100-99041-5. 612 p.

Environnement Canada et ministère du Développement durable, de l'Environnement et des Parcs du Québec, 2007. *Critères pour l'évaluation de la qualité des sédiments au Québec et cadres d'application: prévention, dragage et restauration*. 39 p.

Environnement Illimité Inc., 2011. *Modélisation des effluents minier et domestique*. Projet Renard. Version finale. Décembre 2011. 88 p.

Environnement Illimité Inc., 2015. *Projet de la mine Renard: Relevés hydrométriques – Hiver 2015.* 28 p. et annexes.

Fleury et Boula, 2012. Recommandations pour la planification et la conception d'aménagements d'habitats pour l'omble de fontaine (Salvelinus fontinalis). Rapp. tech. can. sci. halieut. aquat. 3008, Mont-Joli, 33 p.

Golder, 2019. *Relevés hydrologiques 2018 – Mine Renard. Rapport Annuel* – Doc495-1896274-RF-Rev0. Mars 2019. 52 p. et annexes.

Golder, 2017. *Mise à jour du modèle hydraulique 3D – Mine Renard.* Présenté à Les Diamants Stornoway (Canada) Inc. Mai 2017. 387-1669321-7000-RF-Rev0. Préliminaire. 21 pages + annexes.

Golder, 2015. *Analyses de précipitations mensuelles totales pour différentes périodes de retour*. Mémorandum technique. Doc307-1212210119-3050-Rev0. Octobre 2015. 2 p.

Golder, 2012. *Mise à jour du modèle hydrogéologique 3D* – Projet minier Renard. Les Diamants Stornoway. Projet 10-1427-0020/5017, Document 107 Rév. 2.

Golder, 2011a. *Renard Project Business Caste Study, Water Management Plan* – 10-1427-0020-3091.

Golder, 2011b. *Renard Project Climate and Hydrological Analysis* – 10-1427-0020/3050. Document n° 019 Vers. 0. Mars 2011.

Golder Associates Ltd., 2011c. *Estimation par modélisation numérique ou débit d'eau d'exfiltration des aires d'entreposage de mort-terrain, stériles et kimberlite traitée et simulations préliminaires de l'évolution des concentrations dans l'eau souterraine. Projet Renard,* (Québec), Mémorandum technique. Novembre 2011. 20 pages et annexes.

Hébert, 2015. *Guide sur le recyclage des matières résiduelles fertilisantes: Critères de référence et normes réglementaires* – Édition 2015. Québec. ISBN- 978-2-550-72954-9, 216 p.

MAMROT, 2015. *Rapport annuel de l'usage de l'eau potable 2013*. Stratégie québécoise d'économie d'eau potable. 2015.

MELCC, 2019. http://www.environnement.gouv.qc.ca/climat/faits-saillants/index.htm (Page consultée le 29 mars 2020).

MELCC, 2017. Le réseau de surveillance des lacs – méthodes. [http://www.mddep.gouv.qc.ca/eau/rsvl/methodes.htm] (Page consultée le 8 janvier 2020).

MELCC, 2017. *Critères de qualité de l'eau de surface*. [http://www.environnement.gouv.qc.ca/eau/criteres_eau/index.asp] (Page consultée le 24 janvier et le 13 mars 2020).

MDDELCC, 2014. Modification du certificat d'autorisation délivré le 4 décembre 2012 en vertu de l'article 164 de la Loi sur la qualité de l'environnement émise le 9 juin 2014. 5 p.

MDDEFP, 2012. Certificat autorisant la mise en œuvre du projet diamantifère Renard, émis le 4 décembre 2012 en vertu de l'article 164 de la Loi sur la qualité de l'environnement (CA global). Certificat d'autorisation N°: 3214-14-041. 9 p.

MDDEP. 2012. Directive 019 sur l'industrie minière. 66 p. + annexes.

MDDEP, 2008. *Guide d'échantillonnage à des fins d'analyses environnementales.* http://ceaeq.gouv.qc.ca/documents/publications/echantillonnage.htm.

MFFP, 2018. https://mffp.gouv.qc.ca/faune/especes/fiches-descriptives/pygargue-tete-blanche.jsp. [Page consultée le 4 février 2020].

MPO, 2014. Autorisation en vertu de l'alinéa 35(2)b) de la Loi sur les Pêches (LRC 1985, c F-14). Autorisation N°:2014-002. Dossier MPO N°: 13-HQUE-LZ3-00217. 19 p.

MPO, 2013. Autorisation en vertu de l'alinéa 35(2)b) de la Loi sur les Pêches (LRC 1985, c F-14). Autorisation N°: 2013-011. Dossier MPO N°: 10-HQUE-LZ3-00032. 19 p.

NORDA STELO, 2020. *Suivi des eaux souterraines de la mine Renard -Années 2017, 2018 et 2019 Secteurs de l'aire d'accumulation de la kimberlite usinée et de la halde de stériles, du dépôt et de la fabrique d'explosifs, de l'aire des infrastructures minières, du LEET et de la piste d'atterrissage*. Les Diamants Stornoway (Canada) Inc. N/Réf.: 061470.056-100. Juillet 2020. 178p. + annexes.

NORDA STELO, 2019a. *Programme de suivi environnemental*. *Mine Renard.* Février 2019. N/Réf: 61470.050. 308 p.

NORDA STELO, 2019b. *Suivi et surveillance du benthos et des poissons. Plan de l'étude du 1er cycle de suivi des effets sur l'environnement (ESEE).* Février 2019. N/Réf.: 61470.034-300.– Version 1. 107 p. et annexes.

NORDA STELO, 2019c. *Travaux correctifs aux aménagements compensatoires pour l'omble de fontaine à la mine Renard. Programme de compensation de l'habitat du poisson*. Janvier 2019. N/Réf.: 61470.044-100. 45 p. et annexes.

NORDA STELO, 2019d. *Rapport de suivi de la grande faune. Mine Renard*. Juillet 2019. N/Réf.: 61470.053. 66 p. et annexes.

NORDA STELO, 2017a. *ENVS-3.3.8 - Suivi 2016 des effets de la mine diamantifère Renard sur le poisson et son habitat. Rapport de suivi*. Programme de suivi environnemental – Mars 2017 - Version 0. Projet diamantifère Renard N/Réf.: 61470.023-700. 34 p. et annexes.

NORDA STELO, 2017b. *Programme de compensation de l'habitat du poisson. Rapport de l'aménagement tel que construit. Agrandissement d'une frayère à touladi dans le lac Lagopède* – Mars 2017. Projet diamantifère Renard. N/Réf.: 61470.023-400. 19 p. et annexes.

NORDA STELO, 2017c. *Demande d'autorisation et de certificat d'autorisation pour la mise en place d'un réseau de puits de pompage et de prélèvement d'eau souterraine* – Juillet 2017. Projet diamantifère Renard. N/Réf: 61470.028-155 (Version 0). 100 p. et annexes.

NORDA STELO, 2017d. *Détermination des teneurs de fond locales dans les eaux souterraines de l'ensemble du site minier et de la piste d'atterrissage* – Mars 2017. Projet diamantifère Renard. N/Réf: 061470.014.725. 30 p. et annexes.

NORDA STELO, 2016a. *Programme de suivi environnemental et du milieu social* – Octobre 2016. Projet diamantifère Renard. N/Réf.: 61470.024. 248 p.

NORDA STELO, 2016b. *Suivi du maintien de la qualité physico-chimique de l'eau au site de la frayère à touladi dans le lac Lagopède. État de référence* – Juin 2016. Projet diamantifère Renard. N/Réf: 61470.005-100. 32 p. et annexes.

ROCHE ltée, Groupe-conseil, 2015. *Projet de compensation de l'habitat de l'omble de fontaine au site minier (exutoires des lacs F3293, F3294, F2604 et F3301).*

NORDA STELO, 2015. *Suivi du libre passage du poisson dans les ponceaux. Chemin minier reliant la route 167 au projet diamantifère Renard.* Rapport de suivi – Mai 2015. Les Diamants Stornoway (Canada) Inc. N/Réf: 103635.001-900. 22 p. et annexes.

ROCHE ltée, Groupe-conseil, 2013a. Prolongement de la route 167 (chemin minier), Lots C et D.

ROCHE ltée, Groupe-conseil, 2013b. *Demande de révision des objectifs environnementaux de rejet (OER). Condition 2.4 du certificat d'autorisation émis par le MDDEFP le 4 décembre 2012.* Novembre 2013. N/Réf.: 061470-007-400. 88 p. et annexes.

ROCHE ltée, Groupe-conseil, 2011a. *Étude d'impact environnemental et social*. Préparée pour Les Diamants Stornoway (Canada) Inc. Projet diamantifère Renard. Quatre volumes (Volume 1: Rapport principal, volume 2: Annexes, Volume 3: Recueil des cartes, Volume 4: Dessins techniques des infrastructures minières et des installations connexes). Réf: 061470.001-400. Décembre 2011 – 1204 p.

ROCHE ltée, Groupe-conseil. 2011b. *Étude environnementale de base du projet diamantifère Renard: Rapport sectoriel – Milieu biologique*. Rapport final présenté à Les Diamants Stornoway (Canada) Inc. Décembre 2011. 563 p.

SNC Lavalin, 2017. *Relevés hydrologiques – Été 2017*. Projet diamantifère Renard. Mars 2018. Rapport final – Rev. 00. N°645121. 76 p. et annexes.

STORNOWAY, 2019a. *Programme de compensation de l'habitat du poisson. ENVS-3.3.8 – Suivi des effets de la mine Renard sur le poisson et son habitat* – Mars 2019. Mine Renard. 33 p. et annexes.

STORNOWAY, 2019b. *Programme de compensation de l'habitat du poisson. Rapport de suivi de la frayère à touladi* – Mars 2019. Mine Renard. 31 p. et annexes.

STORNOWAY, 2019c. *Rapport annuel de suivi environnemental et du milieu social* – Septembre 2019. Les Diamants Stornoway (Canada) Inc. 209 p. et annexes.

STORNOWAY, 2019d. *Programme de suivi environnemental et du milieu social* – Février 2019. Mine Renard. 210 p. et annexes.

STORNOWAY, 2018a. *Rapport annuel de suivi environnemental et du milieu social* – Septembre 2019. Les Diamants Stornoway (Canada) Inc. p. et annexes.

STORNOWAY, 2018b. *Projet de compensation – Route 167 Nord. Rapport de suivi 2017* – Mars 2018. Les Diamants Stornoway (Canada) Inc. 24 p. et annexes.

STORNOWAY, 2017a *Rapport annuel de suivi environnemental et du milieu social*. Rapport annuel 2015-2016. Septembre 2017. 131 p.et annexes.

STORNOWAY, 2017b. *Programme de compensation de l'habitat du poisson. Rapport de suivi de la frayère à touladi. Agrandissement d'une frayère à touladi dans le lac Lagopède* – Mars 2018. Projet diamantifère Renard. 19 p. et annexes.

STORNOWAY, 2014. *Demande de modification d'énoncés du CA Global.* Présentation au COMEX, 4 août 2014. Projet Renard. 56 p.

TETRA TECH, 2020a. +++ Rapport de campagne. Rev. 00 - 5 juin 2019. Réf.: 39791 TT (60ET). 40 p. et annexes.

TETRA TECH, 2020b. *Suivi de la qualité de l'eau de surface et des sédiments. Rapport annuel*. 10 juin 2020. Réf: 39791TTA. Rév.: 03. 58 p. et annexes.

YOCKELL Inc., 2020. *Rapport de suivi acoustique et des vibrations 2019*. Février 2019| N. Réf.: 21511075. 122 p.

10 Appendices

APPENDIX I

Review and Validation of the Environmental and Social Monitoring Report

Le 23 septembre 2020

Monsieur Martin Boucher
Vice-président, Environnement, Santé, Sécurité et développement durable
Les Diamants Stornoway (Canada) inc.
1111, rue St-Charles Ouest
Bureau 400, tour Ouest
Longueuil (Québec) J4K 5G4

N/Réf. : 061470.067

Objet : Programme de suivi environnemental et du milieu social
Examen et validation du rapport de suivi 2019

Monsieur,

À titre de responsable de projet pour Norda Stelo, de l'étude d'impact du projet diamantifère Renard et de l'assistance technique en environnement pour la mine Renard, les Diamants Stornoway (Canada) inc. m'ont fourni l'opportunité de réaliser un examen complet du rapport de suivi 2019 et de documents qui ont servis à sa préparation.

À la lumière de cet examen et de ma connaissance des activités qui ont eu lieu et dans lesquelles j'ai été impliqué directement ou indirectement, je peux confirmer que les activités qui sont rapportées dans ce rapport ont bel et bien été réalisées et que les résultats du suivi reflètent bien ce qui a été documenté dans ce rapport. Je peux également attester que les mesures de prévention, de gestion des risques, d'atténuation et de compensation qui étaient prévues dans l'étude d'impact environnemental et social et qui ont été discutés avec les Cris et les autorités gouvernementales ont été mises en application.

L'équipe de Norda Stelo a été directement impliquée, et de façon soutenue, dans le développement et la mise en œuvre des études environnementales du projet Renard depuis le début du processus d'évaluation environnementale en 2010 jusqu'à aujourd'hui. Elle a donc été à même de constater à travers ces activités, du respect des engagements de Stornoway envers les communautés d'accueil ainsi que de la mise en œuvre et de l'efficacité du système de gestion environnementale et sociale de la Mine Renard. En effet, au cours de l'année 2019, Norda Stelo a pu constater l'application des mesures prévues à travers :

- la réalisation de l'inventaire 2019 de la grande faune et des entrevues avec les maîtres de trappe;
- la préparation de réponses aux questions du COMEX (suivi des conditions du CA global), du MERN (plan de restauration 2018), du MELCC (programme de suivi environnemental) et de la communauté crie de Mistissini (aménagement d'une frayère à doré jaune);

1015, avenue Wilfrid-Pelletier
Québec QC, Canada G1W 0C4

Tél. : 418 654-9600
Téléc. : 418 654-9699

norda.com

- la traduction du rapport de développement durable 2018 et du plan de restauration 2018 de la mine Renard;
- la préparation d'un rapport d'interprétation de la qualité et des niveaux des eaux souterraines (période de 2017-2019) par rapport à l'état de référence;
- à travers la révision du rapport de suivi 2019, le suivi des mesures et engagements pris dans les versions antérieures des rapports annuels de suivi (2018, 2017);
- le développement et la mise en œuvre des activités de suivi environnemental;
- le suivi et la mise en œuvre des mesures de compensation.

Notre participation directe à ces activités nous a permis de constater le travail de gestion environnementale de la Mine Renard en exploitation, en conformité avec le cadre réglementaire applicable, les conditions des autorisations fédérales et provinciales, du certificat d'autorisation (CA) global ainsi que les engagements pris avec les communautés d'accueil lors des consultations publiques et tables d'information et d'échange.

Les discussions auxquelles j'ai participé avec les représentants de la communauté crie de Mistissini ainsi que la stratégie d'embauche et d'approvisionnement déployée par Stornoway sont conformes aux engagements de la compagnie envers ces communautés dans l'Entente Mecheshoo et de la Déclaration des partenaires.

La diffusion publique de ce rapport de suivi est le reflet de l'approche de transparence de Stornoway depuis le début du développement du projet. J'encourage l'équipe de Stornoway à poursuivre cet excellent travail de respect de l'environnement et des communautés.

Veuillez recevoir, Monsieur, nos salutations distinguées.

Vital Boulé

Vital Boulé, M. Sc., Biologiste
Responsable de projet
Directeur technique
Acceptabilité sociale et Environnement
Norda Stelo Inc.

APPENDIX II

Depollution Attestation - Part IIIII

Atmospheric Emissions and Noise

PARTIE III – ÉMISSIONS ATMOSPHÉRIQUES ET BRUIT

SECTION 1 - ASPECTS GÉNÉRAUX

La présente partie de l'autorisation concerne les émissions atmosphériques et le bruit.

Tout équipement, système ou autre dispositif existant ou exigé dans la présente partie de l'autorisation, doit être maintenu en bon état de fonctionnement et fonctionner de façon optimale pendant les heures de production.

SECTION 2 - POINTS D'ÉMISSION

Les principaux points d'émission ou de dégagement de contaminants dans l'atmosphère faisant l'objet d'une norme, d'une exigence de suivi, d'une exigence d'étude ou de toute autre exigence résultant de l'exploitation de l'établissement sont présentés ci-après au tableau III-1.

Les numéros des points d'émission sont reportés sur des schémas à l'annexe 2 de la partie VII de l'autorisation (annexes 2-B.1 et 2-B.2).

SECTION 3 - NORMES D'ÉMISSION

3.1 Normes d'émission réglementaires

Les normes réglementaires applicables aux points d'émission visées au paragraphe 1° du 1er alinéa de l'article 31.15 de la Loi sont présentées ci-après au tableau III-1.

De plus, certaines normes d'application générale sont citées ci-dessous :

Particules

En vertu de l'article 12 du RAA, les émissions de particules provenant du transfert, de la chute ou de la manutention de matières visées ne doivent pas être visibles à plus de 2 mètres du point d'émission.

En vertu de l'article 14 du RAA, les particules récupérées par un dépoussiéreur à sec doivent être manutentionnées, transportées, entreposées et disposées de façon à ce qu'aucune émission de particules ne soit visible à plus de 2 mètres du point d'émission.

Opacité

En vertu de l'article 16 du RAA, l'opacité des émissions grises ou noires dans l'atmosphère d'une source de contamination, autre que celles prévues à l'article 15 de ce règlement, ne doit pas, pour chacun de ses points d'émission, excéder 20%.

Cependant, pendant le fonctionnement d'une source de contamination, l'opacité des émissions peut excéder 20%, sans toutefois dépasser 40%, pendant une ou plusieurs périodes totalisant un maximum de quatre minutes par heure.

En outre, lors du démarrage d'un moteur fixe à combustion interne, l'opacité des émissions peut excéder 20% pendant une durée maximale de 4 minutes.

De même, lors de l'allumage d'un foyer de combustion ou du soufflage des tubes, l'opacité des émissions peut excéder 20%, sans toutefois dépasser 60%, pendant une durée maximale de 4 minutes.

Teneur en soufre dans les combustibles

En vertu de l'article 57 du RAA, la teneur en soufre dans un combustible fossile utilisé dans un appareil de combustion ou dans un four industriel ne doit pas excéder :

1° 1,5% (masse/masse) en poids pour le mazout lourd;

2° 0,5% (masse/masse) en poids pour le mazout léger;

3° 1,5% (masse/masse) en poids pour le charbon;

4° 1,5% (masse/masse) en poids pour le coke;

5° 1,5% (masse/masse) en poids pour le brai.

En outre, dans le cas où les installations de l'exploitant d'un appareil de combustion ou d'un four industriel sont situées sur un territoire où le gaz naturel est accessible, cet exploitant doit utiliser comme combustible du mazout lourd dont la teneur en soufre est d'au plus 1% (masse/masse) en poids.

3.2 Normes d'émission supplémentaires

Il n'y a pas de norme supplémentaire applicable aux points d'émission et visée au paragraphe 3° du 1er alinéa de l'article 27 de la Loi.

SECTION 4 - EXIGENCES DE SUIVI ET DE CONTRÔLE DES ÉMISSIONS

Les exigences de suivi réglementaires visées au paragraphe 4° du 1er alinéa de l'article 27 de la Loi et les exigences de suivi supplémentaires visées notamment au paragraphe 4° du 1er alinéa de l'article 27 de la Loi ainsi qu'au paragraphe 4° du 1er alinéa de l'article 31.15 de la Loi (référence à l'article 31.11 de la Loi) sont présentées dans les sections visées de la présente partie de l'autorisation et dans le tableau III-1.

Toute donnée inscrite dans un registre ou autre document, enregistrée par un système de mesure et d'enregistrement en continu des émissions, recueillie, mesurée, calculée, utilisée ou fournie conformément à la présente autorisation doit être conservée par l'exploitant pendant une période minimale de 5 ans et disponible sur demande.

4.1 Suivi par échantillonnage

Lorsqu'un échantillonnage est effectué, il doit être effectué selon les modalités et les méthodes de référence prescrites dans la plus récente édition du *Guide d'échantillonnage à des fins d'analyses environnementales – Cahier 4 - Échantillonnage des émissions atmosphériques en provenance de sources fixes*, accessible sur le site Internet du CEAEQ. Notamment, les échantillonnages sont constitués d'au moins trois essais (TE) consécutifs. Les échantillons doivent être transmis pour analyse à un laboratoire accrédité en vertu de l'article 118.6 de la Loi.

Tout échantillonnage doit faire l'objet d'un rapport d'échantillonnage effectué selon les modalités prescrites dans la plus récente édition du *Guide d'échantillonnage à des fins d'analyses environnementales – Cahier 4 - Échantillonnage des émissions atmosphériques en provenance de sources fixe*. Chaque rapport d'échantillonnage doit être accompagné par un écrit du signataire du rapport attestant que les prélèvements d'échantillons ont été faits en conformité avec, selon le cas, les règles de l'art applicables ou les exigences prévues au RAA, y compris celles du guide d'échantillonnage. Le rapport doit être transmis, sur support papier et électronique, au Ministère dans les 120 jours suivant la fin de la campagne d'échantillonnage. Si l'analyse a révélé un dépassement d'une valeur limite ou d'une autre norme d'émission fixée par le RAA, cet événement doit être mentionné dans le rapport ainsi que les mesures correctrices prises pour y remédier.

Les échantillonnages sont réalisés lors d'une opération normale de l'usine.

Pour chaque résultat d'analyse rapporté comme « non détecté », la limite de détection doit être consignée dans le certificat d'analyse. Les certificats d'analyse doivent être conservés pendant cinq ans.

4.2 Suivi par mesure en continu

Aucun suivi par mesure des émissions en continu n'est exigé dans cette autorisation.

4.3 Suivi par inspection et registre

- **Équipements d'épuration**

Tous les dépoussiéreurs et épurateurs (secs ou humides) identifiés au tableau III-1 sont l'objet d'inspections régulières.

Les dépoussiéreurs et les épurateurs à sec ayant une capacité de plus de 17 000 m^3/h doivent être équipés de détecteurs de fuite passifs avant la fin du 24e mois de l'autorisation. En cas d'impossibilité technique, le titulaire devra aviser le Ministère.

La fréquence d'inspection est précisée au tableau III-1 pour chaque équipement. La liste des indicateurs de performance à suivre est précisée au tableau III-2 pour chaque équipement.

Les résultats des inspections (suivi des indicateurs de performance), ainsi que les interventions ou correctifs sont consignés dans un registre et conservés pendant cinq ans.

- **Parcs à résidus**

Le parc à résidus et les haldes à stériles feront l'objet d'inspections régulières pour les émissions diffuses.

La fréquence d'inspection est précisée au tableau III-1 et les éléments à vérifier sont précisés au tableau III-2.

Les résultats des inspections, ainsi que les interventions ou correctifs apportés sont consignés dans un registre et conservés pendant cinq ans.

- **Haldes à stériles et lieux d'entreposage du minerai**

Les haldes à stériles et les aires d'entreposage de minerai (halde à minerai temporaire et 2 piles de minerai (tout-venant et concassé)) feront l'objet d'inspections régulières pour les émissions diffuses.

La fréquence d'inspection est précisée au tableau III- 1.

Les éléments à vérifier sont précisés au tableau III- 2.

Les résultats des inspections ainsi que les interventions ou correctifs apportés sont consignés dans un registre et conservés pendant cinq ans.

4.4 Suivi par bilan

Un suivi des émissions par bilan est effectué pour le dioxyde de soufre et les particules, tel qu'indiqué ci-après.

- **Dioxyde de soufre (SO_2) :**

Les émissions annuelles de SO_2 sont établies à partir de la consommation des combustibles fossiles et de leur teneur en soufre. Pour le bilan, tous les combustibles fossiles utilisés pour les activités de la mine seront pris en compte. Ceci inclut les combustibles fossiles utilisés par les sources fixes et les sources mobiles. Pour chaque source fixe et chaque catégorie de sources mobiles, le bilan des combustibles devra contenir les informations ci-dessous :

- Identification du combustible;
- Utilisation du combustible (spécifier s'il s'agit de sources fixes ou mobiles et distinguer les consommations);
- Caractéristiques du combustible :
  - Le pourcentage de soufre sur base sèche (%);
  - Le pouvoir calorifique supérieur (MJ/kg);
  - La quantité utilisée par année;
  - La quantité de soufre en équivalent SO_2 (kg/an).

- **Particules :**

Les émissions annuelles de particules seront quantifiées à partir de facteurs d'émission. Ces facteurs d'émission seront déterminés à l'aide des résultats de caractérisation des émissions atmosphériques ou provenant de la littérature (exemple : USEPA AP 42, Fifth edition, Compilation of Air Pollutant Emission Factors, Volume 1 : Stationary Point and Area Sources).

Pour le bilan, toutes les sources de particules seront prises en compte, c'est-à-dire autant les sources fixes (cheminées, ventilateurs, dépoussiéreurs, etc.) que les sources d'émission diffuses (parcs, haldes, voies de circulation, etc.).

4.5 Transmission des données de suivi

Les données de suivi sont transmises annuellement au Ministère dans un rapport couvrant la période allant de janvier à décembre, avant le 1er avril de l'année qui suit (les rapports d'échantillonnage et les certificats d'analyse sont joints, le cas échéant).

SECTION 5 - CALCUL DES ÉMISSIONS

5.1 Généralités

Pour un paramètre donné, l'émission est établie en multipliant le débit d'émission mesuré ou estimé par la concentration obtenue par échantillonnage ou estimation. Le taux d'émission correspond à l'émission exprimée par unité de production.

Tous les calculs et les paramètres de calcul des émissions sont conservés pendant cinq ans.

5.2 Calcul des émissions et évaluation du respect des normes

Tel que stipulé à l'article 199 du RAA, les valeurs limites d'émission et les autres normes d'émission établies au regard d'une source de contamination sont respectées si les conditions suivantes sont satisfaites :

- la moyenne arithmétique des trois résultats des mesures prises au cours d'une même campagne d'échantillonnage effectuée est inférieure ou égale à ces valeurs limites ou normes;
- au moins deux de ces résultats sont inférieurs à ces valeurs limites ou normes;
- aucun de ces trois résultats n'excède de plus de 20% ces valeurs limites ou normes.

Une norme peut s'appliquer à un seul point d'émission ou à un ensemble de points d'émission, comme précisé au tableau III-1.

5.2.1 Cas où la norme s'applique à un seul point d'émission (RAA, art. 10)

La norme s'applique à chaque point d'émission. La norme de 30 mg/m^{3}R du RAA s'applique.

5.2.2 Cas où la norme s'applique à un ensemble de points d'émission (RAA, art. 9)

La norme s'applique à l'ensemble d'un procédé, celui-ci pouvant comprendre plusieurs points d'émission.

Pour chaque procédé assujetti à l'article 9 du RAA, un découpage du procédé, une identification de tous les points d'émission et des sources associées, ainsi qu'une sélection des points à échantillonner sont établis.

Le taux d'émission correspond à l'émission exprimée par unité de production.

5.3 Calcul des émissions aux fins de rapport

Les charges annuelles rejetées seront établies à l'aide des bilans annuels prévus à la section 4.4.

SECTION 6 - ONDES SISMIQUES ET BRUIT

Les exigences de suivi applicables aux émissions d'ondes sismiques et de bruit sont des exigences supplémentaires visées aux paragraphes 2.2° et 6° du premier alinéa de l'article 31.13 de la Loi et sont présentées ci-après.

La localisation de la station de mesure du bruit et d'ondes sismiques est reportée sur un schéma à l'Annexe 2 de la partie VII de l'autorisation (annexe 2-B.1). La station de mesures du bruit et des ondes sismiques et les critères applicables sont présentés aux tableaux III-3 et III-4.

6.1 Suivi des émissions d'ondes sismiques

Les données à collecter à chaque dynamitage sont la date et l'heure du dynamitage, la vitesse de vibration, les fréquences de vibration au sol, les pressions d'air, le schéma de sautage, les coordonnées géographiques du point de mesure et l'utilisation d'un pare-éclat et ses conditions d'utilisation (notamment le type de sautage, le type de pare-éclats, la distance, etc.). Ces données doivent être consignées dans un registre conservé sur place. Le registre doit être conservé au moins deux ans et disponible sur demande.

Une calibration du sismographe doit être effectuée une fois par année et la preuve de cette calibration doit être conservée au registre.

Par ailleurs, lors des activités de sautage, l'établissement doit prendre les mesures adéquates pour:

- contrôler et limiter les émissions de poussières, les vibrations et les projections;
- empêcher toute projection au-delà des limites de propriétés sur lesquelles l'établissement détient les droits d'exploitation.

L'établissement doit donc, notamment, appliquer une procédure de mise en œuvre des bonnes pratiques de dynamitage. Cette procédure, adaptée au site, doit être mise à jour régulièrement et signée par un ingénieur, membre de l'Ordre des ingénieurs du Québec.

6.2 Suivi des émissions de bruit

La méthode de référence pour la mesure du bruit, comprenant notamment les caractéristiques techniques des appareils de mesures, la vérification annuelle de la précision des appareils et les relevés sonores, devra être conforme à la version la plus récente de la note d'instruction NI-98-01 sur le bruit.

Les données de suivi devront être disponibles sur demande.

SECTION 7 - AUTRES CONDITIONS D'EXPLOITATION

D'autres conditions d'exploitation applicables à l'établissement et visées au paragraphe 3° du 1er alinéa de l'article 27 de la Loi sont présentées ci-après.

Condition 10 : Contrôle des émissions de poussières : L'exploitant minimise la production de poussière générée par ses opérations par l'utilisation d'eau, d'abat-poussières normés BNQ, de tapis lors des sautages ou par toute autre méthode appropriée.

Condition 11 : Traitement des sols contaminés par biopiles : Des mesures de concentration des COV de la sortie d'air seront effectuées quatre à cinq fois par année. Si des COV sont détectés, le charbon activé du système de traitement sera changé. Les données de suivi des émissions de COV de la plateforme de traitement des sols contaminés doivent être colligées en registre. Le registre doit être conservé pendant 5 ans et être disponible pour consultation par le Ministère.

SECTION 8 - ÉTUDES

Aucune étude n'est prévue dans le cadre de cette autorisation.

PARTIE III – ÉMISSIONS ATMOSPHÉRIQUES ET BRUIT

Tableau III-1 : Points d'émissions - Normes d'émissions - Exigences de suivi

	Points d'émission				Exigences			
	1	2	3	4	5	6	7	8
Opération/procédé	**No**	**Description**	**Sources**	**Capacité / Description de l'épuration**	**Paramètre**	**Norme réglementaire**	**Norme supplémentaire**	**Exigences de suivi**
Extraction du minerai	PT-2 PT-3	Cheminées à remblai (R9)	Remblai des chantiers souterrains	Aucune épuration	Particules	30 mg/m³R (RAA, art. 10)	Aucune	Aucune
	PT-4 PT-5 PT-6	Cheminées à remblai (R4)	Remblai des chantiers souterrains	Aucune épuration				
	PED-2	Émissions diffuses	Halde à stériles Manutention et rejet du stérile	Arrosage par temps sec	Particules	Non visibles à plus de 2 m du point d'émission (RAA, art. 12) (transfert, chute et manutention)	Aucune	Inspection hebdomadaire
	PED-3	Émissions diffuses	Halde à mort-terrain Manutention et rejet du mort-terrain	Arrosage par temps sec				
	PED-4	Émissions diffuses	Haldes à minerai Manutention et entreposage temporaire du minerai	Aucune épuration				
	PED-5	Émissions diffuses	Fosse R2 et R3 Opérations de forage, dynamitage et manutention (minerai, stériles et mort-terrain)	Aucune épuration Utilisation de tapis pour limiter les émissions de poussières lors du dynamitage				
	PED-6	Émissions diffuses	Fosse R-65 Opérations de forage, dynamitage et manutention (minerai, stériles et mort-terrain)	Aucune épuration Utilisation de tapis pour limiter les émissions de poussières lors du dynamitage				

PARTIE III – ÉMISSIONS ATMOSPHÉRIQUES ET BRUIT

Tableau III- 1 : Points d'émissions - Normes d'émissions - Exigences de suivi

	Points d'émission				Exigences			
	1	2	3	4	5	6	7	8
Opération/ procédé	**No**	**Description**	**Sources**	**Capacité / Description de l'épuration**	**Paramètre**	**Norme réglementaire**	**Norme supplémentaire**	**Exigences de suivi**
Traitement du minerai	**PT-1**	Émissions diffuses	Silo de rechargement de l'usine de traitement du minerai Déchargement du minerai tout-venant concassé pour l'alimentation de l'usine	Aucune épuration	Particules	Non visibles à plus de 2 m du point d'émission (RAA, art. 12) (transfert, chute et manutention)	Aucune	Aucune
	PT-7	Émissions diffuses	Alimentation du concasseur primaire Déchargement du minerai pour l'alimentation du concasseur primaire	Aucune épuration				
	PEP-3	Cheminée du concasseur primaire	Concasseur primaire concassage et transfert du minerai)	Dépoussiéreur à manches Wheelabrator Jet III 1012 Capacité : 14 272 m³/h	Particules	30 mg/m³R (RAA, art. 10)	Aucune	Inspection hebdomadaire de l'épurateur et tenue d'un registre
	PEP-4	Cheminée	Concassage et transfert de minerai (points de transfert et convoyeurs dans le secteur de l'usine abritant le concasseur à cône et les rouleaux broyeurs è haute pression (HPGR))	Dépoussiéreur par voie humide AirPol Flooded-wall Capacité : 26 504 m³/h				
	PEP-5	Recirculation de l'air traité	Installation de manutention du ferrosilicium (FeSi)	Dépoussiéreur à manches Donaldson Filtration DFO 2-8 Capacité : 3 636 m³/h	Particules	30 mg/m³R (RAA, art. 10)	Aucune	Inspection mensuelle de l'épurateur et tenue d'un registre

PARTIE III – ÉMISSIONS ATMOSPHÉRIQUES ET BRUIT

	Points d'émission				Exigences			
	1	2	3	4	5	6	7	8
Opération/ procédé	No	Description	Sources	Capacité / Description de l'épuration	Paramètre	Norme réglementaire	Norme supplémentaire	Exigences de suivi
	PEP-6	Cheminée	Circuit de récupération et de triage des diamants (section rouge de l'usine : analyseur par rayons X, cribles de classement, épurateurs aux UV, boîtes à gant, séchoirs et trémies)	Dépoussiéreur à manches Donaldson Filtration DFO 4-24 Capacité : 13 840 m³/h	Particules	30 mg/m³R (RAA, art. 10)	Aucune	Inspection hebdomadaire de l'épurateur et tenue d'un registre
		Cyclone	Trieuse primaire (1er stage)	Marque : Donaldson Co. inc. Modèle : Model 24 Capacité : 5 945 m³/h	Particules	30 mg/m³R (RAA, art. 10)	Aucune	Inspection hebdomadaire et tenue d'un registre
		Cyclone	Trieuse primaire (2e stage)	Marque : Donaldson Co. inc. Modèle : Model 24 Capacité : 5 945 m³/h	Particules	30 mg/m³R (RAA, art. 10)	Aucune	Inspection hebdomadaire et tenue d'un registre
		Cyclone	Première trieuse secondaire (1er stage)	Marque : Donaldson Co. inc. Modèle : Model 24 Capacité : 9 545 m³/h	Particules	30 mg/m³R (RAA, art. 10)	Aucune	Inspection hebdomadaire et tenue d'un registre
		Cyclone	Deuxième trieuse secondaire (1er stage)	Marque : Donaldson Co. inc. Modèle : Model 24 Capacité : 5 945 m3/h	Particules	30 mg/m³R (RAA, art. 10)	Aucune	Inspection hebdomadaire et tenue d'un registre
		Cyclone	Troisième trieuse secondaire (2e stage)	Marque : Donaldson Co. inc. Modèle : Model 24 Capacité : 5 945 m3/h	Particules	30 mg/m³R (RAA, art. 10)	Aucune	Inspection hebdomadaire et tenue d'un registre

PARTIE III – ÉMISSIONS ATMOSPHÉRIQUES ET BRUIT

Tableau III- 1 : Points d'émissions - Normes d'émissions - Exigences de suivi

	Points d'émission				Exigences			
	1	2	3	4	5	6	7	8
Opération/ procédé	**No**	**Description**	**Sources**	**Capacité / Description de l'épuration**	**Paramètre**	**Norme réglementaire**	**Norme supplémentaire**	**Exigences de suivi**
Traitement du minerai	**PED-1**	Émissions diffuses	AKUM Rejet de la kimberlite usinée et érosion éolienne de la pile	Aucune épuration Arrosage par temps sec ou abat-poussières normés Recouvrement par une couche de protection (voir partie IV) Revégétalisation progressive	Particules	Non visibles à plus de 2 m du point d'émission (RAA, art. 12) (transfert, chute et manutention)	Aucune	Inspection mensuelle
	PED-7	Émissions diffuses	Pile d'entreposage du minerai tout-venant Manutention et entreposage du minerai tout-venant	Aucune épuration Gicleurs à eau utilisés au besoin				
	PED-8	Émissions diffuses	Pile de minerai tout-venant concassé Déchargement du minerai tout-venant pour entreposage temporaire	Aucune épuration Gicleurs à eau utilisés au besoin				
Génération d'électricité	**PEP-7**	Huit cheminées à la centrale électrique au gaz naturel	Huit génératrices cinq fonctionnent simultanément	Aucune épuration Caterpillar G3520CIM de 2,055 MW au gaz naturel chacune	**Particules**	Fonction puissance (art. 64 et +)	Aucune	Aucune
					Oxydes d'azote (NO_x)	Selon la puissance du moteur et le combustible utilisé (RAA, art. 52)		
	PEP-8	Chauffage de la mine souterraine	Brûleurs au gaz naturel	Modèle : APX 15 Capacité totale : 135 MM btu/h	**Particules**	Fonction puissance (art. 64 et +)	Aucune	Échantillonnage 1x/3 ans
					Oxydes d'azote (NO_x)	Selon la puissance du moteur et le combustible utilisé (RAA, art. 52)		

PARTIE III – ÉMISSIONS ATMOSPHÉRIQUES ET BRUIT

Tableau III- 1 : Points d'émissions - Normes d'émissions - Exigences de suivi

	Points d'émission				Exigences			
	1	2	3	4	5	6	7	8
Opération/ procédé	**No**	**Description**	**Sources**	**Capacité / Description de l'épuration**	**Paramètre**	**Norme réglementaire**	**Norme supplémentaire**	**Exigences de suivi**
Opérations minières	PED-9	Émissions diffuses	Voies de circulation non pavées (chemins de halage et autres)	Aucune épuration Utilisation d'abat-poussières au besoin	Particules	Non visibles à plus de 2 m du point d'émission (RAA, art. 12) (transfert, chute et manutention)	Aucune	Inspection mensuelle
	PED-10	Émissions diffuses	Plateforme de gravier pour entreposage des matériaux, le stationnement de la machinerie, l'implantation des bâtiments, etc.	Aucune épuration Utilisation d'abat-poussières au besoin				
Plateforme traitement sols contaminés	PEP-9	Cheminée(s) (inexistante en ce moment)	Plateforme de traitement des sols contaminés (biorestauration en piles des sols contaminés, secteur LEET)	Filtres à charbon activé (2 barils en série)	COV	Si des COV sont détectés à la sortie du 1er baril de charbon activé, le 1er baril sera remplacé par le second et un nouveau baril sera installé à la suite.		Voir la condition 11 à la section 7. Mesure 4 à 5 fois par année Suivi pour détecter la présence de COV.

Tableau III- 2 : Indicateurs proposés pour le suivi des émissions

LISTE NON LIMITATIVE DES INDICATEURS DE PERFORMANCE		PARC À RÉSIDUS, HALDES À STÉRILES ET LIEUX D'ENTREPOSAGE DU MINERAI
Épurateur à sec / dépoussiéreur	**Épurateur humide**	
• détecteurs de fuites passifs (résidus dans les éprouvettes); • pressions différentielles aux éléments filtrants (Δp); • temps entre deux décolmatages; • pression d'air comprimé au décolmatage; • position du volet; • état des vannes solénoïdes (son); • état de la courroie du ventilateur (visuel); • fuites à la cheminée (visuel).	• perte de charge (pressions différentielles) à travers l'épurateur incluant l'éliminateur de gouttelettes; • pression des liquides d'épuration mesurée à l'entrée de la conduite d'amenée (débit du liquide d'épuration recirculé); • débit des liquides d'épuration mesuré à l'entrée de la conduite d'amenée (débit du liquide d'épuration recirculé).	• Présence d'érosion éolienne; • Poussières visibles à plus de 2 mètres.

Tableau III- 3 : Station de surveillance du bruit

Nº de la station	Localisation	Description de l'équipement	Niveau sonore maximum (dBA)		Fréquence et type de suivi
			Jour 7h – 19h	Nuit 19h – 7h	
SOR1	À la limite des aires du complexe d'habitation et de services Coordonnées géodésiques : 52º 48' 36.360" N 72º 11' 56.400" O	Sonomètre	Selon la note d'instructions 98-01 sur le bruit		1x/année Relevé sur 24 h Selon le protocole de la note d'instructions 98-01

Tableau III- 4 : Station de surveillance des ondes sismiques

N° de la station	Localisation	Description de l'équipement	Limite des heures de sautage	Paramètre	Norme		Fréquence et type de suivi
					Fréquence des vibrations au sol (Hertz)	Vitesse maximale permise (mm/s)	
SOR1	À la limite des aires du complexe d'habitation et de services Coordonnées géodésiques : 52° 48' 36.360" N 72° 11' 56.400" O	Sismographe	Aucune limite des heures de sautage	Vitesse maximale des vibrations permises au sol	≤ 15	12,7	Lors de chaque opération de sautage (mine à ciel ouvert et mine souterraine)
					> 15 et ≤ 20	19,0	
					> 20 et ≤ 25	23,0	
					> 25 et ≤ 30	30,5	
					> 30 et ≤ 35	33,0	
					> 35 et ≤ 40	38,0	
					> 40	50,0	
					Seuil maximal des pressions d'air		
				Seuil maximal des pressions d'air	128 dB		

APPENDIX III

NOTES ON WATER QUALITY CRITERIA AND RECOMMENDATIONS

Annexe III Notes sur les critères et recommandations pour la qualité de l'eau

a Stratification thermique : Les apports thermiques ne devraient pas modifier la stratification thermique et les dates d'inversion d'origine des eaux réceptrices. Température moyenne hebdomadaire maximale : Les apports thermiques ne devraient pas porter la température des eaux réceptrices au-delà de la température moyenne hebdomadaire maximale. Exposition à court terme à une température extrême : Les apports thermiques devraient être tels que les expositions à court terme aux températures maximales ne soient pas dépassées. Les expositions ne devraient être ni de longueur ni de fréquence nuisant aux espèces importantes.

b Concentration minimale acceptable d'oxygène dissous :
premiers stades du cycle biologique = 6,0 mg/l
autres stades du cycle biologique = 5,5 mg/l
pour le biote d'eau froide : premiers stades du cycle biologique = 9,5 mg/l
autres stades du cycle biologique = 6,5 mg/l

c L'augmentation maximum de 8 NTUs du niveau de teneurs de fond naturelles pour une exposition à court terme (par exemple, période 24-h). L'augmentation moyenne maximum de 2 NTUs du niveau de teneurs de fond naturelles pour une exposition à plus long terme (par exemple, période 30-jours). L'augmentation maximum de 8 NTUs du niveau de teneurs de fond naturelles n'importe quand quand les niveaux de teneurs de fond naturelles sont entre 8 et 80 NTUs. Ne doivent pas augmenter plus de 10 % de niveaux des teneurs de fond naturelles quand le teneur de fond naturelle est 80 NTUs.

d L'augmentation maximum de 25 mg/l des niveaux des teneurs de fond naturelles pour n'importe quelle exposition à court terme (par exemple, période 24-h). L'augmentation moyenne maximum de 5 mg/l des niveaux des teneurs de fond naturelles pour des expositions à plus long terme (par exemple, entrées durant entre 24 h et 30 jours). L'augmentation maximum de 25 mg/l des niveaux des teneurs de fond naturelles à tout moment quand les niveaux de teneurs de fond naturelles sont entre 25 et 250 mg/l. Ne devrait pas augmenter plus de 10 % des niveaux des teneurs de fond naturelles quand la teneur de fond naturelle est > 250 mg/l.

e Le Cadre d'orientation pour le phosphore est pour développer les recommandations pour le phosphore (ne fournit pas des conseils sur d'autres nutriments d'eau douce). Il fournit des gammes de déclenchement pour le phosphore total (s'il vous plaît, consultez le feuillet d'information Cadre d'orientation pour le phosphore pour plus d'information): Ultra-oligotrophe <0,004 mg/l Oligotrophe 0,004 à 0,01 mg/lMésotrophe 0,01 à 0,02 mg/l Méso-eutrophe 0,02 à 0,035 mg/lEutrophe 0,035 à 0,1 mg/lHypereutrophe > 0,1 mg/l

f 0,005 mg/l à un pH <6,5 et 0,1 à un pH ≥6,5.

g La RCQE pour le cuivre est fonction de la dureté de l'eau. Lorsque la dureté de l'eau est de 0 à <82 mg de $CaCO_3$/l, la RCQE est de 0,002 mg/l.

h La RCQE pour le nickel est fonction de la dureté de l'eau. Lorsque la dureté de l'eau est de 0 à ≤60 mg de $CaCO_3$/l, la RCQE est de 0,025 mg/l.

i La RCQE pour le plomb est fonction de la dureté de l'eau. Lorsque la dureté de l'eau est de 0 à ≤60 mg de $CaCO_3$/l, la RCQE est de 0,001 mg/l.

j Un pH de 6,0 à 9,5 est exigé à l'effluent dans la directive sur les mines et la majorité des règlements du Ministère sur les rejets industriels. Cette exigence satisfait l'objectif de protection du milieu aquatique.

k

Intervalle de pH	Effet
3,0 – 3,5	Il est peu vraisemblable qu'un poisson puisse survivre plus de quelques heures dans cet intervalle bien qu'il soit possible de trouver certaines plantes et certains invertébrés à des pH inférieurs.
3,5 – 4,0	Cet intervalle est létal aux salmonidés. Il existe des indications montrant que la chatte de l'est, la tanche, la perche fluviatile et le brochet peuvent survivre dans cet intervalle, vraisemblablement après une période d'acclimatation à des concentrations non létales légèrement plus élevées, mais la limite inférieure de cet intervalle peut encore être létale à la chatte de l'est.
4,0 – 4,5	Vraisemblablement nocif aux salmonidés, à la tanche, à la brème, à la chatte de l'est, à la dorade et à la carpe commune qui ne sont pas acclimatés à de faibles pH, bien que leur résistance dans cet intervalle augmente avec leur taille et leur âge. Les poissons peuvent s'acclimater à ces valeurs, mais de la perche, la brème, la chatte de l'est et le brochet, seul ce dernier peut se reproduire.
4,5 – 5,0	Vraisemblablement nocif aux œufs et à l'alevin des salmonidés, ainsi qu'aux adultes particulièrement dans des eaux douces contenant de faibles concentrations de calcium, de sodium et de chlorure. Peut être nocif à la carpe commune.
5,0 – 6,0	Nocivité improbable pour toutes les espèces, à moins que la concentration de l'anhydride carbonique libre soit supérieure à 20 mg/l ou que l'eau contient des sels de fer fraîchement précipités sous forme d'hydroxyde ferrique dont la toxicité exacte est inconnue. La limite inférieure de cet intervalle peut être nocive aux salmonidés non acclimatés si les concentrations de calcium, de sodium et de chlorure sont faibles ou si la température de l'eau est basse, et peut aussi être nuisible à la reproduction de la chatte de l'est.
6,0 – 6,5	Vraisemblablement non nocif aux poissons à moins que la concentration de l'anhydride carbonique libre dépasse 100 mg/l.
6,5 – 9,0	Non nocif aux poissons, bien que la toxicité d'autres poissons puisse être modifiée par des changements à l'intérieur de cet intervalle.
9,0 – 9,5	Vraisemblablement nocif aux salmonidés et à la perche fluviatile, si cet intervalle persiste.
9,5 – 10,0	Létal aux salmonidés sur une longue période, mais tolérable sur une courte période. Peut être nocif aux stades de développement de certaines espèces.
10,0 – 10,5	Tolérable par la chatte de l'est et les salmonidés sur une courte période, mais létal sur une longue période.
10,5 – 11,0	Rapidement létal aux salmonidés. Une exposition prolongée à la limite supérieure de cet intervalle est létale à la carpe, à la tanche, à la dorade et au brochet.
11,0 – 11,5	Rapidement létal à toutes les espèces.

Annexe Ifl Notes sur les critères et recommandations pour la qualité de l'eau *(suite)*

l Cette concentration est une concentration maximale acceptable (CMA) définie pour l'eau potable.

m En eau limpide(*), le critère de qualité est défini par une augmentation moyenne maximale de 2 uTN par rapport à la valeur naturelle ou ambiante (non influencée par une source ponctuelle affectant la turbidité de l'eau, par une pluie importante ou par la fonte) selon le contexte.En eau turbide(*), le critère de qualité est défini, soit : (en révision) - par une augmentation maximale en tout temps de 8 uTN par rapport à la valeur ambiante lorsque celle-ci est de 8 à 80 uTN; - par une augmentation de 10 % par rapport à la valeur ambiante lorsque celle-ci est supérieure à 80 uTN mesurée à un moment donné.Ces critères de qualité s'appliquent aux eaux douces (dulçaquicoles), estuariennes et marines.(*) Les termes "eau limpide" et "eau turbide" réfèrent à la portion d'un hydrogramme où les concentrations de matières en suspension sont respectivement basses (<25 mg/L) et élevées (>25 mg/L)) (Caux et al., 1997). Les teneurs peuvent être élevées en raison des caractéristiques naturelles du milieu (par exemple, dans la zone de turbidité maximale du Saint-Laurent) ou, périodiquement, en raison des conditions climatiques.

n En eau limpide(*), le critère de qualité est défini par une augmentation maximale de 8 uTN par rapport à la valeur naturelle ou ambiante (non influencée par une source ponctuelle affectant la turbidité de l'eau, par une pluie importante ou par la fonte) selon le contexte.Ce critère de qualité s'applique aux eaux douces (dulçaquicoles), estuariennes et marines.(*) Le terme "eau limpide" réfère à la portion d'un hydrogramme où les concentrations de matières en suspension sont basses (<25 mg/L) (Caux et al., 1997). Les teneurs peuvent être élevées en raison des caractéristiques naturelles du milieu (par exemple, dans la zone de turbidité maximale du Saint-Laurent) ou, périodiquement, en raison des conditions climatiques.

o La sensibilité d'un milieu à l'acidification varie avec l'alcalinité :
Sensibilité Concentration (mg de $CaCO_3$/L)
élevée ------------ < 10
moyenne ------ 10-20
faible ------------- > 20

p En eau limpide(*), le critère de qualité est défini par une augmentation moyenne maximale de 5 mg/L par rapport à la concentration naturelle ou ambiante (non influencée par une source ponctuelle de matières en suspension, par une pluie importante ou par la fonte) selon le contexte. En eau turbide(*), le critère de qualité est défini soit : (en révision) - par une augmentation maximale en tout temps de 25 mg/L par rapport à la concentration ambiante lorsque celle-ci est de 25 à 250 mg/L; - par une augmentation de 10 % par rapport à la concentration ambiante lorsque celle-ci est supérieure à 250 mg/L mesurée à un moment donné.Ces critères de qualité s'appliquent aux eaux douces (dulçaquicoles), estuariennes et marines.(*) Les termes "eau limpide" et "eau turbide" réfèrent à la portion d'un hydrogramme où les concentrations de matières en suspension sont respectivement basses (<25 mg/L) et élevées (>25 mg/L) (Caux et al., 1997). Les concentrations peuvent être élevées en raison des caractéristiques naturelles du milieu (par exemple, dans la zone de turbidité maximale du Saint-Laurent) ou, périodiquement, en raison des conditions climatiques.

q En eau limpide(*), le critère de qualité est défini par une augmentation maximale de 25 mg/L par rapport à la concentration naturelle ou ambiante (non influencée par une source ponctuelle de matières en suspension, par une pluie importante ou par la fonte) selon le contexte. Ce critère de qualité s'applique aux eaux douces (dulçaquicoles), estuariennes et marines.(*) Le terme "eau limpide" réfère à la portion d'un hydrogramme où les concentrations de matières en suspension sont basses (<25 mg/L) (Caux et al., 1997). Les teneurs peuvent être élevées en raison des caractéristiques naturelles du milieu (par exemple, dans la zone de turbidité maximale du Saint-Laurent) ou, périodiquement, en raison des conditions climatiques.

r Cette valeur correspond au déficit maximal tolérable en oxygène pour la vie aquatique à une température estivale moyenne de 21 °C.

s Le critère de qualité pour l'azote ammoniacal varie avec le pH et la température. Les valeurs données sont les plus restrictives en considérant le pH et la température de l'eau mesurés sur le site du projet Renard entre 2002 et 2010.

t La présence d'azote ammoniacal à des concentrations plus élevées peut compromettre l'efficacité de la désinfection.

u Au-delà de cette concentration, les propriétés organoleptiques ou esthétiques de l'eau de consommation pourront être altérées.

v Certains facteurs influencent l'effet potentiel du phosphore. Les principaux facteurs physiques généralement mentionnés sont : le type de substrat, la profondeur, la transparence et la température de l'eau, la vitesse du courant et l'ombrage. Ces caractéristiques ne sont pas prises en compte par les critères de qualité. C'est pourquoi il faut utiliser judicieusement les critères de qualité du phosphore selon le milieu évalué.Les critères de qualité suivants peuvent être utilisés pour évaluer la détérioration d'un lac. Ces critères de qualité ne doivent toutefois pas servir à évaluer les charges de phosphore qui peuvent être rejetées.- Pour les lacs oligotrophes dont la concentration naturelle est ou était de moins de 0,01 mg/L, le critère de qualité est défini par une augmentation maximale de 50 % par rapport à la concentration naturelle sans dépasser 0,01 mg/L.- Pour limiter l'eutrophisation des lacs dont la concentration naturelle se trouve ou se trouvait entre 0,01 et 0,02 mg/L, le critère de qualité est défini par une augmentation maximale de 50 % par rapport à la concentration naturelle, sans dépasser 0,02 mg/L.Ces critères de qualité s'appliquent en période sans glace.0,03: Ce critère de qualité vise à limiter la croissance excessive d'algues et de plantes aquatiques dans les ruisseaux et les rivières. Cette valeur protectrice pour les cours d'eau, n'assure pas toujours la protection des lacs en aval.

w Ce critère de qualité est en révision. Cette valeur est établie à partir des effets toxiques et ne tient pas compte des effets indirects d'eutrophisation.

x Cette concentration est une concentration maximale acceptable (CMA) définie pour l'eau potable. La concentration totale en nitrates et nitrites ne doit pas dépasser 10 mg/L.

y Les concentrations permissibles en nitrites augmentent avec les concentrations en chlorures du milieu aquatique. La valeur donnée est pour une concentration en chlorures inférieure à 2 mg/l.

z Ce critère de qualité est qualifié de provisoire. Ce critère de qualité a été calculé à partir de données de toxicité pour de faibles duretés (≤ 120 mg de $CaCO_3$/l).

A Cette concentration est une concentration maximale acceptable (CMA) définie pour l'eau potable. Il est toutefois recommandé d'ajuster la concentration de fluorures à 1,0 mg/L, soit le niveau optimal pour lutter contre la carie dentaire. Une concentration de 1,2 mg/L doit être maintenue aux endroits où la moyenne annuelle des températures maximales quotidiennes est inférieure à 10 °C.

B Ce critère de qualité s'applique aux eaux dont la dureté est < 100 mg/L et dont la concentration en chlorures est < 5 mg/L.

C Au-delà de cette concentration, les propriétés organoleptiques ou esthétiques de l'eau de consommation pourront être altérées. Une concentration supérieure à 500 mg/L de sulfates peut avoir un effet laxatif sur certaines personnes.

D Ce critère de qualité a été défini pour des eaux de **faible dureté (< 10 mg/L)** et dont le **pH est d'environ 6,5**. Lorsque le milieu aquatique ne s'approche pas de ces conditions, ce critère ne doit pas être utilisé. Lorsque le critère est utilisé, les **données d'eau de surface doivent être corrigées** pour réduire la fraction non biodisponible du métal associée aux particules. Un facteur de correction de 0,66 est utilisé pour les données d'eau de surface ayant une concentration en matières en suspension < 5 mg/L. Un facteur de correction de 0,33 est utilisé pour les données d'eau de surface ayant une concentration en matières en suspension ≥ 5 mg/L. Un critère de qualité propre au site peut aussi être déterminé au cas par cas. Certaines eaux de surface de bonne qualité peuvent présenter des teneurs naturelles plus élevées que le critère de qualité de l'eau. Dans une telle situation, les teneurs naturelles doivent être considérées comme la valeur de référence plutôt que le critère de qualité.

E Il ne devrait pas y avoir d'effets toxiques à cette concentration si le pH se maintient entre 6,5 et 9,0.

F «En raison des possibilités limitées d'utiliser les données obtenues en expérimentation animale comme modèle pour l'homme et de l'incertitude entachant les données humaines, il est impossible de déterminer une valeur guide reposant sur des arguments sanitaires. Néanmoins, l'optimisation des procédés de coagulation utilisant des agents coagulants à base d'aluminium dans les installations de traitement de l'eau de boisson a conduit à la définition de valeurs limites pratiques: 0,1 mg/l ou moins dans les grandes installations de traitement de l'eau et **0,2 mg/l ou moins** dans les petites installations de traitement de l'eau.» (OMS 2004)

G La sensibilité d'un milieu à l'acidification varie avec la concentration en calcium :
Sensibilité Concentration (mg/L)
élevée ------------ < 4
moyenne ------ 4-8
faible ------------- > 8

H Les critères pour certains métaux varient en fonction de la dureté. Les critères ont été calculés pour une dureté de moins de 10 mg de $CaCO_3$/l.

I Ce critère de qualité a été défini à partir d'un problème esthétique cutané nommé argyria. Cette valeur est définie pour l'eau potable.

J Les critères de qualité de l'U.S.EPA, qu'ils s'appliquent aux eaux douces, saumâtres ou salées, ont été définis à partir de données sur l'arsenic III, mais s'appliquent ici à l'arsenic total, ce qui signifie que la toxicité de l'arsenic III et V est considérée comme étant égale et additive.

K Cette concentration est une concentration maximale acceptable (CMA) définie pour l'eau potable. Il s'agit de la concentration d'arsenic qui représente un risque sanitaire « essentiellement négligeable ». Santé Canada défini le terme « essentiellement négligeable » comme étant une plage allant d'un nouveau cas de cancer de plus que le niveau de fond pour 100 000 personnes à un nouveau cas de cancer de plus que le niveau de fond pour 1 million de personnes (p. ex., 10-5 à 10-6) au cours de la durée d'une vie.
Ce critère est utilisé dans un contexte de prévention de la contamination de l'eau de surface, c'est pourquoi il diffère de la norme d'eau potable. Certaines eaux de surface de bonne qualité peuvent contenir des concentrations naturelles plus élevées que le critère de qualité.

L Ce critère de qualité équivaut à un niveau de risque d'un cas de cancer supplémentaire pour une population d'un million d'individus exposés. Ce critère de qualité s'applique à la forme inorganique seulement. Critère de qualité intérimaire.

M Cette concentration est une concentration maximale acceptable (CMA) définie pour l'eau potable.

N La toxicité du cuivre diminue lorsque la concentration en carbone organique dissous est élevée (U.S.EPA, 1998).

O Au-delà de cette concentration, les propriétés organoleptiques ou esthétiques de l'eau de consommation pourront être altérées.

P Ce critère de qualité est qualifié de provisoire. Ce critère de qualité pourrait ne pas être protecteur pour l'éphémère (*Ephemerella subvaria*) si cette espèce est aussi sensible que certaines données l'indiquent. Avant d'être comparées à ce critère de qualité, les données de qualité d'eau de surface doivent être corrigées pour réduire la fraction du métal non biodisponible associée aux particules. Un facteur de correction de 0,5 est utilisé sur les données d'eau de surface ayant une concentration en matières en suspension < 10 mg/L. Un facteur de correction de 0,33 est utilisé sur les données d'eau de surface ayant une concentration en matières en suspension ≥ 10 mg/L. Certaines eaux de surface de bonne qualité peuvent contenir des teneurs naturelles plus élevées que le critère de qualité. Dans ces situations, les teneurs naturelles doivent être considérées comme la valeur de référence plutôt que le critère de qualité. Un critère de qualité propre au site peut aussi être déterminé au cas par cas.

Q Au-delà de cette concentration, les propriétés organoleptiques ou esthétiques de l'eau de consommation pourront être altérées. Certaines eaux de surface de bonne qualité peuvent avoir des concentrations naturelles plus élevées.

R Cette valeur est définie pour l'eau potable.

Annexe III Notes sur les critères et recommandations pour la qualité de l'eau *(suite)*

S Ce critère de qualité est basé sur une consommation de 15 grammes de poisson, mollusque et crustacé par jour. Ce critère de qualité inclut le méthylmercure.

T À partir de données présentées dans U.S.EPA (1976b), le Ministère opte pour un critère de qualité opérationnel de 10 µg/L pour les hydrocarbures pétroliers. D'autres critères existent pour les différents types de produits pétroliers.

U Ce critère de qualité sert à éviter l'altération du goût ou de la couleur du poisson.

V Ce critère de qualité est applicable à l'eau brute destinée à l'approvisionnement en eau potable lorsque cette eau fait l'objet d'un traitement par filtration. Il permet d'éviter la mise en place de procédés de traitement supplémentaires. Ce critère de 200 UFC/100 ml (ou 150 bactéries E. coli/100 ml) s'applique à la moyenne arithmétique des échantillons qui doit correspondre à la moyenne mobile la plus élevée des résultats obtenus pendant 12 mois consécutifs, établie à partir d'une période de référence d'au moins 36 mois.

W Toute diminution ou augmentation artificielle de la température ne doit pas:
- modifier la température de l'eau sur tout un tronçon de rivière ou une portion de lac avec pour résultat le déplacement prévisible ou la modification des populations aquatiques présentes ou potentielles;
- altérer certaines zones sensibles localisées, telle une frayère;
- tuer les organismes vivants à proximité d'un rejet.

De plus, le milieu ne doit pas subir de changements brusques de température occasionnés, par exemple, par un arrêt subit d'un rejet thermique en saison froide.

X Les concentrations en oxygène dissous ne devraient pas être inférieures aux valeurs suivantes:

	Concentration d'oxygène dissous			
	Biote d'eau froide		Biote d'eau chaude	
Température (°C)	% Saturation	mg/L	% Saturation	mg/L
0	54	8	47	7
5	54	7	47	6
10	54	6	47	5
15	54	6	47	5
20	57	5	47	4
25	63	5	48	4

Dans les eaux habitées par des communautés biologiques sensibles, la présence d'un stress physique ou chimique additionnel peut nécessiter l'utilisation de limites plus contraignantes.
Dans les eaux de l'hypolimnion, la concentration naturelle en oxygène dissous est parfois plus faible que les concentrations mentionnées ci-haut. Cet état ne doit pas être aggravé par l'ajout de matières biodégradables qui causeront une baisse d'oxygène dans le milieu.

Y Ce critère de qualité est qualifié de provisoire. Ce critère de qualité s'applique aux eaux de dureté variant de 20 à 100 mg/L ($CaCO_3$).

aa Comme cette substance nécessite une grande quantité d'O_2 pour être dégradée, il faut s'assurer, pour protéger la vie aquatique, que le critère de qualité pour l'oxygène dissous est aussi respecté.

APPENDIX IV

Letter from DFO

End of Fish Habitat Compensation
Works Monitoring

C and D Stretches of Route 167 Nord

Pêches et Océans Canada | Fisheries and Oceans Canada

Gestion des écosystèmes
Région du Québec

Ecosystems Management
Quebec Region

Classif. sécurité / Security

Le 18 mai 2018

Par courriel seulement

Votre réf. / Your ref.

Notre réf. / Our ref.
10-HQUE-LZ3-00032

Monsieur Martin Boucher
Directeur, Développement durable
Les Diamants Stornoway (Canada) inc.
1111, rue Saint-Charles Ouest
Bureau 400, Tour Ouest
Longueuil (Québec) J4K 5G4

Objet: Suivis, Projet de construction de ponts et ponceaux, desserte routière, route 167 nord, Monts Otish, lot C et lot D (km 143 à 240)

Monsieur,

Le Programme de protection des pêches de Pêches et Océans Canada (le Programme) a complété l'analyse des suivis associés au projet indiqué en rubrique, à partir des informations qui nous ont été fournies dans les documents cités ci-dessous :

- Correspondance de Benjamin Jacob (Les Diamants Stornoway Canada inc) à Mélissa Karen Bruneau (Les Diamants Stornoway Canada inc). 16 mai 2018. Rapport de suivi additionnel 2016 du libre passage du poisson dans certains ponceaux de la route 167 Nord. Mémo. Quatre pages et annexes.
- Les Diamants Stornoway (Canada) inc. Mars 2018. Projet de compensation – Route 167 nord Rapport de suivi 2017. 24 pages et annexes.

Nous sommes d'avis que les suivis effectués démontrent que les aménagements ont permis d'atteindre les objectifs à la satisfaction du Programme.

Les termes de l'autorisation 2013-011 émise le 12 avril 2013 pour les travaux de construction de ponts et ponceaux de la route 167 nord vers les Monts Otish sur les lots C et D (km 143 à 240) ont été respectés. Nous considérons ce projet comme terminé.

Pour toute question, n'hésitez pas à communiquer avec Marie-Pierre Veilleux par téléphone au 418-775-0895, par télécopieur au 418-775-0658 ou par courriel à Marie-Pierre.Veilleux@dfo-mpo.gc.ca.

Veuillez agréer, Monsieur, mes salutations distinguées.

Marie-Pierre Veilleux
Biologiste, Protection des pêches - Examens réglementaires

c. c. Mélissa Karen Bruneau, Surintendante Environnement, Les Diamants Stornoway

Canada

APPENDIX V

HSS-3.6. Procedure

Procedure in the Event of Encounters with Wild Animals

	Nom/Name	Fonction/Function	Signature	Date
Préparé par/Prepared by:	Benjamin Jacob	Biologiste / Biologist		13/08/2017
Révisé par/ Revised by:	Michel Lafrenière	Coordonnateur SST/ OHS Coordinator		31/03/2019
Approuvé par/Approved by:	Claude Fortin	Surintendant SST/ OHS superintendant		20/07/2019

1.0 Objet

Cette procédure a pour objectif de communiquer les lignes directrices en matière de pratiques sécuritaires en présence d'animaux sauvages, en particulier des ours noirs, pouvant se retrouver près des sites d'opération de la Société Les Diamants Stornoway (Canada) (SWY). Elle traite de la prévention, de l'identification des risques et de l'intervention en cas de rencontre importune.

1.0 Subject

This procedure aims to communicate the guidelines regarding safe practices in presence of wild animals, particularly black bears, near operation sites of Stornoway Diamonds Corporation (Canada) (SWY). It relates to prevention, risk identification, and intervention in the event of an unwelcome encounter.

2.0 Portée

Cette procédure s'applique à l'ensemble des employés et entrepreneurs ayant à intervenir sur les sites de SWY.

2.0 Scope

This procedure applies to all employees and contractors having to work on SWY sites.

3.0 Définitions

Dans le cadre de cette procédure, les mots, termes, acronymes ou abréviations suivants sont définis comme suit :

3.0 Definitions

As part of this procedure, the following words, terms, acronyms or abbreviations are defined as follows:

Mots, termes, acronymes ou abréviations	Définition	Words, terms, acronyms and abbreviations	Definition
Dispositif de répulsion sonore	Dispositif émettant un son qui aura pour effet de faire fuir l'animal sauvage. Il peut s'agir d'un sifflet, d'une sirène, d'une cloche ou d'un "Bear Banger" consistant en un dispositif émettant une détonation. Ce dispositif informe par la même occasion les autres membres du personnel à proximité.	Sound repellent device	A device that emits a sound that will effectively scare away wild animals. It can be a whistle, siren, bell or "Bear Banger" with a detonation device. This device will also inform the personnel nearby of the presence of an animal.
Dispositif de répulsion visuelle	Dispositifs émettant une lumière comme celle d'une lampe de poche ou un Mini Flare (fusée éclairante) qui, lorsqu'activé, produit des étincelles semblables à celles d'un feu d'artifice. En période de sècheresse, ce dernier dispositif peut présenter un risque d'incendie de forêt.	Visual repellent device	Light emitting device such as a flashlight or a Mini Flare that produces sparks similar to fireworks when activated. In times of drought, the latter device may present a forest fire risk.
Dispositif de répulsion actif	Dispositif à propulsion gazeuse de poivre de Cayenne pouvant atteindre une distance prédéterminée.	Repellent device	Device used to project gaseous Cayenne pepper that can reach a pre-established distance.

4.0 RÔLES ET RESPONSABILITÉS

En plus des rôles et des responsabilités globaux prévus à la procédure-cadre du système de gestion HSS (HSS 1.1), la présente procédure prévoit des rôles et des responsabilités spécifiques pour les intervenants suivants :

4.1 Vice-président opérations

- S'assure que ses gestionnaires sont au fait des exigences de la présente procédure et de son application au niveau des opérations.

4.2 Vice-président développement durable

- S'assure que la formation sur la prévention et l'utilisation des techniques d'intervention en présence d'animaux sauvages est transmise à tous les intervenants.

4.3 Surintendant SST

- Assiste le vice-président développement durable dans la mise en place de la présente procédure et dans le suivi des mesures de prévention identifiées.

4.4 Coordonnateur SST

- S'assure que les dispositifs de répulsion sonores et actifs sont installés par les services surface sont installés aux endroits stratégiques au printemps et retirés à l'automne.

4.5 Superviseur mine surface

- Installe les dispositifs de répulsion sonores et actifs aux endroits stratégiques au printemps et retirés à l'automne tel que précisé sur le plan d'installation.

4.6 Agent de sûreté

- Effectue sur une base quotidienne des observations terrain et relève et documente toute activité impliquant des animaux sauvages;
- Rapporte au service de sûreté l'information sur les zones où la présence d'animaux sauvages a été remarquée;
- Avise le gérant en devoir sur la pagette #111 et par radio pour tout le personnel de la présence d'un ours dans le secteur de la mine.

4.0 ROLES AND RESPONSIBILITIES

Within the overall roles and responsibilities established in the Main HHSMS Procedure (HSS 1.1), the specific roles and responsibilities of the various stakeholders are the following:

4.1 Vice-President, Operations

- Ensures that managers are familiar with the requirements of this procedure and its application at the operational level.

4.2 Vice-President, Sustainable Development

- Ensures that training on prevention and the use of intervention techniques in the presence of wild animals is shared will all stakeholders.

4.3 OHS Superintandant

- Assists the Vice-President, Sustainable Development in implementing this procedure and monitoring identified prevention measures.

4.4 OHS Coordinator

- Ensures that sound and active repulsion devices are installed by surface services are installed at strategic locations in the spring and removed in the fall.

4.5 Mine surface supervisor

- Installs sound and active repulsion devices at strategic locations in the spring and removed in the fall as specified on the installation plan.

4.6 Security officer

- Makes daily field observations and records and documents all activities involving wild animals.
- Reports to the safety service with information regarding areas where wild animals have been observed.
- When a bear is observed in and around the mine area, informs the manager on duty by pager on #111 and all staff by radio.

4.8 Surintendant

- S'assure que ses gestionnaires sont au fait de la présente procédure et de son application dans le cadre du travail;
- Informe le service de sûreté de tout incident ou situation pouvant compromettre la sécurité du personnel à cause de la proximité d'animaux sauvages.

4.9 Superviseur

- S'assure que les membres de son personnel sont au fait de la présente procédure;
- S'assure que son personnel dispose des équipements et accessoires pour se protéger lorsqu'il effectue des travaux en zones isolées;
- Communique à tous ses employés les secteurs d'activités où la présence d'animaux sauvages a été constatée;
- S'assure que les mesures préventives mises en place sont respectées au cours de l'activité de travail.

4.10 Employé

- Participe aux séances de formation sur l'application de la présente procédure et les mesures de prévention applicables;
- Respecte les mesures de prévention établies et les moyens de contrôle prescrits;
- Lors de déplacement hors campement ou du site s'assure de disposer des équipements ou du matériel nécessaire advenant la rencontre d'animaux sauvage;
- Rapporte à son supérieur immédiat toute observation d'animaux sauvages à proximité du camp et du site minier Renard.

4.11 Entrepreneur

- S'assure que ses gestionnaires et employés sont au fait de la présente procédure;
- S'assure que ses superviseurs fournissent les équipements et accessoires nécessaires pour intervenir advenant une rencontre fortuite avec un animal sauvage;
- S'assure que soit communiquée toute observation de la présence d'animaux sauvage dans les zones de travail;
- Rapporte au chargé de projet tout problème découlant de l'application de la présente procédure.

4.8 Superintendant

- Ensures that managers are familiar with this procedure and its application in work operations.
- Informs the security service in the event of an incident or a situation involving the presence of wild animals that could compromise staff safety.

4.9 Supervisor

- Ensures that staff members are familiar with this procedure.
- Ensures that staff has equipment and accessories to protect themselves when working in isolated areas.
- Informs all employees of areas where wild animals have been observed.
- Ensures that the appropriate preventive measures are respected during work activities.

4.10 Employee

- Participates in training sessions on the application of this procedure and applicable preventive measures.
- Respects established preventive measures and prescribed control measures.
- Ensures that they have the necessary equipment or material in the case of an encounter with a wild animal during travel outside of camp.
- Reports all observations of wild animals near the camp and the Renard mine site to their immediate supervisor.

4.11 Contractor

- Ensures that managers and employees are familiar with this procedure.
- Ensures that supervisors provide the necessary equipment and accessories to intervene in the case of a chance encounter with a wild animal.
- Ensures to communicate all observations of wild animals in and around work areas.
- Informs the project manager if a problem were to arise with the application of this procedure.

5.0 PROCESSUS

Afin d'assurer la sécurité des employés, des entrepreneurs et des visiteurs, des mesures de prévention et d'intervention sont établies pour composer avec la présence d'animaux sauvages et particulièrement celle d'ours noirs. Ces mesures s'appliquent de différentes façons et à différentes fréquences dans le but premier de prévenir les accidents potentiels. L'ensemble des moyens de prévention et les mécanismes de communication développés visent à réduire les risques de présence d'animaux sauvages en périphérie des zones de travail et d'hébergement. Les étapes suivantes doivent être mises en place pour assurer la sécurité individuelle et collective des intervenants sur le site de SWY.

5.0 PROCESS

To ensure the safety of employees, contractors, and visitors, preventive and response measures are established to deal with the presence of wild animals, particularly black bears. These measures can be applied in various ways and at various times with the goal of preventing potential accidents. All prevention and communication means that have been developed aim to reduce the risk of the presence of wild animals around the work and lodging areas. The following steps must be implemented to ensure the individual and collective safety of those at the SWY site.

5.1 Prévention

Les installations sont situées dans un territoire sauvage où la faune caractéristique de ces régions abonde. Les activités d'exploration, de construction et par la suite d'opération sont venues perturber cet environnement. Règle générale, l'activité humaine dans un secteur éloigne les animaux sauvages. Cependant les dérangements apportés à leurs habitudes alimentaires par l'activité humaine combinés à la présence de nouvelles sources de nourriture potentielle attirent les animaux sauvages, particulièrement lorsque leur nourriture habituelle se fait rare.

Des mesures de prévention ont été établies afin de réduire l'attrait des animaux sauvages pour les sites d'hébergement et de construction. Voici certaines informations qui permettront de mieux comprendre le mode de vie de ces animaux. Il peut cependant y avoir des variantes comportementales selon les circonstances.

5.1Prevention

The facilities are located in a wild area where wildlife typical of the region is abundant. Exploration, construction, and operation activities disturb that environment. As a general rule, wild animals tend to keep away from human activity in an area. However, disturbances in their dietary habits as a result of human activity and the presence of new potential sources of food attract wild animals, especially when their usual food sources become scarce.

Prevention measures have been established to reduce wild animal attraction at the lodging and construction sites. The information below provides a better understanding of the lifestyles of these animals. However, behavioural variations can occur depending on the situation.

5.1.1 Ours noir

Des ours noirs ont été observés sur site de la mine Renard aux abords du campement et sur les rives du lac Lagopède, mais plus particulièrement au Lieu d'Enfouissement En Tranchée (L.E.E.T.). Une attention particulière doit donc être portée à ces animaux qui dans certaines circonstances peuvent compromettre la sécurité des travailleurs.

Quelques observations sur les ours noirs:

- La période de l'année où ils sont le plus actifs est de mai à novembre;
- Règle générale les ours noirs n'attaquent pas les humains, mais une attention est toujours requise, car exceptionnellement ils peuvent toujours attaquer;
- Même si les attaques et blessures par un ours sont rares, il est essentiel de se rappeler que :

5.1.1 Black Bears

Black bears have been observed on the Renard Mine site around the camp and on the shores of Lake Lagopède, particularly near the trench landfill. Special attention should be paid to these animals, because they are capable of compromising worker safety in certain situations.

Here are a few observations regarding black bears:

- They are most active from May to November;
- Generally, black bears do not attack humans, but vigilance is always required because they can occasionally attack;
- Although bear attacks and resulting wounds are rare, remember the following:
  - Bears are easily attracted to the areas where humans live;

- Les ours sont facilement attirés par les endroits où l'humain vit;
    - Ils sont attirés par les vidanges, les oiseaux, la nourriture pour animaux domestiques, l'odeur de graisse et de résidus de nourriture sur un BBQ;
    - Ces sources de nourriture non naturelles pour eux les incitent à se rapprocher des sites d'activité humaine;
    - Si l'ours a du succès, il reviendra encore et encore;
    - Il perdra progressivement sa peur naturelle de l'être humain et fréquentera régulièrement les lieux où l'être humain vit, habite ou travaille.
- La présence d'ourson peut rendre la mère très protectrice et modifier son comportement habituel; cela peut présenter un danger supplémentaire pour l'humain.
- Les ours noirs attaquent rarement, mais son comportement peut être influencé par différents facteurs tels que mâle ou femelle, en période de reproduction ou femelle avec ses oursons, ours adulte avec territoire établi, son état physique (âgé, blessé) finalement le type d'expérience que l'ours a eue dans le passé avec les humains. Par conséquent les ours ne sont pas entièrement prévisibles.
- Plusieurs raisons poussent un ours à devenir menaçant ou à attaquer un humain et se résument comme suit:
    - Certains ours n'ont plus peur des humains, car ils sont habitués à eux;
    - L'ours est surpris ou approché de trop près et ne sent coincer ou menacer;
    - La femelle et ses oursons sont approchés de trop près;
    - Un ours défend une source de nourriture abondante;
    - Un ours est blessé, est souffrant ou affamé;
    - Un ours considère un humain comme une proie;
- Un ours qui se tient sur ses pattes arrière n'est pas agressif, mais tente plutôt de chercher à identifier une odeur ou vérifier si vous représentez une menace pour lui.

5.2 Précaution et mesures de sécurité

Des mesures de sécurité sont en place pour prévenir les incidents avec les animaux sauvages et particulièrement les ours noirs. Autour du campement, une clôture électrique est en place pour donner une décharge non mortelle à tout animal qui tenterait de franchir le périmètre sécurisé. Une attention particulière doit être portée pour ne pas venir en contact avec celle-ci ou de

- They are attracted by garbage, birds, pet food, and the smell of fat and food residue on grills;
    - These unnatural sources of food encourage them to approach areas of human activity;
    - If a bear is successful, it will return again and again;
    - The bear will progressively lose its fear of people and regularly frequent areas where people live and work.
- The presence of a cub can make the mother very protective and change her usual behaviour; this can be an additional threat to humans.
- Black bears rarely attack, but their behaviour can be influenced by various factors such as their sex, whether or not it is mating season, whether a female has cubs or not, whether it is an adult bear with an established territory, a bear's physical condition (old, wounded), and its previous experiences with humans. As a result, bears are unpredictable.
- There are several reasons that could motivate a bear to threaten or attack a person, such as the following:
    - Some bears no longer fear humans because they are used to them;
    - A bear is surprised or approached too closely and feels cornered or threatened;
    - A female and her cubs are approached too closely;
    - A bear is defending an abundant food source;
    - A bear is wounded, suffering, or hungry;
    - A bear considers a person to be prey;
- A bear standing on its hind legs is not aggressive. It is trying to identify a smell or determine whether you are a threat to it.

5.2 Precautions and Safety Measures

Safety measures are in place to prevent accidents with wild animals, especially black bears. Around the camp, an electric fence is in place, which will give a nonlethal shock to any animal that tries to cross the safety perimeter. Special attention must be paid not to come into contact with the fence or damage it with vehicle or construction equipment.

l'endommager avec un véhicule ou équipement de construction.

Des dispositifs de répulsion sont disponibles et les personnes circulant en dehors des zones protégées doivent avoir de ces moyens sur soi.

Des bornes de sécurité sont installées sur le site et contienne des dispositifs de répulsion sonore, visuelle et active. Ces dispositifs sont complémentaires aux dispositifs de répulsion personnelle cités au paragraphe précédent.

Bear repellents are available and individuals travelling outside of the protected areas must have repellents with them.

Safety markers are installed at the site and contain noisemakers, visual repellents, and active repellents. These repellents are in addition to the personal repellents mentioned above.

5.2.1 Nourriture

Les mesures suivantes doivent être respectées:

- La nourriture doit être consommée dans les salles à manger du complexe d'hébergement;
- Toute nourriture sortie pour la pause du matin ou de l'après-midi doit être rangée dans un lieu sécuritaire et à l'abri des animaux sauvages;
- Tout déchet de nourriture ou excédant de nourriture sortie des aires de repas prévus doit être rapporté au camp pour être disposé dans les contenants appropriés;
- Tout déchet du camp doit être conservé dans un local approprié et dans des contenants prévus à cet effet;
- Les déchets de nourriture enfouis en tranchée doivent être recouverts le plus rapidement possible.

5.2.1 Food

The following measures must be respected:

- Food must be eaten in the cafeterias of the housing complex;
- All food taken out during the morning or afternoon breaks must be put away in a safe place that is inaccessible to wild animals;
- All food waste and excess food taken out of the designated meal areas must be returned to the camp and disposed of in appropriate containers;
- All camp waste must be kept in an appropriate place and in the containers provided for that purpose;
- Food waste in the trench landfill must be covered as quickly as possible.

5.2.2 Petits animaux

Même s'il peut sembler inoffensif de nourrir les plus petits animaux tels les écureuils ou les lièvres, il est important de s'en abstenir et de leur bloquer l'accès aux réserves de nourriture, car ces petits animaux sont des sources d'alimentation pour les animaux sauvages plus gros tels que le renard, le loup et l'ours noir. De plus, ces animaux peuvent être porteurs de la rage. Une prolifération de plus petits animaux peut accroitre la présence de leurs prédateurs et il est par conséquent interdit de les nourrir.

5.2.2 Small Animals

Although it can seem harmless to feed small animals, such as squirrels and hares, it is important to refrain from doing so and to prevent their access to food reserves because these small animals are sources of food for larger wild animals, such as foxes, wolves, and black bears. In addition, small animals can carry rabies. Proliferation of small animals can increase the presence of their predators. Therefore, feeding them is prohibited.

5.2.3 Comportement sécuritaire

La présence d'êtres humains sur des territoires sauvages requiert des précautions particulières pour assurer sa propre sécurité et ne pas compromettre celle des autres membres de l'équipe. Les règles suivantes doivent être observées :

- Ne pas nourrir ou tenter d'approcher un ours ou un ourson;
- Ne pas tenter de prendre de photos ou de vidéos si vous êtes à découvert;
- Comprendre le comportement de l'ours noir et les moyens de reconnaitre sa présence dans son secteur de travail;

5.2.3 Safe Behaviour

The presence of humans in wild areas requires specific precautions to ensure individual safety without compromising the safety of other team members. The following rules must be observed:

- Do not feed or attempt to approach a bear or bear cub;
- Do not try to take photos or video if you are in the open;
- Understand black bears' behaviour and the ways to recognize their presence in your work area;
- Learn techniques for prevention, for using the available repellents, and for appropriately reacting in the case of a chance encounter with a bear;

- Apprendre les techniques pour prévenir, pour utiliser les moyens de répulsion disponibles et pour réagir adéquatement advenant la rencontre fortuite d'un ours;
- Toujours être en alerte, garder les yeux ouverts et être à l'écoute de son entourage; Effectuer fréquemment un tour d'horizon pour déceler la présence d'ours;
- Prendre toutes les précautions nécessaires avec la nourriture et les déchets de nourriture. Utiliser le plus possible des contenants résistant aux ours et sécuriser le couvercle en tout temps;
- Lors de travaux, repérer dans votre secteur la borne de sécurité identifier où se trouve des dispositifs de répulsion sonore tel que sifflet, sirène à air comprimé, "Bear banger" et dispositif de répulsion actif tel que bonbonne de poivre à air comprimé. Une fois utilisé, il faut qu'il soit remplacé pour assurer la sécurité des autres utilisateurs potentiels;
- Lors de déplacement à l'extérieur du campement ou du secteur protégé par une clôture électrique,
  - toujours être accompagné d'au moins une personne;
  - avoir des dispositifs de répulsion sur soi;
  - avoir au moins un moyen pour communiquer avec la sûreté et le superviseur;
  - le soir, avoir également une lampe de poche en bonne condition;
- Lors de déplacement hors site, s'assurer d'informer quelqu'un de la direction du déplacement et du lieu de travail prévu. Advenant une modification, en cours de route en aviser son superviseur;
- Si un ours est en vue dans votre secteur, ne pas l'approcher et contacter immédiatement votre responsable et le service de sûreté pour l'en informer et communiquer votre localisation;
- Utiliser au besoin un sifflet, une sirène ou "Bear banger" pour éloigner l'ours.

5.2.4 Information et communication

Afin de tenir le personnel informé de la présence et de l'activité d'animaux sauvages et particulièrement d'ours noirs, des moyens de communication seront mis en place tels que:

- Un communiqué sera publié lors de rencontre hebdomadaire ou quotidienne de santé et sécurité;
- Des séances d'information seront données aux gestionnaires et une formation sera donnée pour tous les employés sur la faune et les animaux dangereux se trouvant dans les secteurs de travail.

- Always be aware, keep your eyes open, and listen to your surroundings, frequently scan the area to detect the presence of any bears;
- Take all necessary precautions with food and food waste. As much as possible, use bear-proof containers and keep them tightly closed at all times;
- During work, identify the safety marker containing noisemakers such as whistles, sirens, "Bear Bangers," and active repellents such as pepper-based bear spray. After use, the repellents must be replaced to ensure the safety of other potential users;
- When travelling outside of the camp or area protected by electric fencing,
  - always travel with at least one other person;
  - have repellents with you;
  - have at least one way of communicating with security and your supervisor;
  - at night, also have a flashlight in good condition;
- When leaving the site, ensure that you inform someone of the direction in which you are travelling and of the planned work location. In the event of a change, inform your supervisor along the way;
- If you see a bear in your area, do not approach it, and contact your supervisor and the security service immediately to inform them of the situation and your location;
- If necessary, use a whistle, a siren, or a "Bear Banger" to keep the bear at a distance.

5.2.4 Information and Communication

The following communication measures will be implemented to keep personnel informed of the presence and activity of wild animals, particularly black bears:

- A statement will be released during the weekly or daily safety and security meeting;
- Information sessions will be held for managers, and training regarding wildlife and dangerous animals found in the work area will be provided for all employees.

5.3 Intervention en présence d'un ours

Malgré la mise en place des mesures de sécurité visant à réduire la présence d'ours ou d'animaux sauvages aux abords du camp, du site de travail et de construction, des incidents peuvent survenir.

Des bornes de sécurité contenant des dispositifs de répulsion additionnelle sont disponibles sur le site. Lors de son usage, celui-ci doit être rapporté au service surface pour être remplacé.

Compte tenu du niveau d'imprévisibilité d'un ours il n'y a pas qu'une méthode de réagir en sa présence. Advenant une rencontre avec un ours, les mesures suivantes sont recommandées:

5.3.1 Si l'ours est loin et ne semble pas avoir constaté votre présence

- Reculez lentement sans faire de bruit sans le regarder directement dans les yeux. Lorsque vous êtes à l'abri, contactez immédiatement votre responsable et le service de sûreté, en mentionnant votre localisation;
- Suivez les directives qui vous seront transmises par votre responsable et/ou le service de sûreté;
- La reprise des activités sera permise qu'avec l'autorisation de votre supérieur une fois que l'ours aura quitté les lieux et que des moyens additionnels auront été pris pour assurer la sécurité du personnel.

5.3.2 Si l'ours semble avoir constaté votre présence

- Identifiez-vous comme un humain;
- Agitez lentement les bras et parlez lentement sans le regarder directement dans les yeux;
- Reculer lentement sans lui montrer le dos, faites un détour pour s'éloigner du secteur où il se trouve;
- Si vous ne pouvez rebrousser chemin, rester immobile et attendez sans bouger, laissez-lui de la place. NE LE COINCEZ PAS. Lorsque l'ours s'éloignera, quittez lentement le secteur. NE PAS COURIR;
- Lorsque vous serez à l'abri, contactez immédiatement votre responsable et le service de sûreté, en mentionnant votre localisation;
- Suivez les directives qui vous seront transmises par votre responsable et/ou le service de sûreté;
- La reprise des activités sera permise qu'avec l'autorisation de votre supérieur une fois que l'ours aura quitté le secteur et que des moyens additionnels auront été pris pour assurer la sécurité du personnel.

5.3 Response in the Presence of a Bear

Despite the safety measures implemented to reduce the presence of bears or wild animals surrounding the camp and the work and construction site, incidents could happen.

Safety markers containing additional repellents are available at the site. After use, repellents must be returned to the surface service for replacement.

Given the unpredictability of bears, there is no single way to react in their presence. If you encounter a bear, the following measures are recommended:

5.3.1 If the bear is far away and does not seem to have noticed you

- Back away slowly without making noise and without making eye contact. When you are in a safe location, contact your supervisor and the security service immediately and inform them of your location;
- Follow the instructions given to you by your supervisor and/or the security service;
- You may only continue your activities with the authorization of your supervisor once the bear has left the area and additional measures have been taken to ensure personnel safety.

5.3.2 If the bear seems to have noticed you

- Identify yourself as a human;
- Wave your arms slowly and speak slowly without making direct eye contact;
- Back away slowly without turning your back to the bear and take a different route to keep away from the area where the bear is located;
- If you are unable to turn back, stay where you are and wait without moving, giving the bear space. DO NOT CORNER THE BEAR. When the bear has gone away, slowly leave the area. DO NOT RUN;
- When you are in a safe location, contact your supervisor and the security service immediately and inform them of your location;
- Follow the instructions given to you by your supervisor and/or the security service;
- You may only continue your activities with the authorization of your supervisor once the bear has left the area and additional measures have been taken to ensure personnel safety.

5.3.3 Si l'ours a constaté votre présence et s'approche vers vous	5.3.3 If the bear has noticed you and approaches you
• Demeurez debout solidement et éloignez-vous lentement; • Demeurez calme; • S'il continue à avancer vers vous, distrayez le en laissant tomber un sac un objet (qui ne peut être utilisé comme moyen de défense ex. rame, hache, etc.). Ne jetez de la nourriture qu'en dernier recours, car les ours seront plus exigeants et plus menaçants pour les prochaines personnes qu'il rencontrera par la suite sachant qu'il peut avoir de la nourriture facilement. • Prenez votre dispositif de répulsion sonore et/ou visuelle et soyez prêt à l'utiliser (sifflet ou sirène, lampe de poche ou fusée éclairante, mini flare). • Lorsque l'ours quitte le secteur, quittez lentement le secteur. NE PAS COURIR; • Lorsque vous êtes à l'abri, contactez immédiatement votre responsable et le service de sûreté, en mentionnant votre localisation; • Suivez les directives qui vous seront transmises par votre responsable et/ou le service de sûreté; • La reprise des activités sera permise qu'avec l'autorisation de votre supérieur une fois l'ours aura quitté le secteur et que des moyens additionnels auront été pris pour assurer la sécurité du personnel.	• Remain standing solidly and get away slowly; • Remain calm; • If the bear continues to come toward you, distract it by dropping an object (do not use an object that could be used for defence, such as an oar, axe, etc.) from a bag. Only throw food as a last resort because the bear will be more aggressive and threatening toward the next person it encounters, knowing that it can obtain food easily. • Take out your noisemaker or visual repellent (whistle, siren, flashlight, signal flare, or mini flare) and prepare to use it. • When the bear has left the area, slowly leave the area. DO NOT RUN; • When you are in a safe location, contact your supervisor and the security service immediately and inform them of your location; • Follow the instructions given to you by your supervisor and/or the security service; • You may only continue your activities with the authorization of your supervisor once the bear has left the area and additional measures have been taken to ensure personnel safety.
5.3.4 Si vous surprenez un ours et qu'il se montre agressif L'ours est pris de court et agit par réflexe de défense. Même si l'ours vous fait des menaces vous pouvez encore désamorcer cette agressivité en vous éloignant doucement, en lui parlant et en laissant tomber un article devant vous. <u>À ce stade, montrez-vous le moins menaçant possible.</u>	**5.3.4 If you surprise a bear who then becomes aggressive** The bear has been taken off guard and will react with a reflex for self-defence. Even if the bear threatens you, you can relieve the aggressiveness by backing away gently while speaking to the bear and dropping an object in front of you. <u>At this stage, appear as unthreatening as possible.</u>

5.3.5 Si l'ours vous suit de façon insistante ou fonce sur vous sans peur.
L'ours qui prend un humain en chasse se montre insistant et menaçant. Il émet des sons contrairement au jeune ours curieux. Dans cette situation extrême, il est préférable de faire face à l'ours. Les actions suivantes sont indiquées:
• Essayer de l'intimider à votre tour en:
  ○ paraissant dominant;
  ○ cognant des objets l'un contre l'autre,
  ○ haussant la voix,
  ○ agitant vigoureusement les bras, votre manteau, une branche ou votre sac au-dessus de votre tête ou sautez pour avoir l'air plus grand
	5.3.5 If the bear follows you insistently or charges you fearlessly
	A bear chasing a human is insistent and threatening. It makes noises different from those of a young, curious bear. In this extreme situation, it is preferable to face the bear. The following actions are recommended:
	• Try to intimidate the bear by:
	  ○ appearing dominant;
	  ○ banging objects together;
	  ○ raising your voice;
	  ○ waving your arms, your coat, a branch or your bag vigorously over your head or jumping to appear taller.

Cette intimidation fonctionnera si l'ours a encore peur des humains. Si ce dernier ne semble pas intimidé et qu'il se dirige toujours vers vous, faites-lui face et défendez-vous. Utilisez vos poings, des roches, un bâton, une rame, une hache pour vous défendre. Réfugiez-vous derrière un obstacle, roche ou arbre, utilisez cet obstacle comme bouclier.

Si vous pouvez monter dans un arbre, faites-le. Même si cette technique ne fait pas l'unanimité et qu'un ours peut aussi monter, elle a sauvé des vies.

Selon certaines affirmations de faire le mort serait une technique. Selon la nature de la situation et le comportement de l'ours qui peut être variable tel qu'expliqué à la section 3.1.1, l'ours demeure imprévisible. Si l'ours voyait en la présence de l'humain une menace ou un envahisseur, le fait de faire le mort désamorcera la situation, car il n'a plus rien à craindre de vous. Cependant s'il s'agit d'un ours prédateur, le fait de faire le mort ne changera rien, bien au contraire lui facilitera la tâche.

5.4 Abatage de l'animal

Il est interdit d'abattre un ours importun sur la seule base qu'il se promène sur le site minier. L'article 67 de la loi sur la conservation et la mise en valeur de la faune (RLRQ, c C-61.1) stipule qu'il est interdit de tuer un animal s'il peut être effarouché.

> *Article 67 .Une personne ou celle qui lui prête main-forte ne peut tuer ou capturer un animal qui l'attaque ou qui cause du dommage à ses biens ou à ceux dont elle a la garde ou est chargée de l'entretien lorsqu'elle peut effaroucher cet animal ou l'empêcher de causer des dégâts.*
>
> *Nul ne peut abattre ou capturer un animal qui cause du dommage aux biens ou qui doit être déplacé pour des fins d'intérêt public, sauf aux conditions déterminées par règlement du ministre.*

Stornoway doit faire preuve de diligence raisonnable et prouver que tous les moyens ont été utilisés pour effaroucher l'animal et qu'il y a eu une dégradation de la situation avant d'abattre l'animal. Par exemple, l'ours est devenu agressif suite à plusieurs tentatives d'effarouchement. L'annexe A présente les lignes directrices à suivre avant de considérer l'abattage d'un animal.

La tâche d'abattre l'animal devra être confiée en premier lieu au maitre de trappe. Si ce dernier n'est pas au site et qu'il est impossible de le contacter, la demande pourra être faite à un de ses fils. Advenant, qu'aucun membre de la famille du maitre de trappe n'est au site et qu'il est impossible de les contacter, la tâche d'abattre l'animal

This intimidation will work if the bear is still afraid of humans. If the bear does not seem intimidated and continues to come after you, face it and defend yourself. Use your fists, rocks, a stick, an oar, or an axe to defend yourself. Get behind an obstacle, rock, or tree, and use the obstacle as a shield.

If you can climb a tree, do so. Even though this technique does not always work and bears can also climb, it has saved lives.

Some assert that playing dead can be an acceptable technique. According to the situation and the bear's behaviour, which can be variable, as explained in Section 3.1.1, bears can be unpredictable. If the bear sees the human as a threat or an invader, playing dead can diffuse the situation because the bear will no longer have anything to fear from you. However, if the bear is predatory, playing dead will only make its attack easier.

5.4 Killing an animal

It is forbidden to kill an unwelcome bear on the sole basis that it was on the mine site. Article 67 of the *Act Respecting the Conservation and Development of Wildlife* (RLRQ, c C-61.1) stipulates that it is forbidden to kill an animal if it can be frightened away.

> *Article 67. No person nor anyone lending him assistance may kill or capture an animal attacking him or causing damage to his property or property under his care or maintenance unless he is unable to frighten the animal away or prevent it from causing damage.*
>
> *No person may kill or capture an animal that causes damage to property or must be moved in the public interest, except on the conditions determined by regulation of the Minister.*

Stornoway must use due diligence and prove that all means were taken to frighten the animal and that the situation escalated before the animal was killed. For example, the bear had become aggressive following several attempts at frightening it. Appendix A presents guidelines to consider before killing an animal.

The task of killing an animal should first be entrusted to the tallyman. If he is not on site and is unreachable, the task can be delegated to one of his sons. In the case where none of the tallyman's family members are on site and that it is impossible to contact them, the task of killing the animal can be entrusted to someone designated by the security service.

pourra être accomplie par une personne désignée par la Sureté.

L'abattage d'un ours noirs est une activité à déclaration obligatoire (article 68 de la loi C61.1). Un agent de la faune doit être contacté dans les plus brefs délais. S'il est impossible de contacter un agent de la faune, un appel doit être logé à SOS braconnage. Voici les coordonnées pour contacter un agent de la faune et SOS braconnage :

- Agent de la faune (bureau de Chibougamau) : 418-748-7744
- SOS Braconnage : 1 800 463-2191

Si l'ours noir est abattu par le maitre de trappe ou un membre de sa famille, l'animal leur appartient. Si l'animal est abattu par toute autre personne, il appartient aux agents de la faune. L'ours mort ne peut être disposé au LEET et ne peut être donné ou vendu même au maitre de trappe. L'agent de la faune décidera du moyen d'en disposer.

Un rapport d'évènement décrivant l'abattage de l'ours devra être remis à l'agent de la faune sur demande.

Tout manquement à cette procédure peut entrainer une amende ou une poursuite judiciaire de la part du Ministère de la Forêt, de la Faune et des Parcs.

Il est à noter que l'utilisation d'une cage pour capturer et relocaliser un ours importun n'est pas considérée pour l'instant.

Pursuant to Article 68 of the Act C61.1, one must declare having killed a black bear. A wildlife officer must be contacted as soon as possible. If it is impossible to reach a wildlife officer, SOS Braconnage must be called. Here are the phone numbers for both:

- Wildlife officer (Chibougamau office): 418-748-7744
- SOS Braconnage: 1 800 463-2191

If the bear is killed by the tallyman or a member of his family, the animal belongs to them. If the animal is killed by anyone else, it belongs to wildlife authorities. The bear cannot be disposed of in the trench landfill and cannot be given or sold, even to the tallyman. The wildlife officer will decide how to dispose of the animal.

An event report describing how the animal was killed must be provided to wildlife authorities when requested.

Not following this procedure may result in a fine or legal action by the Ministère de la Forêt, de la Faune et des Parcs.

It must be noted that the use of a cage to capture and relocate an unwelcome bear is not an option that can be considered at the moment.

5.5 Rapport d'incident et enquête

Tout incident impliquant un animal sauvage devra être investigué en utilisant le rapport d'enquête et d'analyse d'incident (HSS 1.10.F03) tel que prévu à la procédure HSS 1.10. Les conclusions et des mesures de prévention additionnelles seront établies et communiquées à l'ensemble des employés.

5.5 Incident Report and Investigation

Any incident involving a wild animal must be investigated using the Incident Investigation and Analysis Report (HSS 1.10.F03) as indicated in Section 9.0. Additional conclusions and prevention measures will be set and communicated to all employees.

5.6 Mesures disciplinaires

Le travail en territoire sauvage comporte des risques pour la sécurité du personnel. Les mesures de prévention et les méthodes visant à réduire les risques sont mises en place et doivent être appliquées avec beaucoup de rigueur. Le non-respect de ces règles peut entrainer des situations qui pourraient mettre en danger la vie de la personne ne respectant pas ces règles et exposer inutilement la vie des autres employés.

Par conséquent, le non-respect des mesures de prévention et règles exposées à la procédure, le vol de dispositif de répulsion des bornes de sécurité sur le site entrainera des mesures disciplinaires pouvant mener à un renvoi immédiat du site.

5.6 Disciplinary Measures

Working in a wild area has risks for personnel safety. Prevention measures and methods to reduce risks are implemented and must be rigorously applied. Non-compliance with the rules can lead to situations where the non-compliant person's life is in danger and the lives of other employees are unnecessarily endangered.

As a result, non-compliance with the preventive measures and rules listed in this section or theft of repellents from the safety markers on the site will lead to disciplinary measures that could include immediate removal from the site.

6.0 Audit de la procédure et mise à jour

Cette procédure peut être auditée selon le calendrier des audits prévu à la procédure HSS 1.17. Advenant un besoin d'apporter des changements, ceux-ci seront effectués selon la procédure HSS 1.1.1 précitée avec les approbations appropriées.

6.0 Audit procedures and updates

This procedure can be audited according to the audit calendar under the HSS 1.17 procedure. Should it be necessary to make changes, they will be made according to the HSS 1.1.1 procedure with the appropriate approvals.

7.0 Documents liés

Dans le cadre de cette procédure;

a) les documents suivants ont été cités ou y sont référés :

- HSS 1.1 – Procédure-cadre du système de gestion HSS
- HSS 1.1.1 – Procédure de rédaction et mises à jour SGHSS
- HSS 1.10 – Procédure d'enquête et d'analyse d'accident/incident
- HSS 1.17 – Procédure d'audit interne

b) le document suivant a été cité et doit être utilisé :

- HSS 1.10.F03 – Rapport d'enquête et d'analyse d'accident/incident

7.0 Related documents

Within the frame of this procedure;

a) the following documents were cited or referred to:

- HSS 1.1 – Main HHSMS Procedure
- HSS 1.1.1 –HHSMS Drafting and Updating Procedure
- HSS 1.10 – Accident and incident investigation and analysis report
- HSS 1.17 – SGHHS audit procedure

b) the following documents were cited and must be used:

- HSS 1.10.F03 – Accident and incident investigation and analysis report

8.0 Références règlementaire ou administrative associées

JOLICOEUR, H. 2001. L'ours noir et vous! ou Comment éviter les problèmes avec les ours noirs. Société de la faune et des parcs du Québec, Direction du développement de la faune. Québec. 62 p. Dépôt légal – Bibliothèque nationale du Québec, 2001 ISBN 2-550-37561

8.0 Regulatory and associated administrative references

JOLICOEUR, H. 2001. L'ours noir et vous! ou Comment éviter les problèmes avec les ours noirs. Société de la faune et des parcs du Québec, Direction du développement de la faune. Québec. 62 p. Dépôt légal – Bibliothèque nationale du Québec, 2001 ISBN 2-550-37561

9.0 Historique des révisions – Revision history

Révision/ Revision	Date	Par/By	Objet de la modification	Description of modification
A	30/05/2014	D Dufresne	Préparation de la première version	Preparation of first version
B	31/05/ 2014	D Dufresne	Révision du texte corrigé et adoption des modifications apportées	Verification of corrected text and approval of modifications
C	4/06/2014	D Dufresne	Révision après commentaires et révision documentation.	Review after comments and review of documentation
D	5/06/2014	D Dufresne	Finalisation suite au commentaires	Final touches following comments
0	16/06/2014	D Dufresne	Approbation de la procédure	Approval of procedure
1	14/8/2017	M.Lafrenière	Mise à jour de la procédure	Update of procedure
2	31-03-2019	C. Fortin	Mise à jour de la procédure	Update of procedure

Annexe A – Lignes directrices

Niveau	Animaux	Responsable	Réponse des travailleurs	Réponse de l'officier	Outils
NIVEAU 1 Maximum de 2 interventions	Renard, Loup, Ours noir, ou autres	EMPLOYÉS ET AGENTS SÛRETÉ	Crier, Agiter les bras Frapper des pierres ensemble Laissant le temps de réagir Corne de brume Contacter la sûreté	Prendre la déclaration du travailleur, S'assurer que les travailleurs sont à une distance sécuritaire du lieu d'intervention. Effrayer l'animal en utilisant une méthode d'effarouchement légère frappé des pierres, Corne de brume, Veiller à ce que l'animal ait toujours un corridor de fuite tout en évitant la confrontation (100m)	Frapper des pierres, Corne de brume
		COORDONNATEUR SÛRETÉ	Éviter le périmètre de l'animal NE PAS effaroucher l'animal Contacter la sûreté	Marquage de l'animal de la couleur personnel de l'agent, Annoncer à la radio qu'un (ours ou loup) a été marqué de (couleur) et spécifiez l'emplacement, Documenter le comportement de l'animal pendant le déconditionnement, Si requis, diffusion de la mise en garde courriel	Pistolet d'effarouchement Billes de peinture
NIVEAU 1 Maximum de 1 intervention	Renard, Loup, Ours noir, ou autres	COORDONNATEUR SÛRETÉ	Remplacer par des méthodes d'effarouchement plus agressives, Selon la gravité de l'évènement ou si aucun progrès n'est observé, il peut être nécessaire d'agir plus rapidement et de progrès à la phase 2		Pistolet d'effarouchement Billes de caoutchouc
ÉVACUATION DES TRAVAILLEURS DE LA ZONE D'INTERVENTION (au besoin)					
NIVEAU 2	Renard, Caribou, Loup, Ours noir	COORDONNATEUR SÛRETÉ	Le niveau 2, soit l'abattage l'animal, est requis lorsqu'une bête présente un risque élevé (gestion cas par cas) ou quand les méthodes de déconditionnement de niveau 1 n'ont pas donné de résultats satisfaisants. Contacter le maitre de trappe Sydney SWALLOW.		Autorisation de sortie des armes à feu peut-être donnée dans l'attente du Tallymen 12g Balle de caoutchouc 12g Flash Bang
		AGENT DE SÛRETÉ	Dans l'absence du maitre de trappe Sydney SWALLOW, Pour les cas de protection des travailleurs en danger ou autodéfense, la sûreté est autorisée à abattre l'animal à vue		Autorisation de transporter une arme à feu chargé
NOTE	Ces quatre outils devront être utilisés dans l'ordre, la corne de brume étant le moins agressive et l'arme à feu la plus agressive. Il est important que les SMU échangent l'information sur les outils utilisés et leur efficacité.				
	Tout abattage d'un ours par un employé de Stornoway doit être déclaré au MFFP. C'est le MFFP qui tranchera sur ce qui doit être fait avec l'animal abattu. Si l'animal est abattu par un membre de la famille du maitre de trappe, la carcasse leur appartient et aucune déclaration n'est requise.				

Appendix A – Guidelines

<table>
<tr><th>Level</th><th>Animal</th><th>Person responsible</th><th>Workers' response</th><th>Officer's response</th><th>Tools</th></tr>
<tr><td rowspan="2">LEVEL 1
Maximum of 2 interventions</td><td rowspan="2">Fox, wolf, black bear, or other</td><td>EMPLOYEES AND SECURITY AGENT</td><td>Yell
Wave your arms
Bang stones together
Let the wild animal react
Foghorn
Contact the security service</td><td>Record the worker's declaration.
Make sure workers are at a reasonable distance from the intervention site.
Frighten the animal by using a mild scare tactic such as banging stones together or using a foghorn.
Ensure the animal always has an escape route and avoid a confrontation (100 m).</td><td>Stones
Foghorn</td></tr>
<tr><td>SAFETY COORDINATOR</td><td>Avoid the animal's perimeter
Do NOT frighten the animal
Contact the security service</td><td>Tag the animal with the agent's personal colour.
Announce on the radio that a wolf or a bear has been tagged (specify colour) and specify location.
Document the animal's behaviour during the deconditioning period.
If required, send out a warning by e-mail.</td><td>Bear Banger
Paintballs</td></tr>
<tr><td>LEVEL 1
Maximum of 1 intervention</td><td>Fox, wolf, black bear, or other</td><td>SAFETY COORDINATOR</td><td colspan="2">Employ more aggressive scare tactics.
Depending on the severity of the situation, or if no progress is observed, it could be necessary to act more rapidly and move on to level 2.</td><td>Bear Banger
Rubber bullets</td></tr>
<tr><td colspan="6">EVACUATION OF WORKERS FROM INTERVENTION AREA (when needed)</td></tr>
<tr><td>LEVEL 2</td><td rowspan="2">Fox, Caribou, wolf, black bear</td><td>SAFETY COORDINATOR</td><td colspan="2">Level 2, which consists in killing the animal, is required when an animal presents a high risk (on a case-by-case basis) or when level 1 deconditioning methods did not yield satisfying results.
Contact the tallyman, Sydney SWALLOW.</td><td>Authorization to pull out weapon while waiting for tallyman can be given
12g Rubber Bullets
12g Flash Bang</td></tr>
<tr><td></td><td>SECURITY OFFICER</td><td colspan="2">When the tallyman, Sydney SWALLOW, is absent.
When worker safety is in danger or in a case of self-defence, security is authorized to kill the animal on sight.</td><td>Authorization to carry a loaded firearm.</td></tr>
<tr><td>NOTE</td><td colspan="5">These four tools must be used in order, the foghorn being the least aggressive and the firearm the most aggressive. It is important that SMUs exchange information on tools that are used and their effectiveness.</td></tr>
<tr><td></td><td colspan="5">When a bear is killed by a Stornoway employee, it must be declared to the MFFP, who will determine what should be done with the slaughtered animal. If the animal is killed by a family member of the tallyman's, the carcass belongs to them and no statement is required.</td></tr>
</table>