# Environmental and Social Monitoring Program

## 2017 Monitoring Report

stornoway

August 2018

# Executive Summary

This report covers the results of the 2017 monitoring activities undertaken as part of the application of Renard' mine's Environmental and Social Management System (ESMS). The ESMS has emerged from various environmental management tools SWY has put in place over the years to promote early detection of environmental and social issues, ensure environmental compliance and promote continuous improvement. Included among these tools are the Environmental Surveillance Program, the Environmental and Social Monitoring Program, as well as other internal auditing tools.

The primary objective of this report is to communicate the results of the various environmental and social management activities undertaken at the Renard mine to stakeholders, the general public and government authorities. The report covers the results of environmental and social monitoring activities undertaken in 2017.

### *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 application of the ESMS on site resulted in an orderly, properly sign-posted and safe worksite.

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

*Ecopermits*

The ecopermitting process is an internal procedure SWY put in place to ensure regulatory compliance of work in progress or of any change in working methods. A total of 263 ecopermit applications have been submitted to the Environment Department for assessment since 2015, 55 of which were submitted in 2017. This drop in ecopermit applications is due to the decrease in construction activities in 2017.

*Residual materials management*

The residual materials (RMs) management philosophy put in place by SWY is based on the 3R-RD principle (reduce, reuse, recycle, reclaim, dispose). RMs at SWY are separated at source and collected in dedicated containers so that whatever can be re-used is reclaimed. Since 2014, 75% of residual materials produced at the mine site were recycled or reclaimed. In 2017, 71% were recycled, and the rest were disposed of in the trench landfill site (TLS). This decline was due to the end of construction at the Renard mine, since construction waste is easier to recycle.

The main RMs disposed of in the TLS were waste with a high organic matter content (kitchen waste and garbage bin materials, etc.), CRD (construction, renovation and demolition) waste, and ICI (institutional, commercial and industrial) waste. In 2017, 1,663 m³ of final waste were disposed of in the TLS. 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 MDDELCC.

*Residual Hazardous Materials Management*

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 459 mt of RHMs were shipped off site, including 183 mt in 2017. Waste oil accounts for 63% of RHMs.

*Contaminated soil management*

To treat soil contaminated by leaks or spills at the Renard mine site, a treatment bed (biopile) with an impermeable surface was created in 2016 at the TLS. In the summer of 2017, the 200 t of contaminated soil that had been placed on the bed since the fall 2016 showed a 66% decrease in its initial concentration of petroleum hydrocarbons. In 2017, no contaminated soil was stored in the treatment cells, but was shipped to MDDELCC-authorized centres for decontamination.

### *Environmental Monitoring Program*

*Air Quality and atmospheric emissions*

In 2017, no applicable ambient air quality standards for any of the monitoring parameters (total suspended solids, metals, $PM_{2.5}$, $SO_2$, $NO_2$, and dustfall) were exceeded at the Renard mine site property limits.

In 2017, greenhouse gas emissions at the Renard mine site reached 57,811 t, with 58% released by stationary equipment and the rest by mobile equipment. This emissions level exceeds the reporting threshold of 10,000 t set by the Quebec Air Emissions Inventory (QAEI) and the federal Greenhouse Gas Emissions Reporting Program.

The Renard mine was subject to the greenhouse gas cap and trade system for the first time in 2017.

The mine's emissions in 2017 for total suspended solids also reached reporting thresholds set by the National Air Pollution Surveillance (NAPS) Network for total particulate matter, $PM_{10}$, $PM_{2.5}$, $NO_x$ and carbon monoxide.

*Sound levels*

In 2017, day-time noise levels were generally lower or just slightly higher than the 55 dBA requirement specified in Directive 019, including the applicable +5 dBA back-up alarm penalty. At night, noise levels could exceed the Directive 019 threshold of 50 dBA by 5 dBA (including the +5 dBA penalty).

Although there is general compliance with the standards, SWY plans to achieve more restrictive targets by conducting tests aimed at reducing the propagation of noise emissions on the mine site.

*Vibrations*

Vibrations during blasting operations continued to be monitored in 2017. The measuring point was about 850 m from the housing complex, in the vicinity of R2 pit. At that location, 84% of the maximum (peak) vibration values were below 12.7 mm/s. Excess air pressure levels at the same location exceeded the authorized limit of 128 dBL in 90% of cases. Given that the workers' housing complex is far from the measuring point, it's reasonable to assume that vibration and air pressure levels comply with the standards at the complex. To confirm this assumption, in 2018, vibrations near the housing complex will be measured.

*Surface water and sediment quality*

Surface water quality results for the 2017 sampling campaign are generally comparable to those measured in 2015 and 2016, and in the 2010 baseline. Generally speaking, in 2017, the watercourses and lakes in the study area:

- were well oxygenated with an acidic to slightly acidic pH;
- were mildly turbid and had low total suspended solid (TSS) concentrations;
- had very low nutrient concentrations;
- naturally contained concentrations of some metals, such as aluminum and iron, that exceeded surface water quality criteria.

In Lake Lagopede, in 2017, the summer thermocline (hot surface water and colder water below) was between 4 and 8 m deep from June to September. The winter thermocline (cold surface water and warmer water below) was significant under the ice cover.

A marked increase in conductivity was recorded between 4 and 8 m deep in Lake Lagopede, in both winter and summer. These observations validated the fact that mine effluent concentrates below the thermocline in summer and winter and mixes uniformly in the water column during seasonal mixing.

*Domestic wastewater*

The waste water treatment plant treated and discharged about 32,252 m³ into the final effluent outfall in Lake Lagopede. In 2017, domestic effluent quality was in compliance with:

- the standards set out in the Wastewater Systems Effluent Regulations;
- the environmental discharge objectives (EDOs) established by the MDDELCC, with regard to concentrations as well as load allolcations.

Once domestic wastewater is treated, the dehydrated sludge from the rotary press is transported to the TLS for disposal. A characterization of domestic sludge is in process to determine whether it complies with the fertilizing residual materials guide (Guide sur le recyclage des matières résiduelles fertilisantes). If so, the sludge could be used as fertilizer in the progressive site rehabilitation program.

*Water and mine effluent management*

Water that comes into contact with mine facilities (runoff, dewatering water, etc.) is intercepted by a system of perimeter ditches and culverts that channel the water to R65 pit (retention basin) after which it is treated at the permanent mine effluent treatment plant (PMWTP) and discharged into Lake Lagopede. In 2017, 2,280,448 m³ of water was treated at the PMWTP and then discharged into the final effluent outfall in Lake Lagopede.

In 2017:

- mine effluent quality complied with Directive 019 requirements;
- mean concentrations, except in the case of nitrites, complied with effluent discharge objectives (EDOs) set by the MDDELCC.

In 2018, SWY will deploy additional efforts to optimize blasting operations and thereby reduce nitrite concentrations in final effluent.

In 2017, the Renard mine extracted a total of 2.75 $Mm^3$ of surface and ground water for its operations. These withdrawals were due to the dewatering of the underground mine and the open pits, the ore processing plant's fresh water requirements, potable water production, explosives production and airport sanitation facilities.

As regards the re-use of mine wastewater as opposed to the use of fresh water from Lake Lagopede, an estimated 58% of mine wastewater was re-used in 2017 (46% from January to August and 79% from September to December).

*Vegetation and wetlands*

The slope and a section of the former construction road for the R170 diversion, amounting to a total surface area of 4,000 m², were revegetated in 2017.

As part of a wetland compensation plan for the Renard project, SWY is supporting a research project investigating bogs and fens in the region. Research teams visited the site in 2016 and 2017 and will be returning in 2018.

In 2017, SWY applied corrective measures to five wetlands impacted by the extension of Route 167 North. The regrowth of natural vegetation in these areas was below 80% in the 2016 growing season. The corrective measures involved seeding native plants to promote regrowth of vegetation on the edge of the wetlands and the road. This work will be subject to monitoring in 2018.

*Fish and benthic communities*

A study design for the first cycle of biological monitoring in compliance with the Metal Mining EEM Guidance Document was prepared and submitted to the authorization officer in 2017. The monitoring was designed to determine the impact of the treated mine effluent discharged into Lake Lagopede on fish and their habitat, along with potential use of fisheries resources.

*Fish habitat*

R170 stream diversion was created to diver waters from the outflow of Lake F3298 to Lake F3295. In 2017, downstream migration of fish was feasible in this watercourse during periods of high water or heavy rains. During low flow periods, however, some sections of the watercourse are less conducive for downstream migration.

*Fish habitat compensation*

In 2017, the lake trout spawning ground developed in Lake Lagopede as part of the fish habitat compensation program was monitored. The water quantity measured at the site was satisfactory for lake trout. No lake trout specimen was observed in the spawning ground during the observation periods during the spawning period in October. In addition, no eggs were collected at the spawning ground on the egg-collection traps. During the 2017 spawning period, only 38% of the spawning ground was accessible to the species for spawning owning to low water levels. Also, water depth in winter was inadequate for incubation of the eggs. Work will be done during the low water period to remedy the situation.

*Segments C and D of the extension of Route 167*

Three culverts on Route 167 north (chainages 208+494, 226+628 and 229+256) were inspected in 2017 to confirm the free movement of fish through the culverts. The three culverts did not hinder water flow in any way and fish movements were confirmed.

In September 2017, a second and final follow-up of the compensation measures in place at segments C and D of the extension of Route 167 North was carried out. In the third year post-construction, the compensation measures were stable and the rehabilitated parts of the watercourse allowed for free movement of fish. They were in addition used by many fish species, including sculpin, burbot, lake chub, pearl dace and brook trout.

*Terrestrial wildlife and birds*

Large mammals were monitored in March 2017. The monitoring results were compared with those from March 2011 and 2015, as summarized below:

- The density of the moose population had increased in the mine site study area and in the control zone;
- No caribou sitings were made in 2017 in the study areas of the mine site, the airstrip, the control zone or the mine access road.
- A number of wolf tracks were observed in 2017 near the mine site, the air strip, particularly around the TLS and along the mine accessroad, where specimens were even sighted throughout the year.

Telemetric monitoring of the Temiscamiewoodland caribou herd could not confirm sightings in the mine site study area. Data do show however that the herd could in particular use a corridor along the Eastmain River.

Some black bears were sighted at the mine site in spring and summer 2017. Most were frightened off the site. One bear however would not leave the site and had to be shot to ensure worker safety. At the TLS, a number of black bears were sighted in summer 2017 despite the existence of the electric fence. Measures were taken to ensure it was in good working order and that the bears could not go underneath it.

In 2017, 33 wildlife sightings, mostly black bears, were recorded along Route 167 North and at the mine site. A few moose and caribou were sighted near Route 167 North between km 440 and 620. Two collisions involving moose were recorded in December 2017 on Route 167 North.

Waterfowl nest boxes installed around Lake Lagopede and small neighbouring lakes were still in good condition in 2017. One nest box was being used by an undetermined species.

*Hydrogeological system and groundwater quality*

The quality of groundwater collected in 2017 in the three sectors containing high-risk facilities at the mine site is similar to that observed in 2015 and 2016. Values that exceed the criteria were observed in the case of the mean concentrations of certain metals, such as copper, magnesium, iron, calcium and zinc. Natural background levels determined for these five metals in groundwater at the Renard mine exceed the surface water resurgence criteria.

The quality of groundwater samples from the TLS sector has remained stable since 2015. The 2017 results show mean concentrations below threshold values set out in the Regulation respecting the Landfilling and Incineration of Residual Materials

Mean concentrations in groundwater at the airstrip as in the case of the TLS are below applicable criteria. There is no sign that various metal concentrations are increasing.

*Containment area surveillance*

Inspections of the containment areas are carried out to control the integrity and hence stability of geotechnical structures, verify the application of the materials disposal plan, track changes in the structures over time, and identify any maintenance work required to ensure the structures are in good working order. For this, various weekly, quarterly and annual inspections are carried out along with specific inspections performed by an external auditor.

In 2017, the open pit and underground mine operated on a daily basis throughout the year. Changes to the processed kimberlite storage area proved the effectiveness of the new disposal design concept in the last months of the year.

*Potable water quality*

In 2017, 47,532 m³ of water were distributed by the water treatment plant through the Renard mine water distribution system. Potable water consumption at the mine site varied from 348 to 460 litres/day/person, or 414 litres/day/person on average. The test results were all in compliance with standards set out in the Drinking Water Quality Regulation.

*Water-oil separators*

Effluent from the water-oil separators in the mechanical maintenance garage and the airport are in compliance with the 15 mg/l hydrocarbon disposal requirements.

### *Environmental Incident Management*

During the course of 2017, SWY's Environment Department reported 149 spills, which exceeds the number in 2016 but is similar to the number in 2015; however, 77% of these spills involved volumes below 20 litres, and only 5% involved spills greater than 100 litres. Mechanical failures are the cause of 73% of the spills, with the rest the result of human error.

### *Social Monitoring Program*

The Social Monitoring Program was prepared to meet the conditions set out in the Global Certificate of Authorization, as well as to uphold Stornoway's commitments with regard to the 2011 Environmental and Social Impact Assessment, as well as the commitments made by signatories to the Mecheshoo Agreement (Stornoway, Cree Nation of Mistissini and Grand Council of the Crees) and the Partnership Declaration (Chibougamau and Chapais).

This report therefore presents 2017 findings along with observations that emerged from the monitoring of the following aspects:

- Recruiting and job types and numbers;
- Integration of Cree workers;
- Trapline use;
- Economic spinoffs.

*Recruiting and job types and numbers*

In 2017, Stornoway organized or was involved in a number of regional job information and recruiting sessions, which made a significant contribution to recruiting efforts.

In terms of hiring, the size of the operating team at the Renard mine continued to grow in 2017 and we are extremely proud of the team in place. As at December 31, 2017, 184 of the 437 operating employees at the Renard mine were from Chibougamau, Chapais, Mistissini and other Eeyou Istchee James Bay communities. That means 40% of the workforce comes directly from the region. Retention, however, remains an issue for Stornoway and its partners, and we are looking for solutions in this regard.

In 2017, 5,739 hours were devoted to training Cree employees on various functions in the pit, ore processing plant and the underground mine. As a result of these efforts, 228 certificates and attestations were awarded to Cree personnel.

*Land use by trapline M11 users*

In 2017, Stornoway used part of the Social and Environmental Fund (Mecheshoo Agreement) to build a snowmobile trail about 15 km long as access to the new hunting camp Mr. Swallow built in summer 2016.

On a number of occasions in 2017, particularly on the weekends, the Cree Cultural Centre built on the mine site was used by Renard mine employees for community

meals. A celebration on National Aboriginal Day was for example held at the Cree Cultural Centre on June 20, 2017.

Regular meetings were held throughout 2017 with trapline M11 tallymen and some family members to keep them informed regarding progress of the work and operations at the Renard mine, in addition to addressing their questions and concerns.

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

*Local and regional economic spinoffs*

In terms of regional spinoffs, as at December 31, 2017, 167 Stornoway employees from our host communities (including 53 Cree employees) contributed to generating annual spinoffs of more than $14 million in salaries for Mistissini, Chapais and Chibougamau.

With regard to economic spinoffs, $194 million were invested in purchasing goods and services in 2017 from suppliers throughout Quebec, including $58 million (30%) invested directly in the host region (Cree and James Bay). This investment entails the collaboration between Stornoway and its partners in 2017, during which two special construction projects were carried out (modified kimberlite containment facility and the ore sorting plant). As of 2018, it is expected that the level of goods and services purchased will be significantly less, given that the construction projects will have been completed.

Stornoway is particularly proud of the level of collaboration from regional stakeholders and committees, who are all 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 James Bay 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 Misstissini Cree businesses. In 2017, a total of $180,000 ($90,000 from each partner) was awarded to five projects submitted to the Mistissini Band Council.

*Local community relations*

The 2017 communications plan devised by Stornoway is designed to consolidate support and sustain respect from local stakeholders (monitoring committees, tallymen, employees, politicians, businesses, etc.). The communications plan was deployed throughout 2017 and for the most part its objectives were achieved. The work is ongoing and is essential to maintaining good relations with our regional stakeholders. The main components of the 2017 communications plan were:

- Quarterly meetings held by all the monitoring committees established under the Mecheshoo Agreement with the Cree and the Partnership Declaration with the Chibougamau and Chapais communities;
- Regular meetings to follow up and consult with tallymen;
- Publication of Annual Sustainable Development Report for Renard mine, along with distribution to households in Chapais, Chibougamau and Mistissini;
- Information sessions and newsletters for Renard mine employees and agreement partners;
- Annual open houses in the Mistissini community;
- New Stornoway office opened in Mistissini and new resource person hired;
- Activities organized at Cree Cultural Centre at Renard mine site;
- Recruiting sessions held and job opportunities posted for local and regional populations, as well as Renard mine employees;
- Stornoway attended regional job fairs and various mining association conferences;
- Skills development programs put in place for employees, specifically at the plant.

*Integration of Cree workers*

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 Aboriginal workers in the working environment. Aboriginal 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 Cree employees continue working for as long as possible at the mine 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.

The workweek 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 gives them time to practise their traditional activities with their family over an extended period of time on their days off.

A number of Cree employees however resigned in 2017 because of this work 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.

Since January 2017, Mr. Charlie Awashish has held the position of integration and diversity officer. 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 the best knowledge of Cree culture.

An officer responsible for implementing the Mecheshoo Agreement is also in place in the Mistissini community to support Stornoway's and its partners' communication efforts with local stakeholders and maximize job-related spinoffs.

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

- provides people with experience an opportunity to advance to instructor functions;
- puts employees from different cultures and age groups into contact (multicultural and multigenerational);
- offers experienced workers as well as young aspiring employees opportunities for advancement, along with an unparalleled sense of pride 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 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 and entrepreneurship, assuming responsibility, etc.;
- transfer mining expertise.

# Table of Contents

# List of Tables

# List of Figures

# List of Maps



# List of Photos

# List of Appendices

# 1 Objective

This report presents the results of the 2017 monitoring activities connected with the application of the Environmental and Social Management System at the Renard mine. 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 compliance and promote continuous improvement. Included among these tools are the Construction Environmental Surveillance Program, the Environmental (physical and biological components) and Social Monitoring Program, along with other internal auditing tools. The 2017 monitoring report was examined and validated by Norda Stelo (see Appendix 1.1) 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. Also validated were the prevention, risk management, mitigation and compensation measures set out in the environmental and social impact assessment and discussed with the Cree and government authorities to ensure they were applied.

The primary objective of the 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 application of the environmental and social management tools that SWY put in place during project development phases. In addition, the results of environmental and social monitoring activities carried out in 2017 are outlined. This report follows through on commitments to be transparent and disclose the results of implementing the environmental and social management system, 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.

# 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 our sites leaving them in a condition that is comparable to their initial condition;
- Collaborate with stakeholders to enhance our knowledge of the worksite.

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

Since the ESMS was implemented in 2015, the environmental impacts that were anticipated as specified 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 during construction, the mine was built without any notices of non-compliance or infraction. The ESMS will also cover the operations, closure and site restoration phases.

To remain at the forefront of environmental management, SWY intends to obtain 14001:2015 certification as well as Towards Sustainable Mining (TSM) certification within a few years. This standard defines the requirements of an environmental management system an organization can use to improve its environmental performance. In so doing, it facilitates the implementation of this system. SWY's ESMS was developed from the outset with the goal of achieving this certification. In line with its environmental policy, SWY hopes to:

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

SWY has also acquired environmental management software to implement the ESMS in compliance with ISO 14001 requirements, the regulatory framework, and environmental objectives set by SWY. The 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 Environmental Surveillance Program

Mitigation measures were developed in the impact assessment to predict and mitigate impacts during the construction and operations phases.

The surveillance activities ensured that construction activities were carried out in line with the obligations set out in the plans and specifications, permits and authorizations issued for the project. Surveillance activities will continue during mine operations so as to track the overall environmental performance of SWY operations. Surveillance helps promote the early detection of issues and allow for a fast response in the event of a system malfunction or failure of a mitigation measure.

### 2.1.1 Ecopermitting procedure

Ecopermits are an internal SWY procedure to ensure regulatory compliance of the work to be undertaken by contractors or of any change to a contractor's operating method. Ecopermits 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, road or road works;
- Installation of treatment systems (water-oil separators, or drinking water and wastewater treatment facilities, etc.);
- Construction of or modification to any other facility, infrastructure, equipment or operation that generates liquid, solid or gaseous discharges into the environment, etc.;
- Use of a new product.

Before ecopermits are issued and approval to proceed with the work is granted, applications are assessed by SWY's Environment Department to ensure all authorizations have been obtained and that the type of work involved is compliant with applicable regulations. Included as part of the process is updating the environmental monitoring program to reflect changes that occur. Ecopermits 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

Since 2015, 263 ecopermit applications have been submitted to the Environment Department for assessment, of this 55, were submitted in 2017. This drop in applications is consistent with the decrease in construction activities in 2017. Figure 2.1 illustrates the distribution of ecopermits issued between 2015 and 2017.

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 ecopermits. Watertight trays for example are installed under every piece of mobile equipment (generators, light towers, pumps, etc.) to collect any hydrocarbon leaks from the equipment (Photo 2.1).

**Photo 2.1 Tray under a water pump**

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.

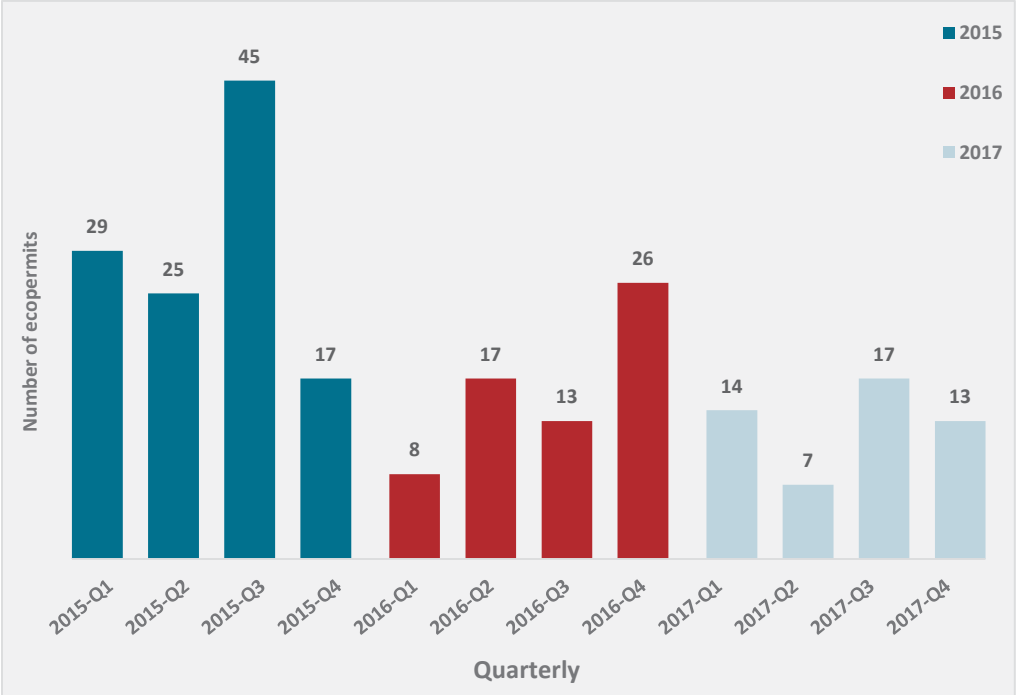



**Figure 2.1 Number of ecopermits issued quarterly**

## 2.2 Recyclable, Residual and Hazardous Materials Management

### 2.2.1 Hazardous materials

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 2.2) set up to facilitate access to material safety data sheets for hazardous materials on site allows employees to search or print 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 2017 to ensure all employees have the knowledge and tools needed for the safe use of the hazardous materials on the job.


**Photo 2.2 Hazmat terminal**

### 2.2.2 Recyclable and ultimate residual materials

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

The residual materials management philosophy put in place by SWY is based on the 3R-RD principle. The first goal is to minimize the quantity of residual materials generated; the second is to reuse such materials; and the third, is to maximize the recycling or recovery of any such materials. Residual materials that cannot be recovered are disposed of in the TLS.

Residual materials at SWY are separated at source and collected in dedicated containers (Photo 2.3) so that whatever can be re-used is recovered. Since the outset of development work on the Renard project, Stornoway has managed RMs as follows:

- Metals (ferrous and non-ferrous), waste oil and grease as well as used tires are transported off site to be recycled and reclaimed by external companies;
- Uncontaminated (untreated) wood is stored at the TLS and chipped as part of the organic waste reclamation program for progressive site revegetation;
- RMs with a high organic content from the cafeteria are sorted at source and placed in a refrigerated room before being transported to the TLS located 10 km away from the Renard mine;
- Domestic wastewater is treated and the dehydrated sludge from the rotary press is then transported to the TLS for disposal. An investigation is currently under way to characterize domestic sludge and determine whether it complies with the fertilizing residual materials guide (*Guide sur le recyclage des matières résiduelles fertilisantes*). If so, it could be used as fertilizer in the progressive rehabilitation program;
- All ultimate RMs (e.g., construction waste) that cannot be reclaimed are discarded in the TLS.

Figure 2.2 shows that untreated wood accounted for a significant proportion (51%) of the residual materials produced at the mine site in 2017. Since 2014, more than 19,228 m³ of the 25,480 m³ of RMs were recycled or reclaimed, or 75% of the RMs produced on the mine site. In 2017, 4,153 m³ of RMs were recycled, while 1,663 m³ were discarded in the TLS, for a total of 5,818 m³ RMs generated by SWY operations.


**Photo 2.3 Source separation of residual materials at the site**

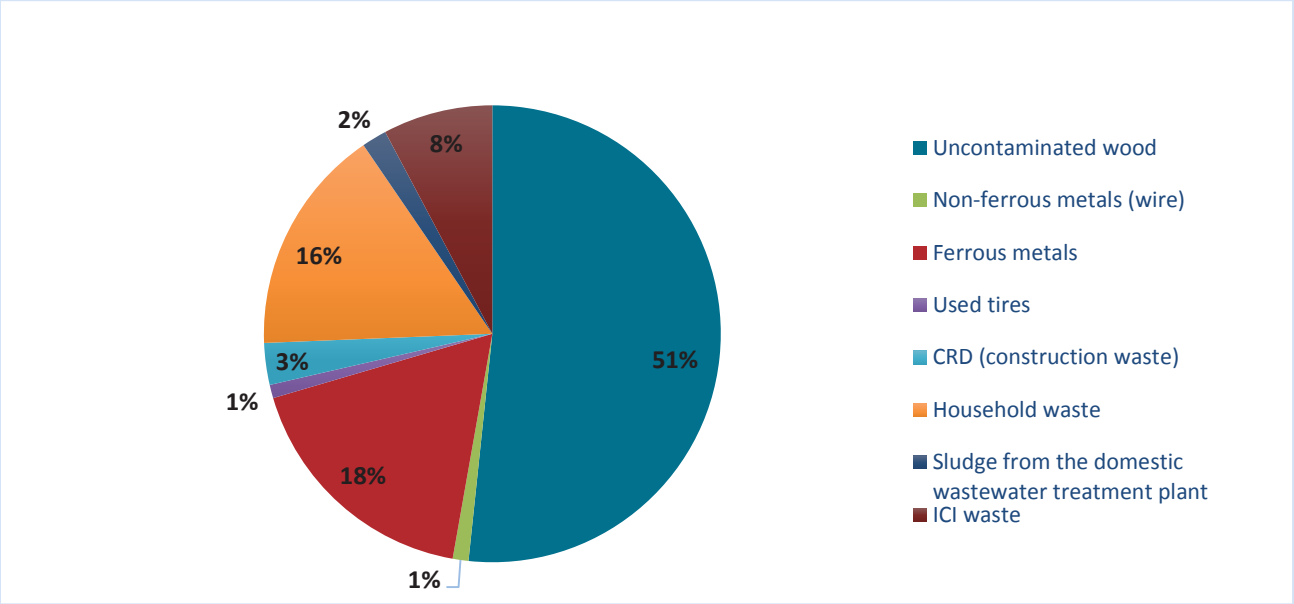



**Figure 2.2 Recyclable and ultimate residual materials generated at the Renard mine site in 2017**

**Photo 2.4 Pile of chipped wood at TLS**

**Control of TLS**

The operator at the landfill visually checks the residual materials transported to the landfill and confirms whether they are allowed at the landfill. All residual materials generated at the mine site (including the airstrip and domestic wastewater treatment plant) are allowed at the landfill, except for waste rock and mine tailings, recyclables, residual hazardous materials and biomedical waste. 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.

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 during operations.

Residual materials placed in the trenches are covered with a layer of soil at least once a week from May to October, as specified in the regulations. RM management is critical during that period. Higher 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 the residual materials in the trenches have reached the specified height, a 60 cm layer of soil consisting of impermeable material is placed on the material and graded to prevent water accumulation. A final layer of topsoil (15 to 30 cm) is placed on the impermeable material. The cells are covered as they are filled to allow for the progressive rehabilitation of the TLS.

In 2017, two cells were opened and no cell was closed. The active cells were covered during the period specified in the regulations with a cover material to control waste dispersion. A total of 860 m³ of cover materials was used in 2017. In 2018, two cells will be closed.

The quantity and type of residual materials that are landfilled are recorded in a log, as are the type and quantity of cover materials. A report on operations is submitted annually to the MDDELCC.

The primary residual materials produced at the mine site and disposed of at the TLS are waste with a high organic matter content (kitchen waste, waste bin materials, etc.) CRD (construction, renovation and demolition) waste, and ICI (institutional, commercial and industrial) waste.

#### 2.2.2.1 Control of residual hazardous materials and the RHM storage area

Residual hazardous materials (RHMs) produced at the Renard mine site consist primarily of waste oil and grease, oil-contaminated solids (filters, aerosols, various containers, etc.), various organic solutions (fuels, antifreeze, 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.

Since 2015, about 459 t of RHMs have been shipped off site. In 2017, about 183t were shipped off site. As illustrated in Figure 2.3, waste oil consists of 63% of RHMs, followed by oily solids which account for 13%. The “Other” category includes waste grease, acids, contaminated containers, aerosols, batteries and other substances.

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). A total of 10.8 kg BMW was shipped off site for disposal in 2017.

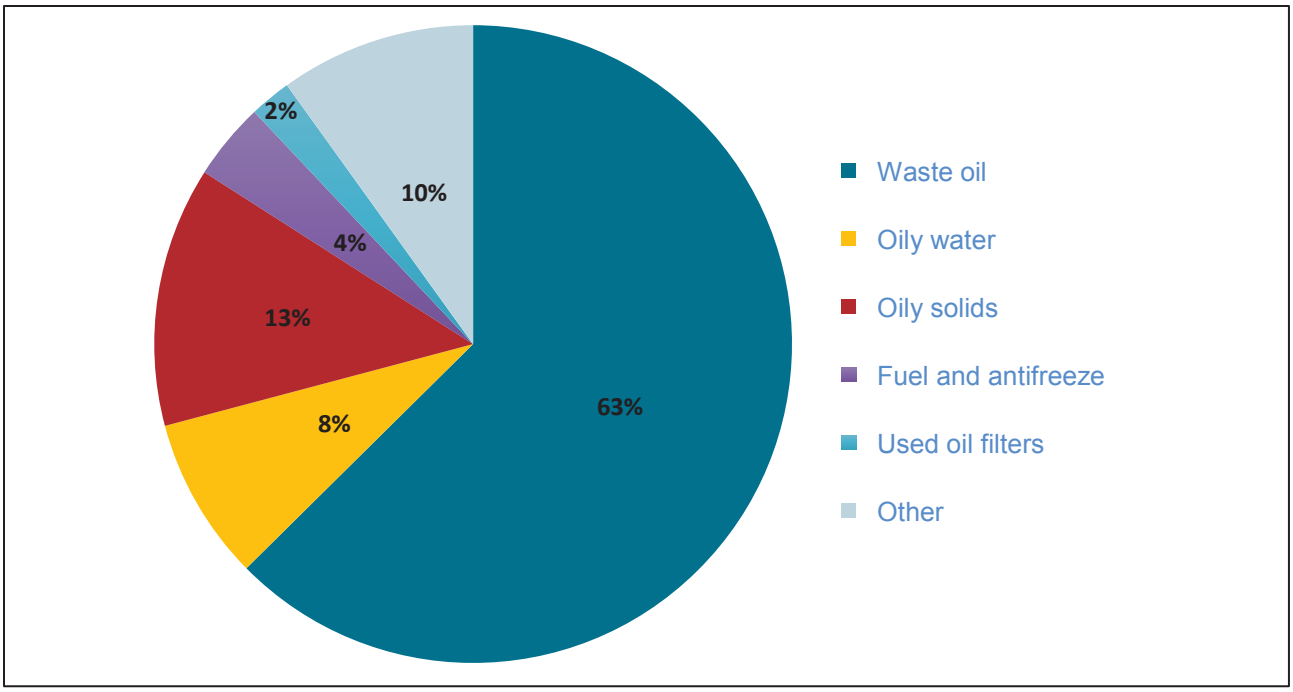



**Figure 2.3 Residual hazardous materials (RHMs) shipped off site in 2017**

### 2.2.3 Contaminated soil management

To treat soil contaminated as a result of leaks or accidental spills at the Renard mine site, a biopile treatment bed with an impermeable surface was designed and installed in 2016 at the TLS a few kilometres away from the mine (Photo 2.5). This facility is designed to provide on-site treatment of contaminated soils whose quality does not meet the minimum requirement of criteria A as specified in the MDDELCC's soil protection and contaminated site rehabilitation guide (Gui*de d'intervention – Protection des sols et rehabilitation des terrains contaminés*), and reduce the contamination level.

**Photo 2.5 Contaminated soil treatment bed**

In summer 2017, the 200 mt of soil being treated in the cell since fall 2016 was sampled to determine the extent to which it had been rehabilitated after one year of treatment. The test results showed a decrease of about 66% in hydrocarbons in the soil compared with the initial values in 2016.

More specifically, the rehabilitated soils presented a concentration of 1,041 mg/kg of petroleum hydrocarbons ($C_{10}$-$C_{50}$), which is equivalent to Criteria B-C, as compared with the initial concentration which was 3,050 mg/kg in 2016. These soils were therefore used as daily cover material at the TLS, as recommended by Terrapex (Terrapex, 2017).

In 2017, no contaminated soil was stored in the treatment cells. It was all sent to MDDELCC-authorized centres for decontamination. In 2017, 731 tonnes of contaminated soil was shipped to either the RSI Environnement treatment centre in Saint-Ambroise or the Chibougamau municipal treatment centre (Photo 2.7) for decontamination. Prior to shipping, all the soil was sampled (Photo 2.6) to determine the level of contamination and ensure it was sent to the appropriate treatment centre (Photo 2.7).

**Photo 2.6 Sampling contaminated soils**


**Photo 2.7 Loading and transporting contaminated soil**

# 3 Environmental Monitoring Program

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 Environmental Monitoring Program 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 will be deployed.

The Environmental Monitoring Program 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

## 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:

- Validate snow cover forecasts and ice thickness at the mine site;
- Support the interpretation of air quality monitoring results;
- 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.

To uphold the commitments Stornoway made in the ESIA (Roche, 2011) 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 once weekly. There are two weather stations in place at the mine site, one at the airport and the other near Lake Lagopede (Photo 3.1).

**Photo 3.1 Weather station near Lake Lagopede**

The data collected at the Lake Lagopede station are used for analytical purposes, because this station is closest to mining operations. Data collected at the airport are used primarily for aviation purposes. 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 temperature, relative humidity, atmospheric pressure, and wind speed and direction. A precipitation gauge was installed near the tower to quantify precipitation in summer and winter (Photo 3.2).

As of recently, solar radiation near Lake Lagopede is being calculated using the pyranometer installed in 2016. These data are essential to determining evaporation from Lake Lagopede, which is needed for determining the water balance at the mine site.

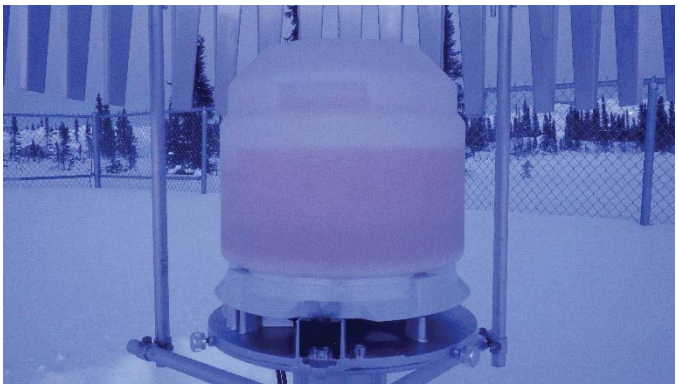


**Photo 3.2 Precipitation gauge near weather station**

The Lake Lagopede weather station communicates continuously with a server from which recorded data can be retrieved for analysis. Weather data are also shared with the MDDELCC in accordance with a new agreement between the two parties.

Minimum and maximum daily temperatures are shown in Figure 3.1.

Monthly average temperatures at the Renard mine site were compared with historical averages recorded at the Grande Rivière (1981-2010) and the Bonnard (1981-2010) stations, a comparison that confirmed that there was no significant variance between current and past average temperatures (Table 3.1).

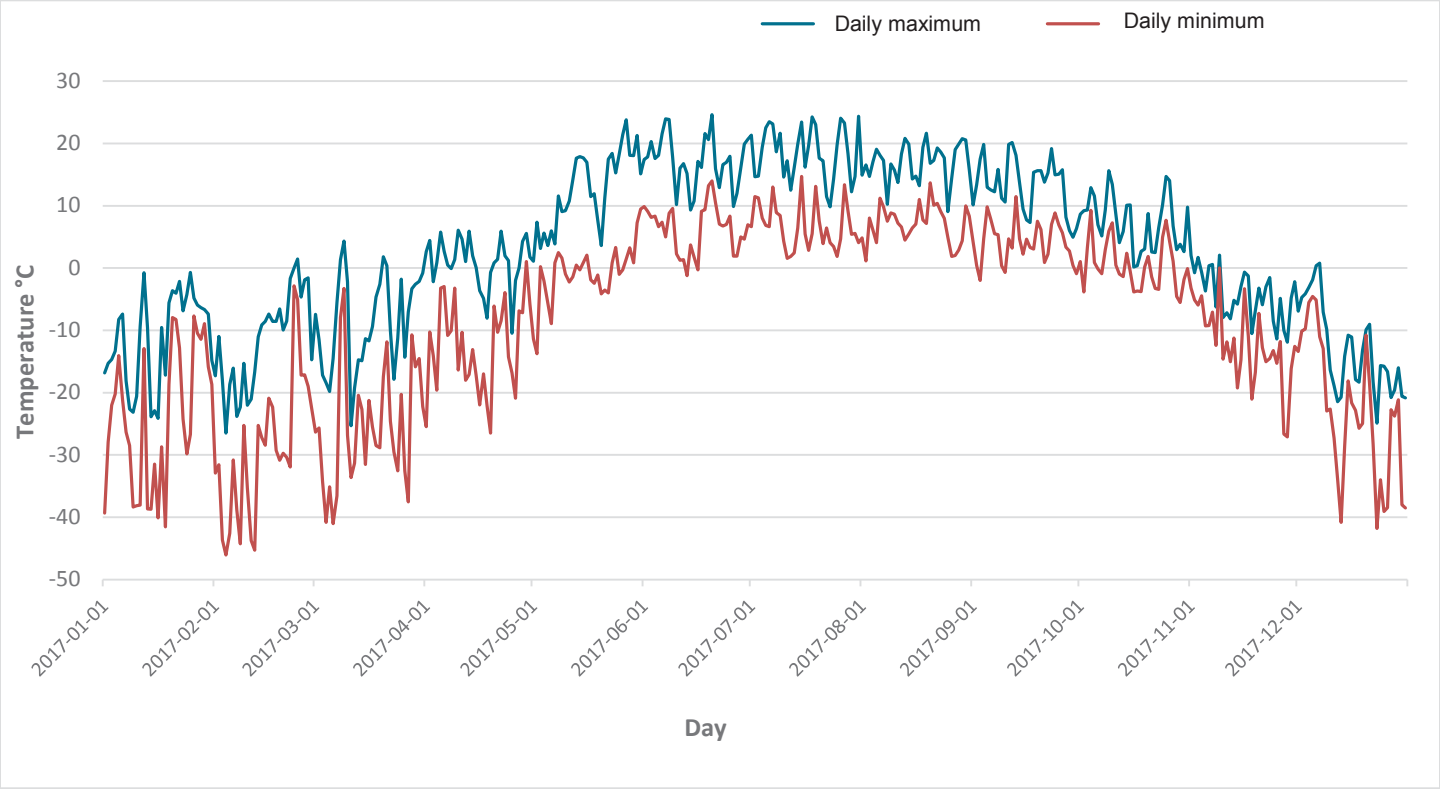



**Figure 3.1 Minimum and maximum daily temperatures in 2017**

**Table 3.1 Monthly temperatures at the mine site in 2017**

| Month | Renard Mine Site Weather Station Average (°C) | Average Temperatures at Nearby Weather Stations | |
|---|---|---|---|
| | | La Grande Rivière (1981-2010) (°C) | Bonnard (1981-2010) (°C) |
| January | -17.2 | -23.2 | -20.9 |
| February | -19.1 | -21.6 | -18 |
| March | -16.2 | -14.5 | -11.4 |
| April | -4.4 | -5 | -1.9 |
| May | 6.5 | 4.3 | 5.8 |
| June | 11.8 | 10.8 | 12 |
| July | 13.1 | 14.2 | 14.5 |
| August | 12.2 | 13.1 | 13.5 |
| September | 8.7 | 8.1 | 8.6 |
| October | 3.8 | 1.7 | 1.9 |
| November | -8.3 | -6.1 | -6.7 |
| December | -17.3 | -16 | -16 |

In 2017, the only quarterly average precipitation values recorded that were below Golder (2015) and La Grande Rivière average values were the July to September values. Note that the impact of climate change was taken into consideration in designing water management infrastructure for the processed kimberlite containment facility. For this, precipitation in the model was increased by 20%.

Snow cover was also measured at the mine site (Photo 3.3), and is useful for water balance calculations. In late December 2017, 86 cm of snow fell at the Renard mine site. On the same date in 2016, there were 36 cm of snow on the ground. A maximum of 90 cm of snow was measured on the ground in winter 2017.

In 2018, snow density will also be monitored.

Table 3.3 shows the snow and ice cover on Lake Lagopede in winter in 2017.

**Table 3.2 Monthly precipitation measured in 2017**

| Month | Monthly Precipitation Measured at Renard Mine (mm) | Estimated Multi-Year Monthly Averages at Renard Mine (Golder, 2015) (mm) | Monthly Precipitation Measured at La Grande Rivière (1981-2010) (mm) |
|---|---|---|---|
| January | 49 | 36 | 31 |
| February | 59 | 28 | 22 |
| March | 12 | 36 | 29 |
| April | 44 | 34 | 33 |
| May | 59 | 55 | 39 |
| June | 91 | 84 | 65 |
| July | 126 | 105 | 78 |
| August | 98 | 107 | 91 |
| September | 59 | 98 | 111 |
| October | 120 | 79 | 87 |
| November | 64 | 58 | 68 |
| December | 40 | 35 | 43 |
| **Total** | **821** | **755** | **697** |

**Table 3.3 Ice thickness measured at AQR 69, 70 and 71 stations on Lake Lagopede**

| Sampling Date | Ice Thickness* | | | |
|---|---|---|---|---|
| | Station | Snow (cm) | White Ice (cm) | Black Ice (cm) |
| **2017-01-12** | Average at AQR-69-70-71 | 27 | 0 | 44.33 |
| **2017-02-10** | Measurement taken at AQR-71 | 52 | 0 | 58 |
| **2017-03-01** | Average at AQR-69-70-71 | 53.3 | 26.6 | 46.6 |
| **2017-04-03** | Average at AQR-69-70-71 | 18.33 | 39.66 | 44.66 |
| **2017-04-30** | Average at AQR-69-70-71 | 28 | 40.33 | 51.67 |
| **2017-12-30** | Average at AQR-69-70-71 | 30 | 26.6 | 10.6 |

**Photo 3.3 Measurement of snow thickness near Lake Lagopede**

The weather station near Lake Lagopede is also used to develop a wind rose for the mine site. Figures 3.2 to 3.4 show quarterly wind roses for 2017.

Winds measured at the weather station in the first and last quarters of 2017 are primarily from the south (nearly 12% and 15% of winds measured). In the second quarter (May to September) dominant winds were mainly from the northwest (about 12%). Dominant 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 fast transition periods between seasons, the dominant climate at the mine site is a cold continental climate.

## 3.2 Air Quality and Atmospheric Emissions

### 3.2.1 Air quality monitoring

The primary goal of air quality and atmospheric emissions 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) at the property limits and the air quality targets established for the project. Air quality monitoring is performed in accordance with the National Air Pollution Surveillance Network (NAPSN) schedule.

It is carried out at six ambient air monitoring stations installed within and on the perimeter of the mine site (Map 3.1), including a reference station and five stations exposed to mine activities. The reference station was installed upwind of the mine site in relation to the direction of the dominant winds to establish the local background level for various contaminants (total suspended particulates (TSP), metals, $SO_2$, $NO_2$ and dustfall).

One of the exposed stations is between the R2-R3 pit and the housing complex, so as to monitor workers' exposure to TSP, $PM_{2.5}$, metals, $SO_2$, $NO_2$ and dustfall near mining operations. Another station is downstream of the mine site in relation to the dominant winds to assess the impact of the mine on ambient air quality at the mine property limits. Two other stations were installed to measure dustfall from non-point sources on Lake Lagopede and Lake F3298 and validate the results of the atmospheric dispersion model. Finally, an additional station was set up west of the processed kimberlite containment facility in the summer 2016 (Photo 3.4).

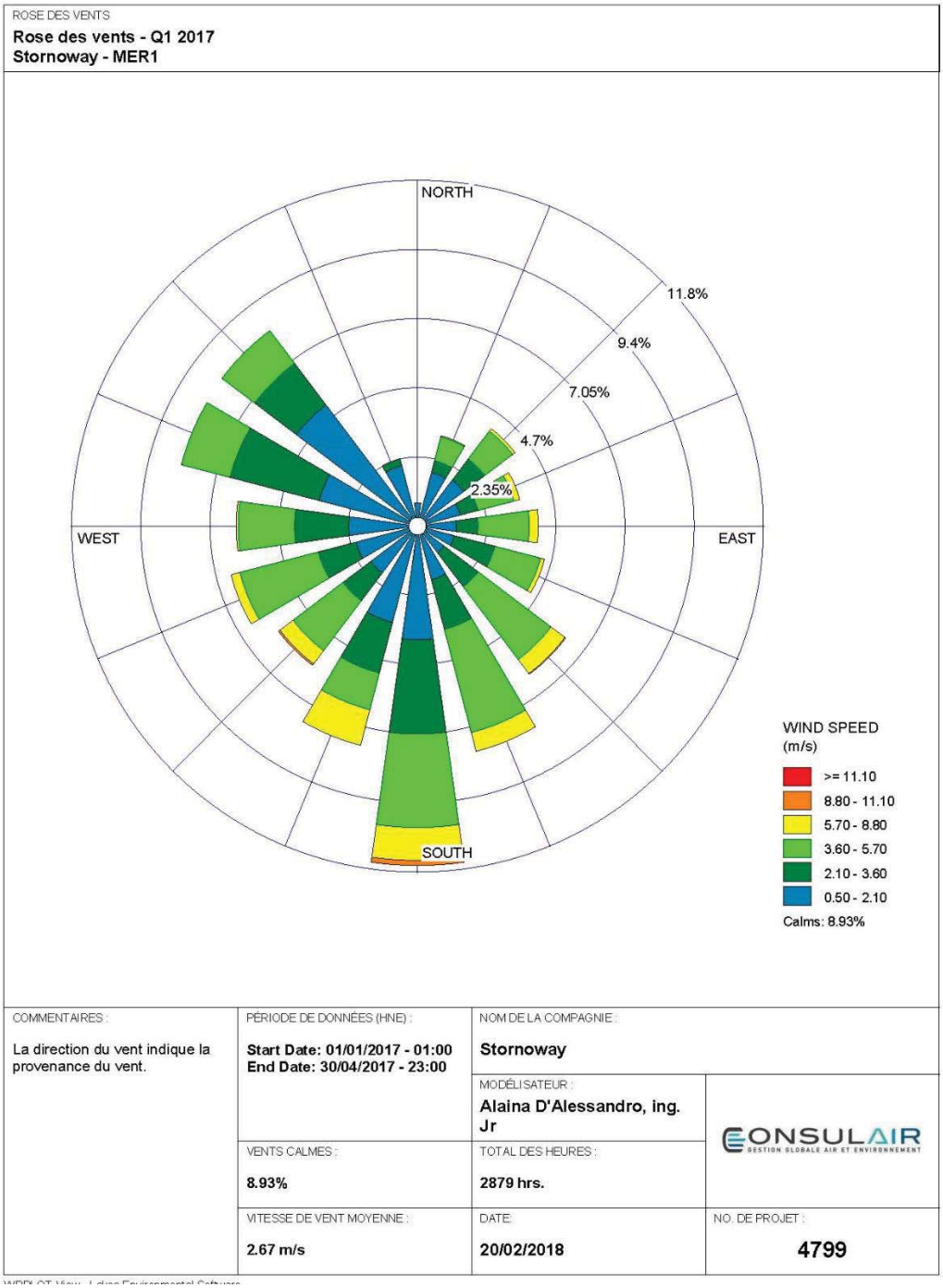



**Figure 3.2 Wind rose at Renard mine for first quarter of 2017**

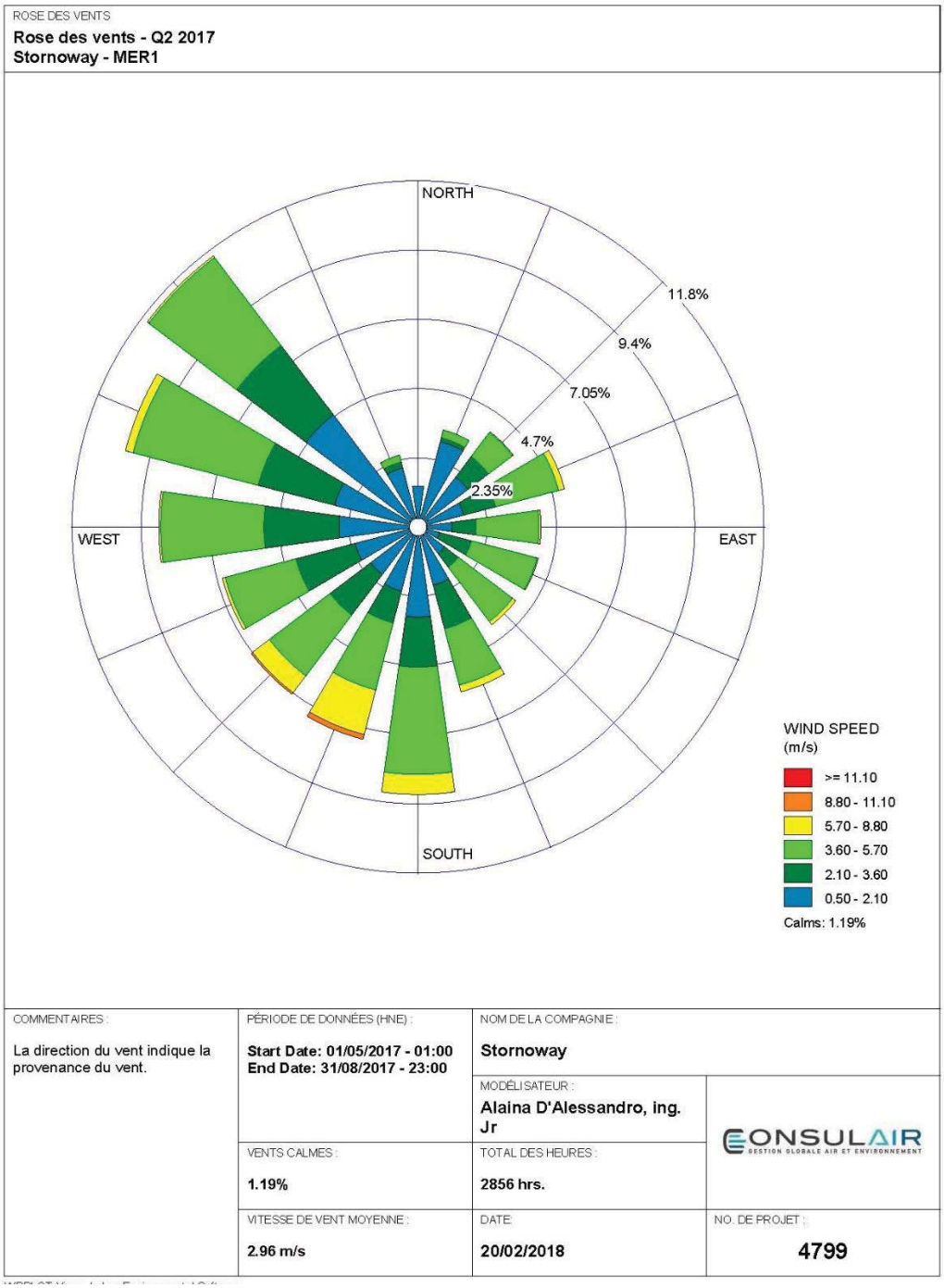



**Figure 3.3 Wind rose at Renard mine for second quarter of 2017**

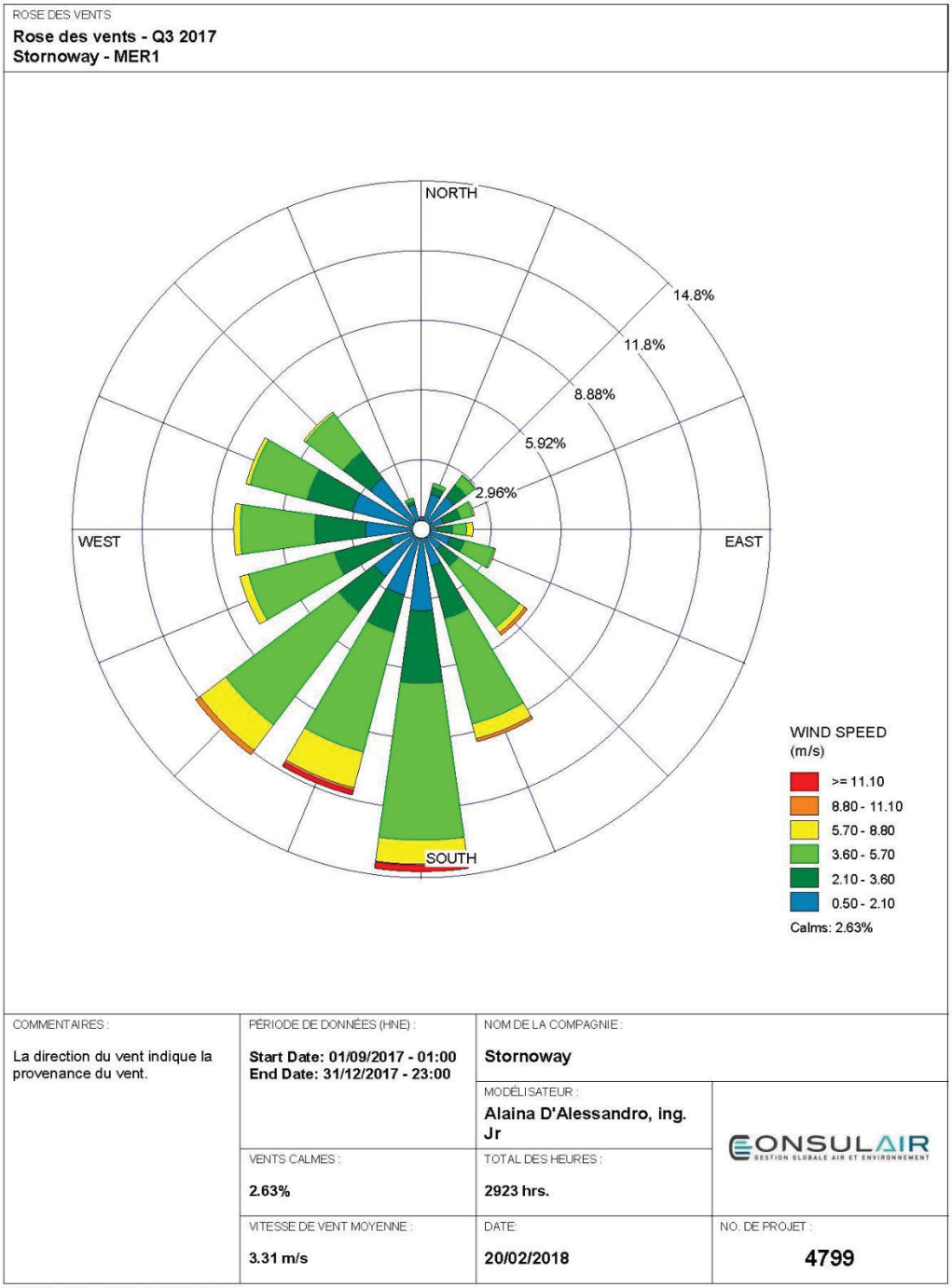



**Figure 3.4 Wind rose at Renard mine for third quarter of 2017**

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) / Processed kimberlite accumulation area (modified)

Fosse R-65 / R-65 Open pit

Halde de stériles / Waste rock stockpile

Halde de mort-terrain / Overburden stockpile

Fosse R-2 / R-2 Open pit

Fosse R-3 / R-3 Open pit

Aire temporaire d'entreposage du minerai / Temporary ore stockpile area

Lac Lagopède

Lac Lagopède

km 648+418

km 648

167

1 650

1 700

1 600

1 800

1 850

1 900

1 950

**Nomenclature des stations / List of stations**

| référence / reference | exposée / exposed | |
|---|---|---|
| ✖ | ● | Station qualité de l'air / Air quality station |
| | ● | Station environnement sonore / Sound environment 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

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 (July 7, 2015; updated May 4, 2018)

Cours d'eau permanent /Permanent watercourse

Cours d'eau intermittent à écoulement de surface et souterrain / Watercourse with intermittent surface and ground water flow

Écoulement souterrain / Groundwater flow

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 / Atmospheric Emissions, Air Quality and Noise Level Monitoring Stations**

NORDA STELO

Juin 2018 / June 2018

*Courbe de niveau ( intervalle de 50 pieds) / Contour Lines (50-foot intervals)*
*Carte de base / Base map : Stornoway, 2010; CanVec, 1: 50 000, 33A16-33A09, RNCan, 2010*
*Fichier / File : 61470-050_Map3-1_Air_quality_st_180613.WOR*

**Carte / Map 3.1**

The data collected from this station are used to determine the concentration level of certain contaminants potentially generated by mine operations in areas where $NO_2$ concentrations in the ambient air were estimated in the contaminant dispersion model to be the highest


**Photo 3.4 Air sampling station near MPKC (November 2017)**

The TSP concentrations at the property limits were in compliance with the applicable CAR standard (120 µg/m³) for the scheduled 61 days of monitoring. The maximum values measured at the property limits were 68 µg/m³ for station AIR1 and 61 µg/m³ for station AIR3.

In 2017, $PM_{2.5}$ levels were measured at the station in the centre of mining operations (AIR2). In the 28 days when the TSP concentration measured at station AIR2 exceeded 10 µg/m³, the average $PM_{2.5}$ percentage of TSP was 29%. Applying this percentage to the maximum TSP concentrations measured at AIR1 (68 µg/m³ of TSP, hence about 20 µg/m³ of $PM_{2.5}$) and AIR3 (61 µg/m³ of PTS, hence about 18 µg/m³ of $PM_{2.5}$) proves that the applicable CAR standard (30 µg/m³) was not exceeded at the property limits.

In keeping with the recommendations of the air quality consultant, Stornoway decided to relocate the $PM_{2.5}$ sampler (Hi-Vol $PM_{2.5}$) upstream of mining operations. Another Hi-vol $PM_{2.5}$ sampler was purchased and installed downstream of dominant winds. In doing so, Stornoway is measuring rather than calculating $PM_{2.5}$ at the property limits.

The $NO_2$ and $SO_2$ annual concentrations measured at the property limits and on the property were all at least two times lower than CAR standards, which are 54.8 ppb for $NO_2$ and 19.8 ppb for $SO_2$ (Table 3.4).

**Table 3.4 $NO_2$ and $SO_2$**

| | $NO_2$ (ppb) | | | $SO_2$ (ppb) | | |
|---|---|---|---|---|---|---|
| **Station** | AIR1 | AIR3 | AIR6 | AIR1 | AIR3 | AIR6 |
| **Annual average** | 0.6 | 0.8 | 1.0 | 0.2 | 0.2 | 0.2 |

Average dustfall levels measured and validated at the property limits and near the lakes in 2017 (Table 3.5) were lower than the reference value of 5 t/km$^2$/30 days (a standard that has now been repealed).

**Table 3.5 Average dustfall**

| | AIR 1 | AIR 3 | AIR 4 | AIR 5 | AIR 6 |
|---|---|---|---|---|---|
| **Annual average (tonnes/km²/30d)** | 2.3 | 2.4 | 1.9 | 3.9 | 2.6 |

In all, none of the applicable CAR standards or reference values was exceeded at the Renard mine property limits for any of the parameters monitored as part of the Ambient Air Quality Monitoring Program.

### 3.2.2 Atmospheric emissions

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. These emissions include greenhouse gases as well as pollutants likely to be released by mining operations. The 2017 report was prepared and submitted to government authorities in 2018.

Greenhouse gas emissions in 2017 were calculated in accordance with procedures set out in the Regulation respecting Mandatory Reporting of Certain Emissions of Contaminants into the Atmosphere (Q-2, r.15). With emissions at 57,811 t, hence above the reporting threshold of 10,000 t, they had to be reported to the Quebec Atmospheric Emissions Inventory (IQÉA) and the federal Greenhouse Gas Reporting Program

An audit report on these emissions is required when mine emissions exceed 25,000 tonnes. This threshold does not however apply to emissions from stationary equipment, which amounted to 33,617 tonnes in 2017. These emissions were generated by the combustion of 525,975 litres of propane, 623,855 litres of diesel fuel in stationary generators and 11,585,768 kg of liquefied natural gas (equivalent to 16.3 million m$^3$ of natural gas).

Greenhouse gas emissions at the Renard mine from the use of mobile equipment amounted to 24,194 tonnes.

Since greenhouse gas emissions from stationary equipment exceeded 25,000 tonnes, an audit report on emissions was required. In addition, in 2017, the Renard mine was subject to the cap and trade system for the first time.

Renard mine emissions in 2017 exceeded the National Pollutant Release Inventory (NPRI) reporting threshold for:

- Total suspended particulates: emissions of 48,320 tonnes exceed reporting threshold of 20 t;
- Particulates under 10 microns ($PM_{10}$): emissions of 36,289 tonnes exceeded the reporting threshold of 0.5 t;
- Particulates under 2.5 microns ($PM_{2.5}$): emissions of 31,631 tonnes exceeded reporting threshold of 0.3 t.
- Nitrogen oxides ($NO_x$): emissions of 76,90 tonnes exceeded reporting threshold of 20 t;
- Carbon monoxide (CO): emissions of 176,17 tonnes exceeded reporting threshold of 20 t.

In 2018, a decrease in surface air emissions is anticipated, since part of the operations will move to the underground mine.

### 3.2.3 Air scrubber management

As part of plant construction, three scrubbers were installed over the ore crushing and grinding equipment to eliminate air contaminants at source. The crushing, grinding and scrubbing systems were brought on line in July 2016. A dust collector maintenance program was put in place to ensure the performance and smooth operation of the equipment. The dust collectors are maintained monthly by building technicians, and each procedure is logged.

Since 2016, SWY has had an air quality monitoring program in place (Section 3.2). This program is designed to demonstrate and validate the effectiveness of the air scrubbing equipment.

Finally, environment technicians on their daily inspections observe whether there is any dust being discharged by the dust collectors. During these inspections, no anomaly, no report and no dust emissions were observed or recorded from the air scrubbers.

## 3.3 Noise and vibration levels

In compliance with Directive 019, Stornoway made a commitment to the MDDELCC 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. A limit of 12.7 mm/s is set for vibrations and 128 dBL for threshold air pressure.

The objective of this monitoring is to track changes in sound 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. Sound 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

The method to assess noise levels set out in the Memorandum of Instruction 98-01 ("handling of noise-related complaints and requirements imposed on noise-producing companies") (NI9801) is applied at the mine site. Short (1 h) and longer (24 h) noise surveys will be conducted in the only sensitive area at the mine site, i.e., the housing complex as well as service areas. The housing complex is considered to be a housing area in an industrial zone. Photo 3.5 illustrates the location of the sonometer used for the noise surveys. It is positioned between the sensitive area and the main mining activities that are likely to impact noise levels for workers

In 2017, five acoustic monitoring surveys were conducted during operations. As in the case of the 2016 acoustic monitoring surveys, a penalty of +5 dBA applies where a large number of backup alarms are in use.

**Photo 3.5 Noise recording station**

Taking into consideration the +5 dBA penalty, the daytime noise levels are generally lower or just slightly higher than the 55 dBA standard. On average, for the 12-hour daytime period, the equivalent noise level is

about 1 dBA lower than the 55 dBA standard. Night time readings that exceeded the 50 dBA limit value by about 5 dBA were observed.

Clearly, in relation to the objectives set by Stornoway of 40 dBA at night and 45 dBA during the day, the day-time and night-time limit values have been exceeded. The average discrepancy recorded taking into consideration the +5 dBA penalty is 8.4 dBA. This average discrepancy however is of the same order of magnitude as in 2016 (8.5 dBA).

A number of noise surveys were conducted to assess the noise produced by various mining infrastructure.

First, noise levels when the crusher was not in operation were monitored. Despite the additional surveys conducted from the recording point, it was not possible to detect the relative significance of the crushing system and the impact it had on the rooms in the housing complex. In fact noise levels were similar whether the crushing system was in operation or not, and the same behaviours were observed regardless of timeframes.

A noise survey was then conducted when both the crusher and the ore processing plant were not in operation. The results suggest that the plant maintains the L95% background noise level at about 45 dBA at the recording point. The residual portion of the noise is produced by other activities, including crushing operations.

Although there is general compliance with the standards, SWY aims to achieve more restrictive targets by conducting tests aimed at reducing the propagation of noise emissions on the site. In 2018, the recording station will be relocated closer to workers' rooms so that the noise levels recorded are more representative of what is actually heard. Noise surveys will be carried out to cover other types of mining operations and hence gain a better understanding of the impact of each activity.

### 3.3.2 Vibrations

Vibration triggered by blasting operations continued to be monitored in 2017. A seismograph coupled with a microphone was used to measure excess air pressure.

Vibration and excess air pressure measurements were recorded more than 80 times in 2017. The measuring point is located about 850 m from the housing complex, near R2 pit. The vibration sensor was installed in compliance with best practices for recording noise from blasting.

Peak values recorded for vibration levels near blasting points were generally below 12.7 mm/s. Recorded values were higher only at 13 specific times. Excess air pressure measurements varied between 108 and 148 dBL. Excess air pressure was lower than the 128 dBL limit value on only eight (8) readings. Given the distance between the blasting points and the housing complex, it is reasonable to believe that vibration and excess air pressure levels are within the standards. It is however not feasible to confirm this beyond any reasonable doubt. In 2018, vibration levels will be recorded close to the housing complex to eliminate any doubt.

**Photo 3.6 Seismograph used during blasting operations**

## 3.4 Hydrological regime

Water from Lake Lagopede is used during Renard mine operations to supply the mine camp with drinking water. Treated mine water is also discharged into the lake (north basin) along with treated domestic wastewater (south basin). Monitoring the water regime facilitates the interpretation of environmental monitoring data and differentiates the direct impact of the project from the impacts associated with natural weather and hydrological variations in the area. Finally, water regime data are used to validate water quality predictions in the plume dispersion modelling of mine and domestic effluent in Lake Lagopede (Roche, 2011).

### 3.4.1 Water levels at water level stations

To monitor the water regime of watercourses and water the levels in nearby lakes, four water level stations were installed to measure water levels on an hourly basis at strategic locations in Lake Lagopede watershed (north basin of Lake Lagopede (AQR62), Lake F3294 (AQR54), Lake F3296 (AQR31), Lake F3300 (AQR72)) (Map 3.2). These stations, which were installed in 2011, improve the quality and temporal scope of flow data for the main tributaries of Lake Lagopede. The data are also used to establish stronger relationships between water levels and flows in lakes F3294 and F3296, which are used to assess water inflow into Lake Lagopede. Water

level readings (Figure 3.3) are compared with flow measurements to establish a stream discharge calibration curve and determine estimated flow for each water level. Estimated flows at the Lake Lagopede station are illustrated in Figure 3.4. Owing to limited data from the high-water period (early May to early June), it was not possible to reliably connect water level readings to an estimated flow. The discharge curve needs to be refined in this regard by collecting readings during high-flow periods. The water level-flow relationship would be more accurate and could be used to transform a broader range of water level readings into estimated flows.

Water level readings measured since fall show similar trends at the four stations with two-high water level readings in the weeks of October 21 to 26 and November 10 to 15. In addition, readings from all the stations showed that the 2017 spring flood began between April 22 and 24. However, the range of water level readings collected since fall 2016 provide a complete annual hydrological cycle at all the stations. The readings are therefore clearly comparable with those reported in Englobe (2016) for the 2011 to 2015 period, except the low-flow period at station F3300, where the hydrological regime was correctly characterized only in 2012.

In 2018, the accuracy of the stream discharge calibration curves should be substantially improved since data will be collected in a third annual campaign that will be carrierd out during the high-water period. High-flow estimates will therefore be more accurate. In addition, the two stations that have yet to be upgraded since they were installed as part of the baseline study will be replaced and equipped with telemetry instrumentation. This eqiupment will enable remote control of the station and data uploading, functions the two other stations have been performing since 2016.

688 000 mE

690 000 mE

5 856 000 mN

5 854 000 mN

AQR54-(H)

AQR31-(H)

AQR62-(H)

AQR71-(EG)

AQR69-(ESG)

AQR70-(EG)

AQR58-(FG)

AQR72-(H)

Lac Lagopède

Lac Lagopède

Aire d'accumulation de la kimberlite usinée (modifiée) / Processed kimberlite accumulation area (modified)

Fosse R-65 / R-65 Open pit

Halde de stériles / Waste rock stockpile

Halde de mort-terrain / Overburden stockpile

Fosse R-2 / R-2 Open pit

Fosse R-3 / R-3 Open pit

Aire temporaire d'entreposage du minerai / Temporary ore stockpile area

km 648+418

km 648

km 647

Seuil B-B' / Riffle B-B'

Seuil A-A' / Riffle A-A'

167

1 650

1 700

1 600

1 800

1 850

1 900

1 950

**Nomenclature des stations / List of stations**

Station qualité de l'eau de surface et des sédiments / Surface water and sediment quality stations

AQR1-(ESI)

***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)

***Indicateurs/ Indicators***
B = Bathymétrie / Bathymetry
H = Mesure du niveau de l'eau (limnimètre)/ Water level measurement (limnimeter)
F = Mesure de courant/ Flow measurement
E = Qualité de l'eau de surface/ Surface water quality
S = Qualité des sédiments/ Sediment quality
I = Invertebrés benthiques/ Benthic invertebrates
P = Pêches expérimentales/ Fisheries
C = Caractérisation de l'habitat du poisson / Fish habitat characterization
G = Mesure de l'épaisseur de glace / Ice thickness measurement

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 (July 7, 2015; updated May 4, 2018)

Cours d'eau permanent / Permanent watercourse

Cours d'eau intermittent à écoulement de surface et souterrain / Watercourse with intermittent surface and ground water flow

Écoulement souterrain / Groundwater flow

0 250 500 m

UTM, zone 18 (NAD83)

N

**Localisation des stations limnimétriques et des seuils A-A' et B-B' entre les bassins nord et sud du lac Lagopède / Location of Water Level and Riffle A-A' and B-B' Riffle Stations between the North and South Basins of Lake Lagopede**

NORDA STELO

Juin 2018 / June 2018

*Courbe de niveau ( intervalle de 50 pieds) / Contour Lines (50-foot intervals)*
*Carte de base / Base map : Stornoway, 2010; CanVec, 1: 50 000, 33A16-33A09, RNCan, 2010*
*Fichier / File : 61470-050_Map3-2_Water_level_st_180606.WOR*

**Carte / Map 3.2**

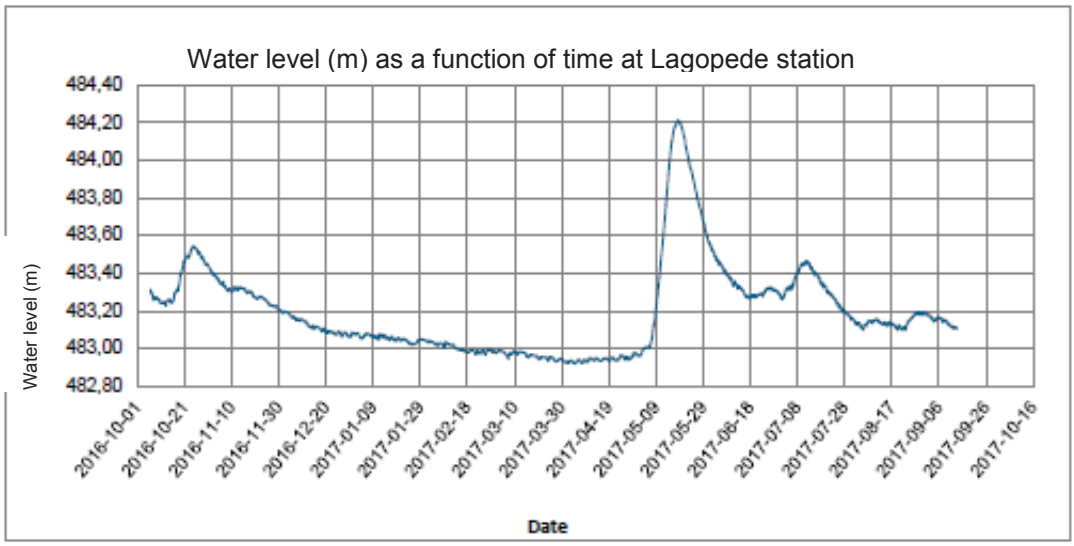



**Figure 3.5 Water level time series at Lagopede station from October 2016 to September 2017**

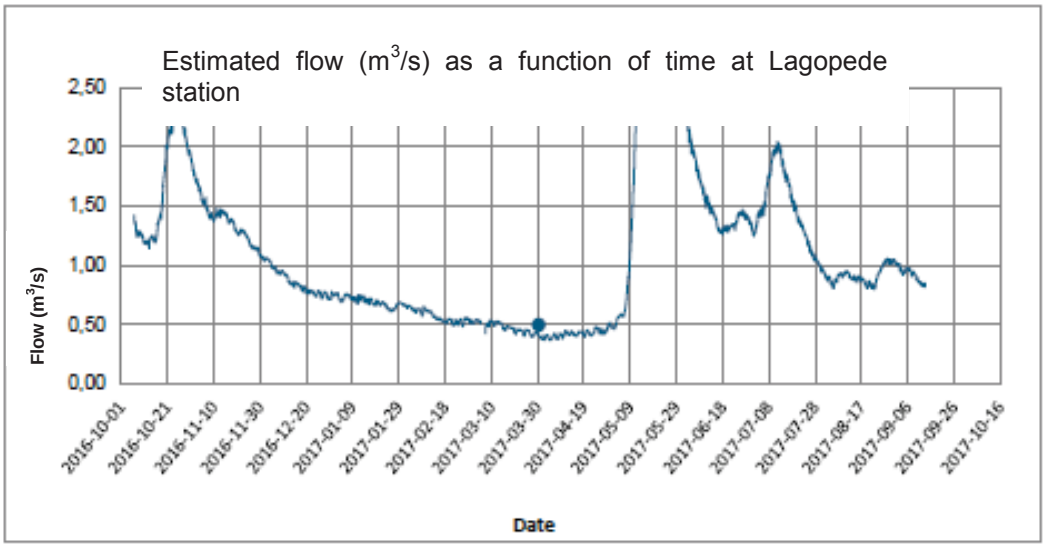



**Figure 3.6 Estimated flow time series at Lagopede station from October 2016 to September 2017**

#### 3.4.2.1 Winter flow monitoring – Lake Lagopede

In light of the various mine effluent modelling studies, a seasonal restriction to flow at the A-A' shoal was anticipated (Map 3.1) during the low-flow period in summer and winter: in the summer low-flow period owing to thermal stratification in the water column in Lake Lagopede and in winter as a result of ice accumulation and low water flow generally observed at that time of year. Data collected to date demonstrate that the B-B' riffle poses a vertical restriction to flow in winter owing to the presence of ice across the entire flow cross-section, but no restriction at the A-A' shoal.

In 2017, the low flow in winter calculated directly at the A-A' shoal was 0.50 m³/s, the same value as in 2016. The flow measurement results (Table 3.7) combined with ice thickness and bathymetric surveys (Figure 3.7) at the A-A' shoal in recent years all seem to agree: the A-A' shoal poses no vertical restriction to water flow during the winter low-flow period. In addition, flow readings at A-A' shoal (0.499 m³/s) are consistent with the inflow from the main tributaries to the lake, and hence flows from stations F3294 (0.494 m³/s) and F3296 (0.005 m³/s). To further our understanding of winter flow at A-A' shoal and as required by the MDDELCC, water flow at A-A' shoal will continue to be monitored in 2018.

**Table 3.6 Characterization of shoal A-A'**

| DATE | TIME (HNE) | Measured Water Level (m) | Measured Flow ($m^3/s$) | Estimated Flow ($m^3/s$) | Variance (%) |
|---|---|---|---|---|---|
| **2013-03-26** | **1:10:00 PM** | **482.92** | **0.35** | **0.38** | 8.90% |
| 2015-08-07 | 16:18:00 | 483.532 | 2.375 | 2.375 | 0.00% |
| **2016-02-23** | **3:30:00 PM** | **482.97** | **0.50** | **0.49** | -3.10% |
| 2016-10-06 | n/a | 483.26 | 1.248 | 1.249 | 0.10% |
| Roche water balance Qmin10years | | 482.896 | 0.327 | 0.31 | -5.10% |
| 2016-10-06 | 13:00:00 | 483.26 | 1.172 | 1.249 | 6.50% |
| **2017-03-30** | **10:31:44 AM** | **482.94** | **0.50** | **0.43** | *-14.40%* |
| 2017-09-12 | 15:11:00 | 483.141 | 0.63 | 0.914 | 45.00% |

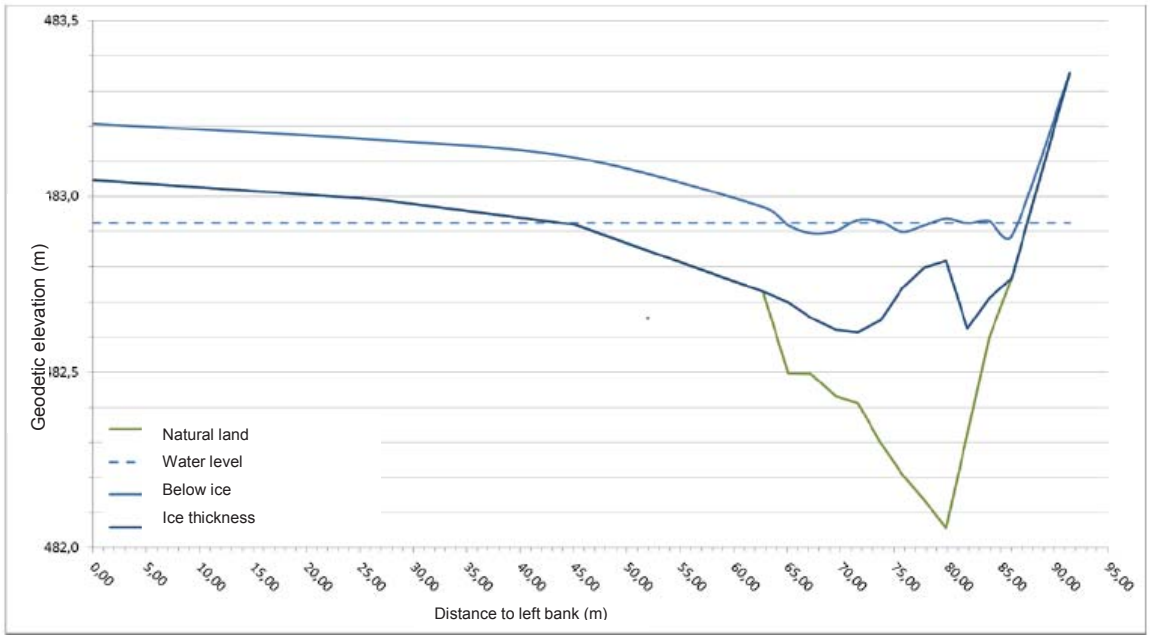



**Figure 3.7 Ice stratigraphy and bathymetric measurements at A-A' shoal**

#### 3.4.2.2 Current velocities and temperature profiles in the north basin of Lake Lagopede

Temperature readings taken to date in the north basin of Lake Lagopede indicate the presence of summer and winter thermal stratification (thermocline). Water masses on either side of the thermocline have different temperatures and densities, thereby limiting exchanges between water masses. Current velocity readings in the water column are very low in both winter and summer.

The characterization of temperature profiles in the north basin of Lake Lagopede in winter 2017 made it possible to identify profile categories and hence three large water masses. The typical profiles all have a cold surface layer of about 1 m deep associated with ice formation. One of these large water masses, the one in the sector upstream of B-B' riffle, is considered to be natural. A second water mass, which is downstream from the effluent and covers most of the north basin, has an intermediate layer about 14-m thick between 4-m and 18-m deep, and a temperature of about 1.9°C. This intermediate water mass is affected by the discharge from the outfall. Finally, a third water mass was observed upstream and downstream from the north basin of Lake Lagopede. In this water mass, mixed conditions were present with a warmer, mixed intermediate layer to A-A' shoal, which suggests that the dispersion of the effluent plume continues in winter under the ice cover, as effluent plume dispersion modelling studies had suggested previously.

In summer 2017, it was noted that the profiles could be grouped in the same way as in the winter campaign. Four large water masses were identified and their typical profiles are colour coded in Figure 3.8. Among these, a mass that is considered to be natural was observed in the sector upstream from the north basin of Lake Lagopede (purple). There are two intermediate zones (orange and blue) where the impact of the effluent was seen in the formation of a third water layer between the epilimnion and the hypolimnion. The difference between the two intermediate zones is explained by the increase in the elevation of the thermocline downstream of the north basin. The last water mass (green), which has a warmer temperature, was observed upstream of B-B' riffle and downstream of A-A' shoal. The shallow waters and low flows in these zones may be the cause of the warmer water in this area. Finally, given the effluent temperature when the profiles were determined and the ambient water temperature in the depths corresponding to the diffuser, the plume has a positive buoyancy in relation to the ambient environment and hence tends to rise. It is therefore not confined to the north basin, thereby enhancing the dilution of the effluent beyond the A-A' shoal.

On the basis of the profiles studied in the two field campaigns conducted in 2017, it can be assumed that the A-A' shoal does not create any restriction to the dispersion of mine effluent to the south basin.

In summer 2017, a pair of drifters fitted with GPS receivers (Photo 3.7) were used to characterize surface current velocities in the north basin of Lake Lagopede. One drifter was equipped with an underwater sail that resisted the flow of water and could therefore indicate the direction of the current. The other drifter did not have an underwater sail and was designed to determine how the wind influenced currents. Comparing the trajectories should make it feasible to define the direction of surface flow. Two series of measurements for each of the drifters were carried out on September 17 and 18, 2017 (Photo 3.8). Repetitive possibly cyclical events could as a result be identified, events that could be interpreted as hydrodynamic phenomenon. Examining the influence of the wind on surface currents could well prove helpful. It's a common feature of lakes that often has an impact on water-layer mixing periods in lakes with a thermocline.

Measuring the current at A – A' shoal using short time series also showed that current velocity and sometimes its direction could fluctuate. It would be helpful to describe wind patterns for Lake Lagopede when the lake is ice free so as to describe wind events from the south that could impact water circulation that is generally south flowing at the riffle.

**Photo 3.7 Drifter used to measure current speed**

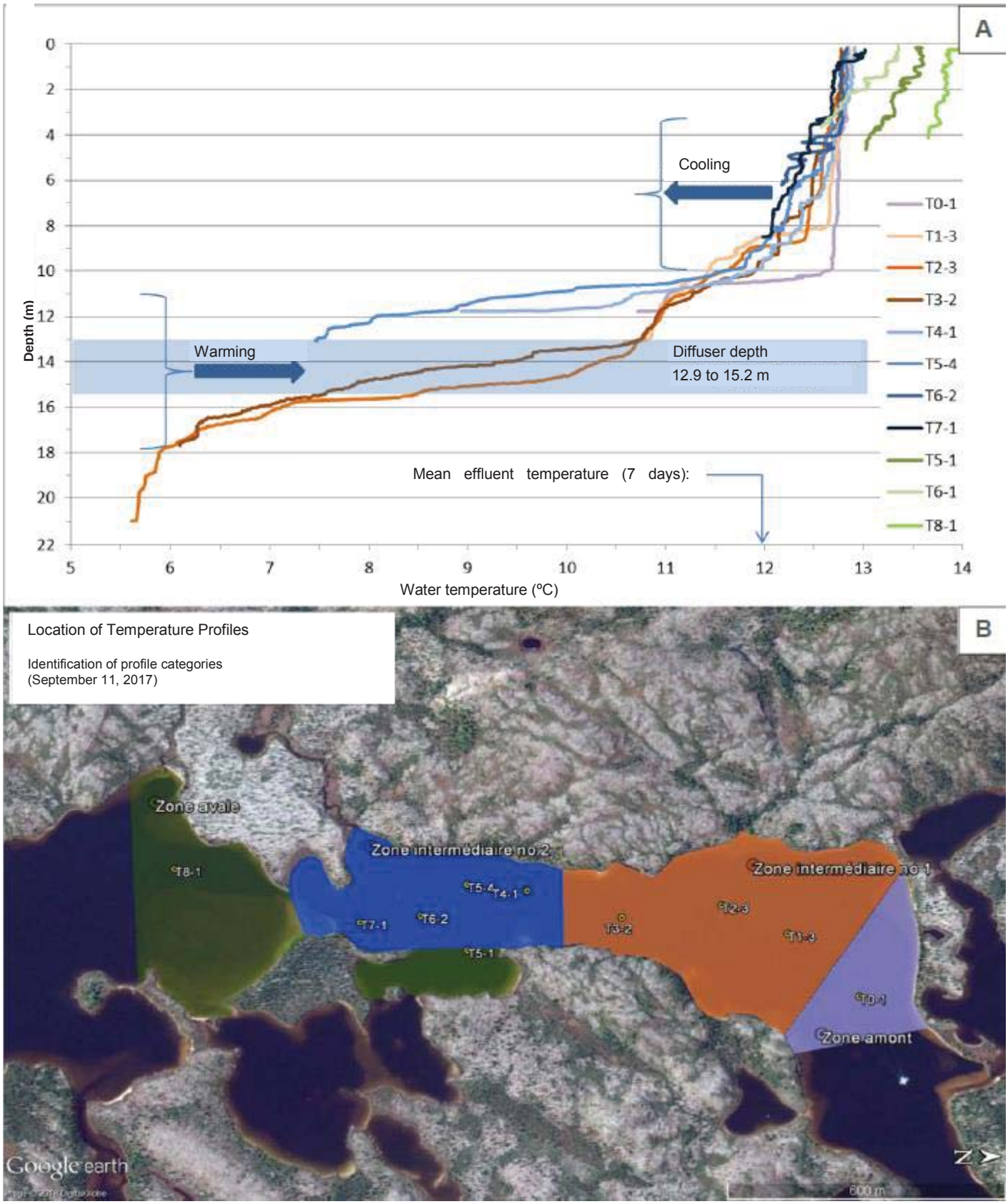
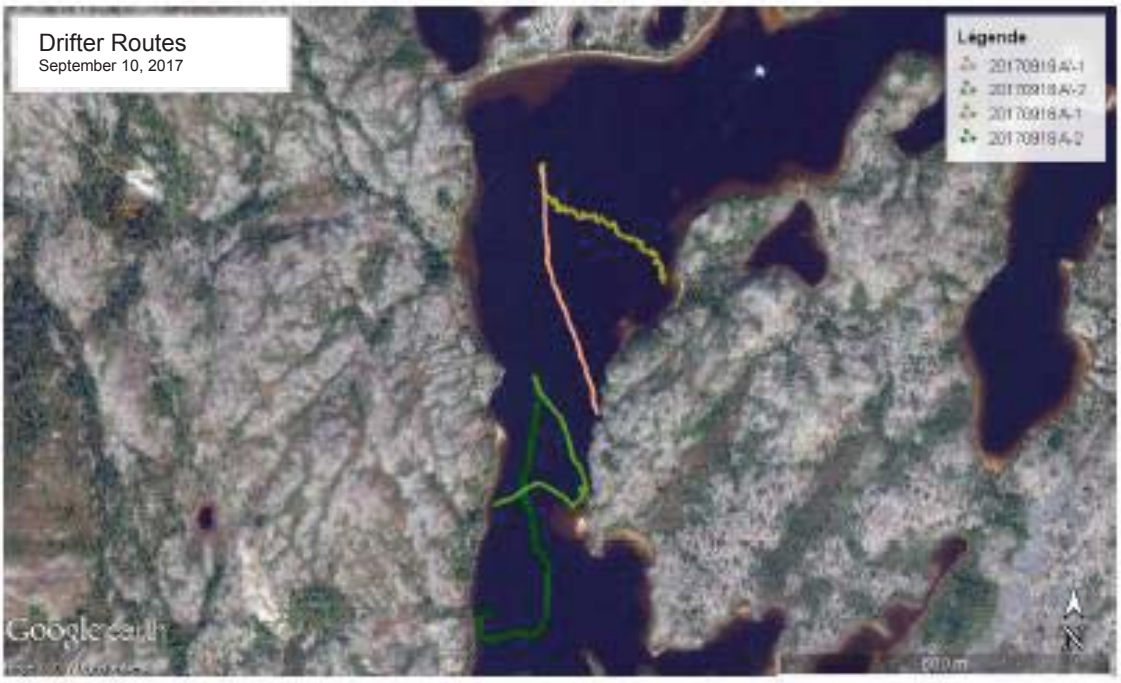



**Figure 3.8 Categories of temperature profiles in water masses observed in summer 2017**




A-1 Drifter with sail
A'-1 Drifter without sail

**Photo 3.8 Path taken by drifters on September 17 and 18, 2017**

#### 3.4.2.3 Lake Lagopede water balance

Hydrological data combined with data from the new weather station made it feasible in 2017 to establish a water balance for Lake Lagopede.

This global water balance deals exclusively with the north basin and was established using water losses and gains in Lake Lagopede. Water losses include evaporation, flow discharged from Lake Lagopede and water pumped from the fresh water pumping station. Water gains include precipitation, runoff, and domestic wastewater and treated mine water discharges.

In 2017, water losses were greater (40,000 m³) than gains resulting in a slightly negative water balance given the total volume of the north basin is 5.9 million m³.

## 3.5 Drinking Water Quality

In 2017, 47,532 m³ of drinking water was distributed by the drinking water treatment plant through the distribution system at the Renard mine site, with a 100% availability rate. Figure 3.9 illustrates monthly water distribution (in $m^3$), the average number of workers on site, and average consumption of drinking water at the Renard mine site (in litres/person/day).

In 2017, an increase in mean monthly distribution was observed as of March. Following this finding, a thorough investigation was launched and it was discovered that a piece of equipment at the ore processing plant had been mistakenly connected to the drinking water distribution system, which explained the sudden and continued increase in water consumption. An assessment of daily distribution identified abnormal consumption peaks, which could be associated with malfunctions or leaks in the distribution system, or waste.

With a view to encouraging responsible water use, SWY launched in 2016 a worker awareness campaign on the quality of water distributed at the mine site and the importance of using the water produced and distributed at the mine site wisely. The purpose of this campaign was two-fold: to make workers aware of the essential nature of water for humans and the environment, and to decrease bottled water consumption. The awareness campaign continued in 2017 so as to inform new employees of efforts deployed to produce quality water for all workers on site.

The Regulation respecting the Quality of Drinking Water (RQEP) does not impose any type of monitoring program on companies. SWY has however opted on a voluntary basis and in the interests of transparency to set up a drinking water quality monitoring program in line with RQEP requirements, the Regulation respecting Occupational Health and Safety (RSST), and the operational conditions set out in the Global Certificate of Authorization issued by the MDDELCC.

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. Table 3.7 shows the mean concentration measured in 2017 for the various parameters analyzed as part of the Drinking Water Monitoring Program. All the analytical results obtained to date meet RQEP standards.

From a bacteriological standpoint, no analytical result points to the presence of microorganisms that are indicators of either fecal contamination (e.g., *E. coli*) or total coliforms, since the values were zero or below the detection limit. Also, no sample had an atypical bacteria count greater than the allowable limit. In this regard, the residual chlorine concentration was always maintained above the required limit of 0.3 mg/l at the outlet of the plant thereby ensuring optimal disinfection.

To ensure the durability of equipment at the water treatment plant, preventive maintenance is carried out on a regular basis by operators, mechanics and electricians. For example, the membranes in the two nanofiltration units are washed on a monthly basis to preserve the physical integrity of the system and their service life. A log is maintained to archive information on required corrective actions.

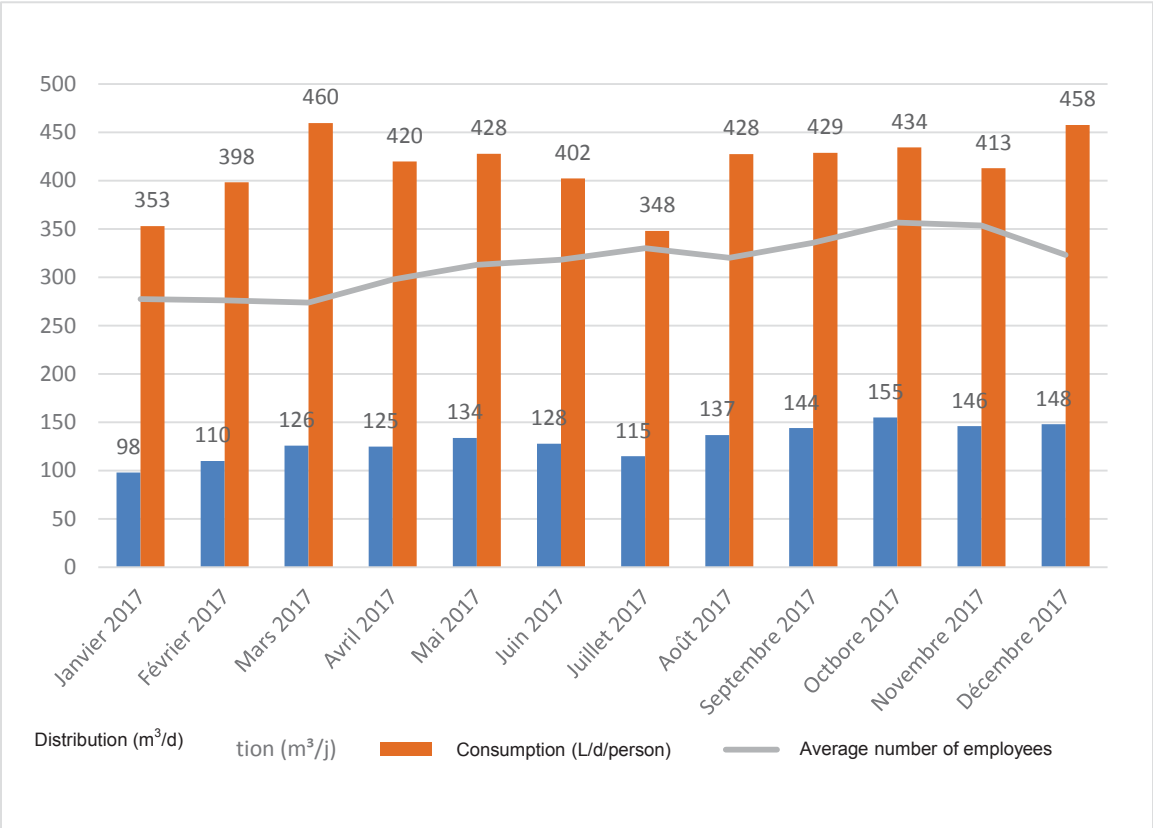



**Figure 3.9 Drinking water consumption at the Renard mine site in 2017**

**Table 3.7 Drinking water quality analyses in relation to quality standards set out in Appendix 1 of the RQEP**

| PARAMETERS | UNITS | RQEP | Mean Concentration | Maximum Value | Annual Sampling |
|---|---|---|---|---|---|
| **Physico-chemical** | | | | | |
| Antimoine (Sb) | mg/L | 0.006 | -- | -- | <0.001 |
| Arsenic (As) | mg/L | 0.01 | -- | -- | <0.001 |
| Barium (Ba) | mg/L | 1 | -- | -- | 0.001 |
| Boron (B) | mg/L | 5 | -- | -- | <0.04 |
| Cadmium (Cd) | mg/L | 0.005 | -- | -- | <0.00017 |
| Chloramines | mg/L | 3 | -- | -- | <0.1 |
| Free residual chlorine | mg/L | 0.3 (1) | 0.55 | 0.35(1) | 0.6 |
| Chromium (Cr) | mg/L | 0.05 | -- | -- | <0.001 |
| Copper (Cu) | mg/L | 1 | 0.00683 | 0.0122 | 0.0122 |
| Cyanides (CN-) | mg/L | 0.2 | -- | -- | <0.003 |
| Fluorides (F-) | mg/L | 1.5 | -- | -- | <0.01 |
| Nitrites and nitrates (in N) | mg/L | 10 | 0.41 | 1.15 | 0.21 |
| Nitrites (in N) | mg/L | 1 | 0.01 | <0.02 | <0.01 |
| Mercury (Hg) | mg/L | 0.001 | -- | -- | 0.00002 |
| pH | - | 6.5 to 8.5 | 7.26 | 6.82-7.57 | 7.57 |
| Lead (Pb) | mg/L | 0.01 | 0.00008 | <0.0001 | <0.0001 |
| Selenium (Se) | mg/L | 0.01 | -- | -- | <0.001 |
| Turbidity | UTN | 5 | 0.2 | 0.3 | <0.1 |
| Uranium (U) | mg/L | 0.02 | -- | -- | <0.0005 |
| **Other organic substances** | | | | | |
| Trihalomethanes | ug/L | 80 (2) | 5.0 | 10.9 | 5.6 |
| **Bacteriological** | | | | | |
| Atypical bacteria | /membrane | 200 | <1 | <1 | <1 |
| Total coliforms | UFC/100mL | 10 | <1 | <1 | <1 |
| Escherichia coli | UFC/100mL | 0 | <1 | <1 | <1 |

(1) Minimum value

(2) Mean maximum concentration calculated over four quarters

## 3.6 Surface Water and Sediment Quality

### 3.6.1 Surface water

As part of the Renard diamond project, Stornoway Diamonds (Canada) Inc. has committed to conducting surface water and sediment quality monitoring. This monitoring is also required under Condition 41 in the Global Certificate of Authorization issued on December 4, 2012, by the MDDEFP and the monitoring guidelines set out in the federal comprehensive study report. The objectives of the Surface Water and Sediment Quality Monitoring Program are to:

- Evaluate the effectiveness of design and mitigation measures in place and thereby minimize project impacts on the water system (e.g., limit phosphorus loading and prevent TSS loadings);
- Monitor the performance of the mine and domestic water management system as well as the mine tailings and ore management infrastructure;
- Monitor eventual changes in mining operational procedures or to any other component of the project that are likely to alter water and sediment quality;
- Document changes in water and sediment quality in the receiving environment;
- Obtain measurements of environmental variables that will facilitate the interpretation of benthos and fish monitoring and surveillance results;
- Apply corrective measures in accordance with the monitoring results.

A network of 26 surface water and sediment monitoring stations were deployed on the Renard mine site and on the perimeter of mining facilities in reference zones. The stations were positioned in terms of the potential sources of contamination as well as to obtain a good geographical representation of the hydrological network, including reference zones that are not influenced by mining activities.

The specific objective of the surface water and sediment quality monitoring program carried out in 2017 was to characterize the status of the receiving environment during and following construction and project implementation in relation to the reference state established as part of the environmental baseline study (EBS) for the Renard mine (Roche, 2011).

The surface water and sediment quality monitoring campaigns in 2017 were carried out in accordance with the schedule set out in the Environmental and Social Monitoring Program (ESMP). Four sampling campaigns were carried out in the mine sector throughout the year, according to the seasonal hydrological periods (winter low flow (Photo 3.9), spring flood, summer low flow and fall flood). Water quality monitoring in the airstrip sector was done once in the fall flood period in 2017.

**Photo 3.9 Fall 2017 sampling campaign**

Generally, surface water quality results from the 2017 sampling campaigns are comparable to those obtained in 2015 and 2016 and to the 2010 baseline conditons. A summary of the descriptive statistics for the surface water and sediment quality results in 2015 and 2016 and the 2010 baseline is presented in Table 3.8 (notes related to surface water quality criteria are presented in Appendix 3.1).

The primary characteristics of surface water quality as measured in 2017 are as follows:

- Watercourses and lakes are still well oxygenated overall with an acidic to slightly acidic pH, falling within the range of values measured in the 2010 baseline;
- As in the case of the 2010 baseline, the pH values measured in watercourses and lakes are mostly below the 6.5 threshold, the lower limit of the range of criteria for the protection of aquatic life (MDDELCC (chronic effect) and CCME (long-term effect)), and the Quebec criteria for the prevention of contamination (water and organisms);
- As in the case of the 2010 baseline, the water in lakes and watercourses was generally only mildly turbid and had low total suspended solid (TSS) concentrations;
- Nutrients were present in very low concentrations. Phosphorus concentrations measured in lakes in 2017 are characteristic of ultra-oligotrophic (<0.0004 mg/l) to oligotrophic (0.004 to 0.01 mg/l) lakes (MDDELCC, 2017), hence very low in this nutrient. The mine effluent plume dispersion modelling demonstrated that it is likely that in the presence of a thermocline (summer or winter) some effluent could accumulate below the thermocline. Four samples in

fact had nitrate concentrations that exceeded the criteria for the protection of aquatic life (MDDELCC (chronic effect)). These four samples were collected close to the lake bottom in the mine effluent discharge zone. Seasonal mixing (spring and fall) of water masses however would dilute the effect of the effluent across the water column, which dilutes the accumulation phenomenon twice yearly. Nitrate values measured in summer and fall 2017 near the effluent outfall had moreover returned to normal;

- As in the 2010 baseline, some metals, which constitute the natural geochemical background in the area, were detected in the water, including aluminum and iron, whose concentrations naturally exceed surface water quality criteria;
- Overall, the surface water quality results are comparable to those in 2015, 2016 and the 2010 baseline, except in the case of nitrates;
- More extensive statistical analyses are under way to determine whether the water and sediment quality results in 2017 differ significantly from those in previous years (2015 and 2016) and the 2010 baseline, as well as between the reference zones and the areas exposed to the project (mine and airstrip).

**Table 3.8 Overall descriptive statistics on surface water quality for watercourses and lakes in the 2017. 2015-2016 monitoring campaigns and 2010 baseline**

| Parameters | Unit | Federal (CCME) | | Provincial (MDDELCC) | | | | RDL 2017 | WATERCOURSES | | | | | | | | | | | | | | | | | | Lakes | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Recommendations for the Protection of Aquatic Life | | Protection of Aquatic Life | | Prevention of Contamination | | | 2017 Monitoring | | | | | | 2015-2016 Monitoring | | | | | | 2010 Baseline | | | | | | 2017 Monitoring | | | | | | 2015-2016 Monitoring | | | | | | 2010 Baseline | | | | | |
| | | Short Term | Long Term | Chronic Effect | Acute Effect | With Drinking Water Intake | Without Drinking Water Intake | | Number of Values | Nb < DL | Non-Compliance with Criteria (Nb) | Minimum | Median | Maximum | Number of Values | %<DL | Non-Compliance with Criteria (%) | Minimum | Median | Maximum | Number of Values | %<DL | Non-Compliance with Criteria (%) | Minimum | Median | Maximum | Number of Values | Nb < DL | Non-Compliance with Criteria (Nb) | Minimum | Median | Maximum | Number of Values | %<LD | Non-Compliance with Criteria (%) | Minimum | Médiane | Maximum | Number of Values | %<DL | Non-Compliance with Criteria (%) | Minimum | Median | Maximum |
| **Conventional parameters** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Alcalinity | mg/L | - | - | $^{o}$ | - | - | - | 1 | 21 | 5 | 0 | <1 | 2 | 23 | 11 | 9% | 0% | <1 | 2 | 8 | 19 | 47% | 0% | <1 | 1 | 4 | 89 | 9 | 0 | <1 | 2 | 15 | 56 | 4% | 0% | <1 | 2 | 5 | 25 | 36% | 0% | <1 | 2 | 7 |
| Ammonia nitrogen (N-NH$_3$) | mg/L | - | - | 1.23s | 17.9s | 0.2t and 1.5u | - | 0.02 | 21 | 15 | 0 | <0.02 | <0.02 | 0.06 | 18 | 78% | 11% | <0.06 | <0.06 | *0.75* | 19 | 100% | 0% | <0.06 | <0.06 | <0.06 | 89 | 33 | 5 | <0.02 | 0.03 | 0.7 | 72 | 79% | 3% | <0.06 | <0.06 | *4.34* | 25 | 100% | 0% | <0.06 | <0.06 | <0.06 |
| Total nitrogen (total N) | mg/L | - | - | - | - | - | - | 0.3 | 21 | 17 | 0 | <0.3 | <0.3 | 1.29 | 13 | 8461538461 | 0% | <0.02 | 0.145 | 1.4 | 0 | - | - | - | - | - | 89 | 44 | 0 | <0.3 | 0.3 | 6.43 | 43 | 9% | 0% | <0.02 | 0.254 | 1.1 | 0 | - | - | - | - | - |
| Total Kjedahl nitrgen (TKN) | mg/L | - | - | - | - | - | - | 0.4 | | | | | | | 4 | 75% | 0% | <0.4 | <0.4 | 0.79 | 19 | 21% | 0% | <0.4 | 0.51 | 0.69 | | | | | | | 19 | 84% | 0% | <0.4 | <0.4 | 0.61 | 25 | 44% | 0% | <0.4 | 0.44 | 0.72 |
| Bromides (Br-) | mg/L | - | - | 0.0027 | 0.0024 | - | - | 0.1 | 21 | 21 | 0 | <0.1 | <0.1 | <0.1 | 15 | 100% | 0% | <0.1 | <0.1 | <0.1 | 0 | - | - | - | - | - | 89 | 84 | 0 | <0.1 | <0.1 | *0.2* | 57 | 100% | 0% | <0.1 | <0.1 | <0.1 | 0 | - | - | - | - | - |
| Total organic carbon (TOC) | mg/L | - | - | - | - | - | - | 0.2 | 21 | 0 | 0 | 3.6 | 4.78 | 22.2 | 18 | 0% | 0% | 3.3 | 6.95 | 17.1 | 0 | - | - | - | - | - | 89 | 0 | 0 | 3.01 | 4.59 | 17.2 | 72 | 0% | 0% | 1.7 | 5.3 | 11.7 | 0 | - | - | - | - | - |
| Dissolved organic carbon (DOC) | mg/L | - | - | - | - | - | - | 0.2 | 21 | 1 | 0 | <0.20 | 4.1 | 21.6 | 18 | 0% | 0% | 3.4 | 6.95 | 17.6 | 0 | - | - | - | - | - | 89 | 1 | 0 | <0.20 | 4.01 | 15.2 | 72 | 0% | 0% | 1.3 | 5.35 | 10 | 0 | - | - | - | - | - |
| Chlorophyll A | mg/L | - | - | - | - | - | - | 0.00005 | 0 | - | - | - | - | - | 0 | - | - | - | - | - | 0 | - | - | - | - | - | 12 | 2 | 0 | <0.00005 | 0.00053 | 0.00074 | 26 | 0% | 0% | 0.0002 | 0.0006 | 0.0015 | 0 | - | - | - | - | - |
| Pheopigments | mg/L | - | - | - | - | - | - | 0.00005 | 0 | - | - | - | - | - | 0 | - | - | - | - | - | 0 | - | - | - | - | - | 0 | - | - | - | - | - | 26 | 0% | 0% | 0.00005 | 0.0004 | 0.0009 | 0 | - | - | - | - | - |
| Chlorures (Cl-) | mg/L | 640 | 120 | 230 | 860 | 250 | - | 0.05 | 21 | 0 | 0 | 0.094 | 0.17 | 4.56 | 11 | 0% | 0% | 0.06 | 0.14 | 1.3 | 19 | 0% | 0% | 0.06 | 0.1 | 0.49 | 89 | 0 | 0 | 0.093 | 0.77 | 24.8 | 57 | 0% | 0% | 0.05 | 0.22 | 0.8 | 25 | 0% | 0% | 0.05 | 0.26 | 0.85 |
| Conductivité * | uS/cm | - | - | - | - | - | - | *In situ* | 21 | 0 | 0 | 2 | 13 | 54 | 17 | 0% | 0% | 1 | 12 | 70 | 19 | 0% | 0% | 6.1 | 10.3 | 26.9 | 88 | 0 | 0 | 3 | 28 | 540 | 69 | 0% | 0% | 0 | 16 | 56 | 25 | 0% | 0% | 6.8 | 10.8 | 28.4 |
| BOD5 | mg/L | - | - | 3$^{r}$ | - | - | - | 2 | 21 | 20 | 1 | <2 | <2 | *4* | 18 | 100% | 0% | <4 | <4 | <4 | 0 | - | - | - | - | - | 89 | 87 | 0 | <2 | <2 | 3 | 72 | 99% | 1% | <4 | <4 | *4* | 0 | - | - | - | - | - |
| COD | mg/L | - | - | - | - | - | - | 3 | 21 | 5 | 0 | <3 | 12 | 43 | 19 | 0% | 0% | 10 | 20 | 130 | 0 | - | - | - | - | - | 89 | 9 | 0 | <3 | 11 | 75 | 73 | 3% | 0% | <10 | 18 | 39 | 0 | - | - | - | - | - |
| Total hardness (CaCO$_3$) | mg/L | - | - | - | - | - | - | 1 | 17 | 0 | 0 | 1.6 | 2.59 | 7.28 | 14 | 0% | 0% | 1.8 | 3.1 | 15 | 19 | 68% | 0% | <1 | <1 | 6.5 | 77 | 0 | 0 | 1.61 | 5.1 | 58.6 | 66 | 0% | 0% | 2 | 3.65 | 14 | 25 | 72% | 0% | <1 | <1 | 14 |
| Fluorides (F-) | mg/L | - | 0.12 | 0.2z | 4$^{z}$ | 1.5A | - | 0.01 | 21 | 11 | 0 | <0.01 | <0.01 | 0.032 | 18 | 100% | 0% | <0.1 | <0.1 | <0.1 | 0 | - | - | - | - | - | 89 | 39 | 5 | <0.01 | 0.01 | **0.3** | 72 | 97% | 0% | <0.1 | <0.1 | **0.2** | 0 | - | - | - | - | - |
| Total suspended solids (TSS) | mg/L | +25$^{d}$ | +5$^{d}$ | +5 to 25p | +25$^{q}$ | - | - | 1 | 21 | 12 | 0 | <1 | <2 | 4 | 19 | 68% | 0% | <3 | <3 | 42 | 19 | 95% | 0% | <3 | <3 | 3 | 89 | 47 | 0 | <1 | <2 | 4 | 73 | 84% | 0% | <3 | <3 | 12 | 25 | 96% | 0% | <3 | <3 | 19 |
| Nitrates (NO$_3^-$) | mg/L | 550 | 13 | 2.9w | - | 10x | - | 0.01 | 21 | 3 | 0 | <0.01 | 0.031 | 1.29 | 18 | 89% | 0% | <0.1 | <0.1 | 1.5 | 19 | 100% | 0% | <0.1 | <0.1 | <0.1 | 89 | 4 | 4 | <0.01 | 0.293 | *5.6* | 70 | 69% | 0% | <0.1 | <0.1 | 1.1 | 25 | 100% | 0% | <0.1 | <0.1 | <0.1 |
| Nitrites (NO$_2^-$) | mg/L | - | 0.06 | 0.02 to 0.20y | 0.06 to 0.60y | 1$^{x}$ | - | 0.01 | 21 | 18 | 2 | <0.01 | <0.01 | *0.03* | 11 | 100% | 0% | <0.02 | <0.02 | <0.02 | 9 | 100% | 0% | <0.02 | <0.02 | <0.02 | 89 | 77 | 2 | <0.01 | <0.01 | *0.06* | 57 | 95% | 5% | <0.02 | <0.02 | ***0.15*** | 16 | 100% | 0% | <0.02 | <0.02 | <0.02 |
| Dissolved oxygen (%)* | % | - | - | 54 to 63% X | - | - | - | *In situ* | 21 | 0 | 0 | 71.2 | 88.8 | 111.9 | 15 | 0% | 0% | 66.1 | 80.9 | 112.4 | 17 | 0% | 0% | 60.6 | 86.8 | 106 | 88 | 0 | 7 | *4.2* | 90.3 | 111.9 | 69 | 0% | 1% | *16.2* | 89.5 | 113.6 | 22 | 0% | 0% | *65.5* | 87.5 | 105 |
| Dissolved oxygen (mg/l)* | mg/L | - | 6.0 to 9.5b | 5 to 8 mg/l X | - | - | - | *In situ* | 21 | 0 | 0 | 8.46 | 10.47 | 16.53 | 16 | 0% | 6.25% | ***5.95*** | 8.87 | 12.6 | 17 | 0% | 6% | 5.84 | 7.59 | 11.33 | 88 | 0 | 5 | *0.6* | 10.82 | 15.48 | 69 | 0% | 1% | ***1.97*** | 9.89 | 14.34 | 22 | 0% | 5% | ***5.28*** | 8.05 | 9.32 |
| pH* | Unité de pH | - | 6.5 to 9.0 | 6.5 to 9.0j | 5.0 to 9.0k | 6.5 to 8.5l | - | *In situ* | 21 | 0 | 21 | ***5.11*** | ***6.23*** | 7.01 | 19 | 0% | 95% | ***5.0*** | ***5.71*** | 6.93 | 19 | 0% | 95% | 4.97 | 5.7 | 7.93 | 89 | 0 | 89 | ***4.7*** | ***6.3*** | 7.63 | 73 | 0% | 90% | ***5.0*** | ***6.2*** | 6.99 | 25 | 0% | 68% | ***4.73*** | ***5.91*** | 7.1 |
| Phenols-4AAP | mg/L | - | - | - | - | - | 0.005U | 0.002 | 21 | 9 | 4 | <0.002 | 0.002 | 0.007 | 16 | 93.75% | 0% | <0.005 | <0.005 | 0.005 | 0 | - | - | - | - | - | 89 | 29 | 12 | <0.002 | 0.002 | 0.009 | 56 | 91% | 9% | <0.005 | <0.005 | 0.018 | 0 | - | - | - | - | - |
| Total phosphorus (P) | mg/L | - | 0.004 to 0.01e | 0.02. 0.03 ou >50%v | - | - | - | 0.0006 | 21 | 0 | 1 | 0.0013 | 0.0038 | **0.0158** | 17 | 65% | 12% | <0.005 | <0.005 | **0.0168** | 19 | 11% | 5% | <0.005 | 0.006 | 0.011 | 89 | 6 | 1 | <0.0006 | 0.0032 | **0.0106** | 86 | 66% | 16% | <0.005 | <0.005 | ***0.148*** | 25 | 40% | 8% | <0.005 | 0.006 | ***0.022*** |
| Oxidation reduction potential* | mV | - | - | - | - | - | - | *In situ* | 6 | 0 | 0 | 203 | 236.5 | 326.1 | 1 | 0% | 0 | 137.8 | 137.8 | 137.8 | 19 | 0% | 0% | 100 | 205 | 297.8 | 14 | 0 | 0 | 156.8 | 238.5 | 306 | 1 | 0% | 0% | 369.8 | - | - | 25 | 0% | 0% | 105.0 | 232.9 | 293.3 |
| Total dissolved solids | mg/L | - | - | - | - | - | - | 9 | 21 | 1 | 0 | <9 | 26 | 48 | 19 | 63% | 0% | <25 | <25 | 70 | 19 | 16% | 0% | <25 | 31 | 54 | 89 | 1 | 0 | <9 | 26 | 148 | 73 | 63% | 0% | <25 | <25 | 64 | 25 | 64% | 0% | <25 | <25 | 57 |
| Total solids | mg/L | - | - | - | - | - | - | 4 | 21 | 1 | 0 | <4 | 28 | 62 | 19 | 16% | 0% | <10 | 28 | 88 | 0 | - | - | - | - | - | 89 | 0 | 0 | 6 | 32 | 152 | 73 | 19% | 0% | <10 | 24 | 104 | 0 | - | - | - | - | - |
| Sulphates (SO$_4^{2-}$) | mg/L | - | - | 500B | 500B | 500C | - | 0.08 | 21 | 0 | 0 | 0.566 | 1.1 | 7.91 | 18 | 83% | 0% | <2 | <2 | 13 | 19 | 89% | 0% | <2 | <2 | 6 | 89 | 1 | 0 | <0.08 | 3.33 | 38.3 | 70 | 73% | 0% | <2 | <2 | 8.1 | 25 | 92% | 0% | <2 | <2 | 6.75 |
| Temperature* | °C | $^{a}$ | | $^{w}$ | - | - | - | *In situ* | 21 | 0 | 0 | 0.1 | 7.8 | 14.3 | 17 | 0% | 0% | 0 | 12 | 17.8 | 18 | 0% | 0% | 9.6 | 16.03 | 26 | 88 | 0 | 0 | 0 | 7.3 | 15.4 | 71 | 0% | 0% | 0 | 12.7 | 20.72 | 25 | 0% | 0% | 12.09 | 15.99 | 26.7 |
| Transparency* | m | - | - | - | - | - | - | *In situ* | 0 | - | - | - | - | - | 1 | 0% | 0% | 1.4 | 1.4 | 1.4 | 0 | - | - | - | - | - | 24 | - | - | 2.5 | 3.00 | 3.5 | 36 | 0% | 0% | 1.75 | 2.435 | 3.375 | 0 | - | - | - | - | - |
| Turbidity* | UTN | +8$^{c}$ | +2$^{c}$ | +2$^{m}$ | +8$^{n}$ | - | - | *In situ* | 21 | 0 | 0 | 0 | 0 | 1.5 | 16 | 0% | 0% | 0 | 0.25 | 9.6 | 19 | 0% | 0% | 0 | 1.01 | 2.41 | 88 | 0 | 0 | 0 | 0 | 4.2 | 71 | 0% | 0% | 0 | 0.3 | 7.2 | 25 | 0% | 0% | 0 | 0.87 | 29.53 |
| **Metals** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Aluminium (Al) | mg/L | - | 0.005 and 0.1f | 0.087D | 0.75E | 0.2 F | - | 0.0005 | 21 | 0 | 21 | 0.0601 | ***0.112*** | ***0.433*** | 16 | 0% | 100% | **0.087** | ***0.18*** | ***0.58*** | 19 | 16% | 84% | <0.03 | 0.13 | 0.48 | 89 | 0 | 89 | **0.0702** | ***0.115*** | ***0.27*** | 72 | 1% | 99% | <0.03 | ***0.14*** | ***0.26*** | 25 | 32% | 68% | <0.03 | **0.08** | ***0.87*** |
| Antimony (Sb) | mg/L | - | - | 0.24 | 1.1 | 0.006G | 0.64 | 0.000005 | 21 | 12 | 0 | <0.000005 | <0.000015 | 0.000087 | 13 | 23% | 0% | <0.000005 | 0.000012 | 0.000025 | 0 | - | - | - | - | - | 89 | 37 | 0 | <0.000005 | 0.000018 | 0.000668 | 59 | 20% | 0% | <0.000005 | 0.000015 | 0.0002 | 0 | - | - | - | - | - |
| Silver (Ag) | mg/L | - | 0.00025 | - | - | - | - | 0.000003 | 21 | 16 | 0 | 0.0000004 | <0.000003 | 0.000004 | 13 | 100% | 0% | <0.000003 | <0.000003 | <0.000003 | 0 | - | - | - | - | - | 89 | 66 | 0 | <0.000003 | <0.000003 | 0.000054 | 59 | 98% | 0% | <0.000003 | <0.000003 | 0.000007 | 0 | - | - | - | - | - |
| Arsenic (As) | mg/L | - | 0.005 | 0.15J | 0.34J | 0.0003K | 0.021L | 0.00008 | 21 | 15 | 0 | <0.00008 | <0.00008 | 0.00023 | 13 | 23% | 0% | <0.00008 | 0.0001 | 0.00021 | 0 | - | - | - | - | - | 89 | 71 | 2 | <0.00008 | <0.00008 | 0.00041 | 59 | 25% | 0% | <0.00008 | 0.00009 | 0.00015 | 0 | - | - | - | - | - |
| Barium (Ba) | mg/L | - | - | 0.038H | 0.11H | 1$^{M}$ | 160 | 0.0003 | 21 | 0 | 0 | 0.00177 | 0.00334 | 0.0101 | 16 | 0% | 0% | 0.0026 | 0.0038 | 0.0093 | 0 | - | - | - | - | - | 89 | 0 | 0 | 0.00232 | 0.00454 | 0.0245 | 72 | 4% | 0% | <0.002 | 0.0039 | 0.0066 | 0 | - | - | - | - | - |
| Beryllium (Be) | mg/L | - | - | - | - | - | - | 0.000006 | 21 | 3 | 0 | <0.000006 | 0.000011 | 0.000019 | 13 | 92% | 0% | <0.00001 | <0.00001 | 0.00001 | 0 | - | - | - | - | - | 89 | 9 | 0 | <0.000006 | 0.000009 | 0.000026 | 59 | 93% | 0% | <0.00001 | <0.00001 | 0.00001 | 0 | - | - | - | - | - |
| Boron (B) | mg/L | 29 | 1.5 | 5 | 28 | 0.2 | 160 | 0.0003 | 21 | 13 | 0 | <0.0003 | <0.0003 | 0.0375 | 13 | 0% | 0% | 0.0005 | 0.0007 | 0.0045 | 0 | - | - | - | - | - | 89 | 23 | 0 | <0.0003 | 0.0028 | 0.0829 | 59 | 0% | 0% | 0.0005 | 0.0009 | 0.0048 | 0 | - | - | - | - | - |
| Cadmium (Cd) | mg/L | 0.001 | 0.00009 | 0.0002H | 0.0004H | 0.005M | 0.13 | 0.000006 | 21 | 4 | 0 | <0.000006 | 0.000009 | 0.000024 | 13 | 23% | 0% | <0.000006 | 0.000007 | 0.000013 | 0 | - | - | - | - | - | 89 | 14 | 0 | <0.000006 | 0.000009 | 0.000023 | 59 | 22% | 0% | <0.000006 | 0.000007 | 0.000012 | 0 | - | - | - | - | - |
| Calcium (Ca) | mg/L | - | - | G | - | - | - | 0.02 | 21 | 0 | 0 | 0.324 | 0.574 | 1.7 | 16 | 6.25% | 0% | <0.5 | 0.795 | 4.6 | 19 | 5% | 0% | <0.5 | 0.8 | 2.6 | 89 | 0 | 0 | 0.324 | 1.33 | 18.8 | 72 | 0% | 0% | 0.53 | 1 | 4.7 | 25 | 8% | 0% | <0.5 | 0.7 | 2.85 |
| Total chromium (Cr) | mg/L | - | CrIII: 0.0089 | CrIII: 0.55H | CrIII: 0.27H | 0.05M | CrVI: 9.4 | 0.00004 | 21 | 1 | 0 | <0.00004 | 0.00059 | 0.0015 | 13 | 8% | 0% | <0.00004 | 0.00045 | 0.0012 | 0 | - | - | - | - | - | 89 | 7 | 0 | <0.00004 | 0.00066 | 0.00253 | 59 | 0% | 0% | 0.00007 | 0.00027 | 0.0012 | 0 | - | - | - | - | - |
| Cobalt (Co) | mg/L | - | - | 0.1 | 0.37 | - | - | 0.000005 | 21 | 0 | 0 | 0.000046 | 0.000104 | 0.000336 | 13 | 0% | 0% | 0.00011 | 0.00017 | 0.0017 | 0 | - | - | - | - | - | 89 | 0 | 0 | 0.00006 | 0.000136 | 0.00147 | 59 | 0% | 0% | 0.00005 | 0.00013 | 0.00061 | 0 | - | - | - | - | - |
| Copper (Cu) | mg/L | - | 0.002g | 0.0016HN | 0.0032HN | 1$^{O}$ | 38 | 0.00005 | 21 | 0 | 0 | 0.00012 | 0.00027 | 0.00063 | 13 | 0% | 0% | 0.0002 | 0.00032 | 0.00049 | 0 | - | - | - | - | - | 89 | 0 | 1 | 0.00009 | 0.00032 | *0.0017* | 59 | 0% | 0% | 0.00007 | 0.0003 | 0.00068 | 0 | - | - | - | - | - |
| Iron (Fe) | mg/L | - | 0.3 | 1.3P | 3.4P | 0.3Q | - | 0.1 | 21 | 0 | 3 | 0.0648 | 0.109 | **0.704** | 16 | 0% | 25% | 0.11 | 0.22 | ***3.2*** | 19 | 0% | 11% | 0.1 | 0.22 | 0.55 | 89 | 0 | 5 | 0.0572 | 0.105 | ***2.15*** | 72 | 33% | 4% | <0.1 | 0.11 | **1.2** | 25 | 48% | 12% | <0.1 | 0.1 | **0.8** |
| Magnesium (Mg) | mg/L | - | - | - | - | - | - | 0.2 | 21 | 0 | 0 | 0.161 | 0.24 | 0.737 | 16 | 25% | 0% | <0.2 | 0.26 | 0.89 | 19 | 26% | 0% | <0.2 | 0.2 | 0.85 | 89 | 0 | 0 | 0.161 | 0.367 | 2.89 | 72 | 17% | 0% | <0.2 | 0.25 | 0.65 | 25 | 20% | 0% | <0.2 | 0.2 | 2.3 |
| Manganese (Mn) | mg/L | - | - | 0.26H | 0.6H | 0.05Q | 59 | 0.003 | 21 | 0 | 0 | 0.00116 | 0.00285 | 0.00555 | 16 | 62.5% | 0% | <0.003 | <0.003 | 0.082 | 19 | 63% | 0% | <0.003 | <0.003 | 0.005 | 89 | 0 | 1 | 0.00175 | 0.00407 | 0.07 | 72 | 19% | 0% | <0.003 | 0.0047 | 0.032 | 25 | 48% | 0% | <0.003 | 0.003 | 0.012 |
| Mercury (Hg) | mg/L | - | 0.000026 | 0.00091 | 0.0016 | 0.0000018S | 0.0000018S | 0.0000019 | 21 | 16 | 21 | <0.0000019 | <0.000002 | <0.000025 | 13 | 54% | 46% | <0.000002 | <0.000002 | 0.000003 | 0 | - | - | - | - | - | 89 | 82 | 89 | <0.0000019 | <0.0000019 | <0.000025 | 59 | 68% | 32% | <0.000002 | <0.000002 | 0.000004 | 0 | - | - | - | - | - |
| Molybdenum (Mo) | mg/L | - | 0.073 | 3.2 | 29 | 0.04R | 10 | 0.00001 | 21 | 0 | 0 | 0.00003 | 0.00008 | 0.00044 | 13 | 0% | 0% | 0.00004 | 0.00006 | 0.00012 | 0 | - | - | - | - | - | 89 | 2 | 0 | 0.00001 | 0.00025 | 0.00531 | 59 | 0% | 0% | 0.00002 | 0.0001 | 0.001 | 0 | - | - | - | - | - |
| Nickel (Ni) | mg/L | - | 0.025h | 0.007H | 0.07H | 0.07R | 4.6 | 0.00003 | 21 | 0 | 0 | 0.00018 | 0.00051 | 0.00178 | 13 | 0% | 0% | 0.00042 | 0.00067 | 0.0012 | 0 | - | - | - | - | - | 89 | 0 | 0 | 0.00028 | 0.00084 | 0.00485 | 59 | 0% | 0% | 0.00025 | 0.0006 | 0.001 | 0 | - | - | - | - | - |
| Lead (Pb) | mg/L | - | 0.001i | 0.00017H | 0.004H | 0.01M | 0.19 | 0.00001 | 21 | 0 | 4 | 0.00004 | 0.00011 | *0.00028* | 13 | 0% | 23% | 0.00009 | 0.00015 | *0.00022* | 0 | - | - | - | - | - | 89 | 0 | 4 | 0.00005 | 0.00009 | *0.00056* | 59 | 0% | 2% | 0.00004 | 0.00007 | *0.00022* | 0 | - | - | - | - | - |
| Potassium (K) | mg/L | - | - | - | - | - | - | 0.1 | 21 | 0 | 0 | 0.106 | 0.215 | 0.679 | 13 | 0% | 0% | 0.12 | 0.22 | 0.78 | 19 | 11% | 0% | <0.1 | 0.2 | 0.9 | 89 | 0 | 0 | 0.107 | 0.45 | 5.66 | 59 | 0% | 0% | 0.13 | 0.3 | 0.77 | 25 | 12% | 0% | <0.1 | 0.2 | 1 |
| Selenium (Se) | mg/L | - | 0.001 | 0.005 | 0.062 | 0.01M | 4.2 | 0.00005 | 21 | 14 | 0 | <0.00005 | <0.00005 | 0.00047 | 13 | 92% | 0% | <0.00005 | <0.00005 | 0.00007 | 0 | - | - | - | - | - | 89 | 43 | 0 | <0.00005 | 0.00007 | 0.00098 | 59 | 95% | 0% | <0.00005 | <0.00005 | 0.00012 | 0 | - | - | - | - | - |
| Silicium (Si) | mg/L | - | - | - | - | - | - | 0.02 | 21 | 0 | 0 | 1.02 | 1.43 | 3.9 | 3 | 0% | 0% | 1.6 | 1.7 | 2.1 | 0 | - | - | - | - | - | 89 | 0 | 0 | 0.881 | 1.49 | 3.92 | 13 | 0% | 0% | 1.2 | 1.6 | 1.9 | 0 | - | - | - | - | - |
| Sodium (Na) | mg/L | - | - | - | - | - | - | 0.00005 | 21 | 0 | 0 | 0.405 | 0.668 | 3.03 | 16 | 18.75% | 0% | <0.5 | 0.645 | 5 | 19 | 26% | 0% | <0.5 | 0.56 | 1.1 | 89 | 0 | 0 | 0.401 | 1.14 | 10.8 | 72 | 7% | 0% | <0.5 | 0.77 | 3 | 25 | 56% | 0% | <0.5 | <0.5 | 1.25 |
| Strontium (Sr) | mg/L | - | - | 21 | 40 | 4 | - | 0.00005 | 21 | 0 | 0 | 0.0044 | 0.00698 | 0.0223 | 13 | 0% | 0% | 0.0048 | 0.0073 | 0.017 | 0 | - | - | - | - | - | 89 | 0 | 0 | 0.00455 | 0.0161 | 0.243 | 59 | 0% | 0% | 0.0049 | 0.0093 | 0.031 | 0 | - | - | - | - | - |
| Uranium (U) | mg/L | 0.033 | 0.015 | 0.014Y | 0.32Y | 0.02M | - | 0.000005 | 21 | 3 | 0 | <0.000005 | 0.000009 | 0.000022 | 13 | 0% | 0% | 0.000004 | 0.000007 | 0.000015 | 0 | - | - | - | - | - | 89 | 4 | 0 | <0.000005 | 0.000011 | 0.00008 | 59 | 0% | 0% | 0.000004 | 0.000009 | 0.00004 | 0 | - | - | - | - | - |
| Vanadium (V) | mg/L | - | - | 0.012 | 0.11 | 0.22 | 2.2 | 0.00002 | 21 | 18 | 0 | <0.00002 | <0.00002 | 0.00028 | 13 | 0% | 0% | 0.00011 | 0.00021 | 0.00081 | 0 | - | - | - | - | - | 89 | 80 | 0 | <0.00002 | <0.00002 | 0.00731 | 59 | 0% | 0% | 0.0001 | 0.00016 | 0.00067 | 0 | - | - | - | - | - |
| Zinc (Zn) | mg/L | - | 0.03 | 0.017H | 0.017H | 5O | 26 | 0.0005 | 21 | 3 | 0 | <0.0005 | 0.0015 | 0.0125 | 13 | 54% | 0% | <0.002 | <0.002 | 0.0042 | 10 | 100% | 0% | <0.002 | <0.002 | <0.002 | 89 | 0 | 1 | 0.001 | 0.0025 | *0.0181* | 59 | 73% | 0% | <0.002 | <0.002 | 0.0063 | 9 | 100% | 0% | <0.002 | <0.002 | <0.002 |
| Hydrocarbons | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Hydrocarbon C$_{10}$-C$_{50}$ | mg/L | - | - | 0.010T | - | - | - | 0.1 | 21 | 20 | 1 | <0.1 | <0.100 | *0.145* | 19 | 79% | 21% | <0.1 | <0.1 | *0.2* | 19 | 100% | 0% | <0.1 | <0.1 | <0.1 | 89 | 82 | 7 | <0.1 | <0.100 | *0.196* | 73 | 93% | 7% | <0.1 | <0.1 | *0.2* | 24 | 96% | 4% | <0.1 | <0.1 | *0.42* |
| Propylene glycol | mg/L | - | 500 | 500 aa | 1 000 | 580 | 47 000 | 5 | 1 | 1 | 0 | <5 | <5 | <5 | 4 | 100% | 0% | <10 | <10 | <10 | 0 | - | - | - | - | - | 1 | 1 | 0 | <5 | <5 | <5 | 3 | 100% | 0% | <10 | <10 | <10 | 0 | - | - | - | - | - |
| Bacteriology | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Atypical bacteria | nb/membrane | - | - | - | - | - | - | 2 | 0 | - | - | - | - | - | 0 | - | - | - | - | - | 0 | - | - | - | - | - | 16 | 0 | 0 | 14 | 115 | 980 | 4 | 0% | 0% | 4 | 102 | 200 | 0 | - | - | - | - | - |
| Fecal coliforms | UFC/100 ml | - | - | - | - | 200V | - | 2 | 0 | - | - | - | - | - | 0 | - | - | - | - | - | 0 | - | - | - | - | - | 16 | 15 | 0 | <2 | <2 | 3 | 10 | 100% | 0% | <10 | <10 | <10 | 0 | - | - | - | - | - |
| Total coliforms | UFC/100 ml | - | - | - | - | - | - | 2 | 0 | - | - | - | - | - | 0 | - | - | - | - | - | 0 | - | - | - | - | - | 16 | 1 | 0 | <2 | 28 | 470 | 8 | 75% | 0% | <10 | <10 | 36 | 0 | - | - | - | - | - |
| Escherichia coli | UFC/100 ml | - | - | - | - | 150V | - | 2 | 0 | - | - | - | - | - | 0 | - | - | - | - | - | 0 | - | - | - | - | - | 16 | 16 | 0 | <2 | <2 | <2 | 10 | 100% | 0% | <10 | <10 | <10 | 0 | - | - | - | - | - |
| Phenols | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

**Legend:**

| | |
|---|---|
| **bold** | **Result exceeds Canadian recommendation for the protection of aquatic life (long term)** |
| hached line | Result exceeds Canadian recommendation for the protection of aquatic life (short term) |
| *italics* | *Result exceeds Quebec criteria for the protection of acquatic life (chronic effect)* |
| underline | Result exceeds Quebec criteria for the protection of aquatic life (acute effect) |
| ☐ | Result exceeds Quebec criteria for the prevention of contamination (with water intake) |
| ▨ | Result exceeds Quebec criteria for the prevention of contamination (without water intake) |

### 3.6.2 Monthly monitoring of temperature and conductivity at the mine outfall

Modelling was done as part of the ESIA to determine mine effluent dispersion and dilution patterns in Lake Lagopede (Environnement Illimité, 2011). For the model, the assumption was made that the mine effluent could concentrate below the summer and winter thermocline (zone of rapid transition in temperature). The dimictic nature of Lake Lagopede, a natural phenomenon in lakes where water mixing occurs twice yearly, means that the effluent would be completely diluted throughout the water column. The effluent discharge objectives (EDOs) for the mine effluent were calculated on the basis of these assumptions to protect the ecosystem even during the low-flow periods. To validate the dispersion modelling predictions, monthly monitoring of water conductivity and temperature was undertaken as of September 2015. Monthly readings continued in 2017 and will continue to April 2019, when the program is reviewed.

This monitoring consists in measuring temperature and conductivity distribution in the water column (every metre) on a monthly basis at three stations located near the mine effluent, i.e., 300 m upstream, 300 m downstream and in the deepest part of the bay (Photo 3.10).


**Photo 3.10 Monthly monitoring of temperature and conductivity in the north basin of Lake Lagopede (June 2017)**

Since it was determined that mine effluent conductivity would be higher than in the poorly conducting waters of the receiving environment, measuring this parameter in the water column indicates whether mine effluent concentrates under the thermocline. The temperature profiles illustrate the thermal stratification of the temperature (whether the thermocline is present or not) and validate the hydrological modelling conditions of Lake Lagopede. Figures 3.10 and 3.11 show the results obtained at the deepest station in the north basin of Lake Lagopede (AQR69) in 2017.

The change in temperature in the water column at station AQR69 indicates the presence of a summer thermocline (warm water on the surface and cold water below) between 4 and 8 m deep from June to September. A significant winter thermocline (cold water on the surface and warmer water below) is present under the ice cover. There is a marked increase in conductivity between 4 and 8 m both in summer and under ice cover in winter.

Fall mixing began in late September in the North basin of Lake Lagopede. It is characterized by almost uniform temperature and conductivity in the entire water column in October and November.

Lake measurements confirmed that effluent concentrates under the thermocline in summer and winter, and mixes uniformly in the water column in fall.

In spring, temperature and conductivity measurements were taken in early May when the ice cover was present. Measurements were carried out in June when a thermocline was present in the water column. The mixing period was therefore not measured in 2017.

A thermograph line was installed in summer 2016 in two of Lake Lagopede deep areas, including the pool near the effluent (station AQR69). Figure 3.12 clearly shows the approximate period for fall mixing (right panel) when the temperature is practically uniform throughout the water column for just over a month. The spring mixing period is less well defined and happens over a short period of time (approximate period in left panel).

In 2018, temperature and conductivity readings will be taken once the ice has thawed in order to more accurately measure the spring mixing period.

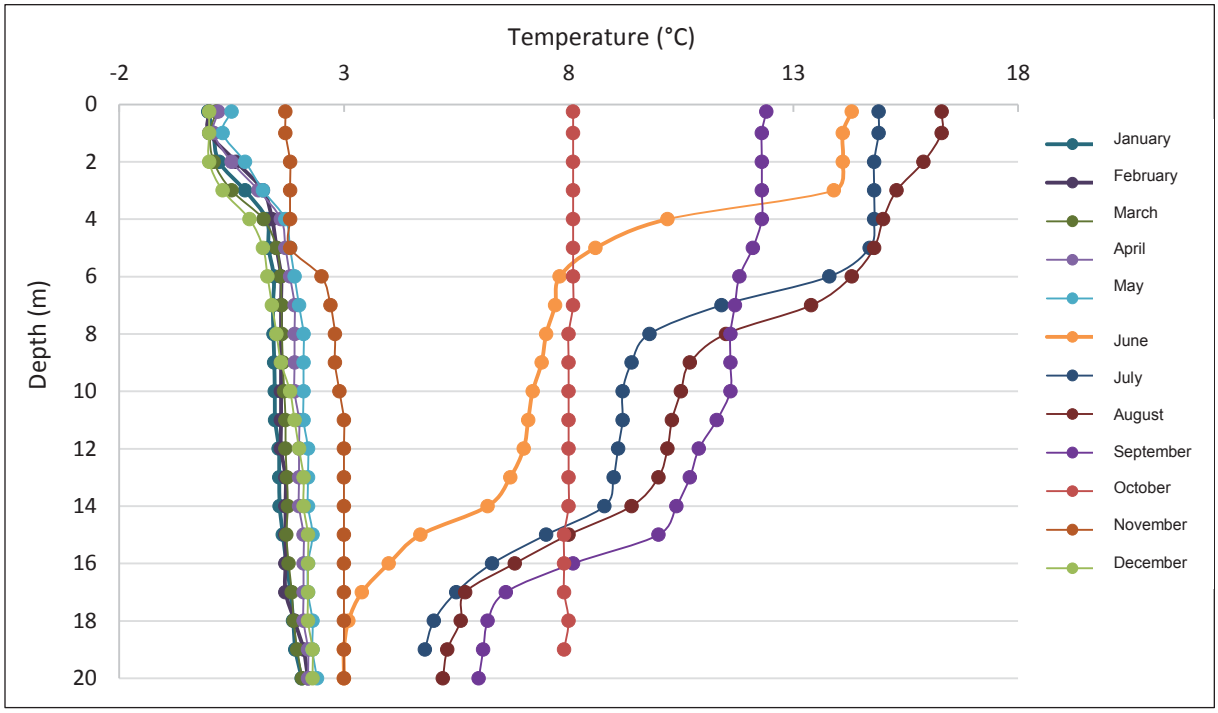



**Figure 3.10 Monthly temperature profile at station AQR69 for 2017**

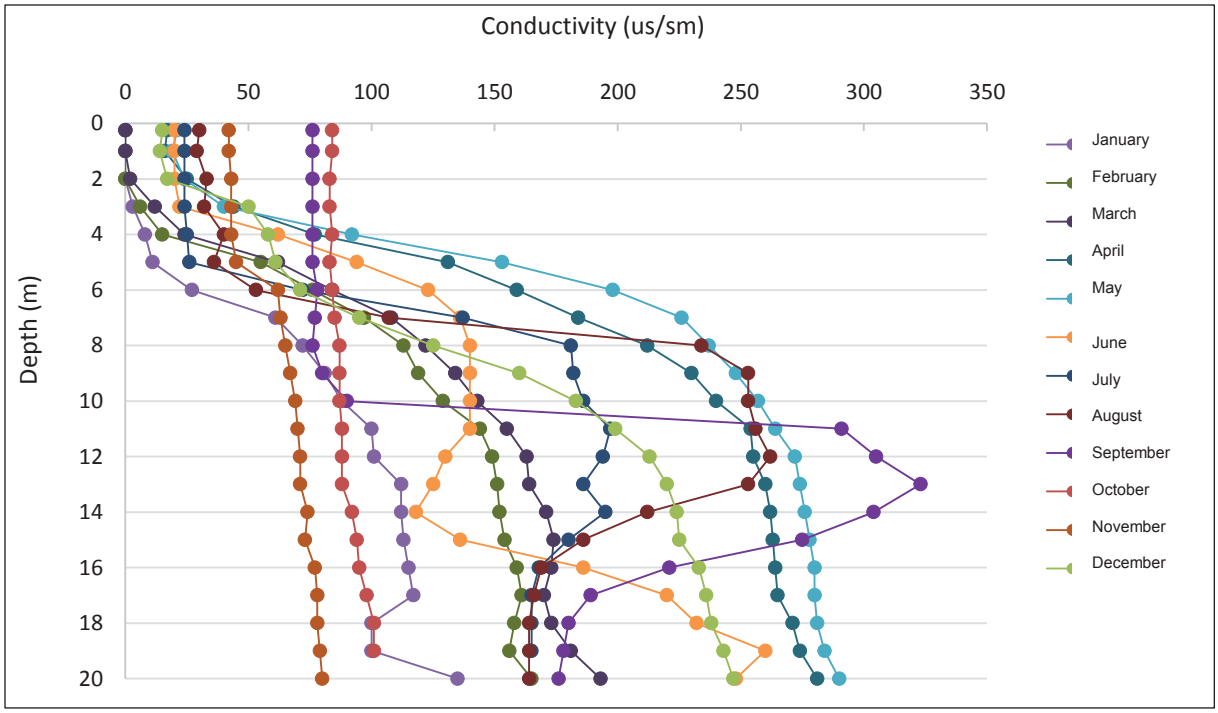



**Figure 3.11 Monthly conductivity profile at station AQR69 for 2017**

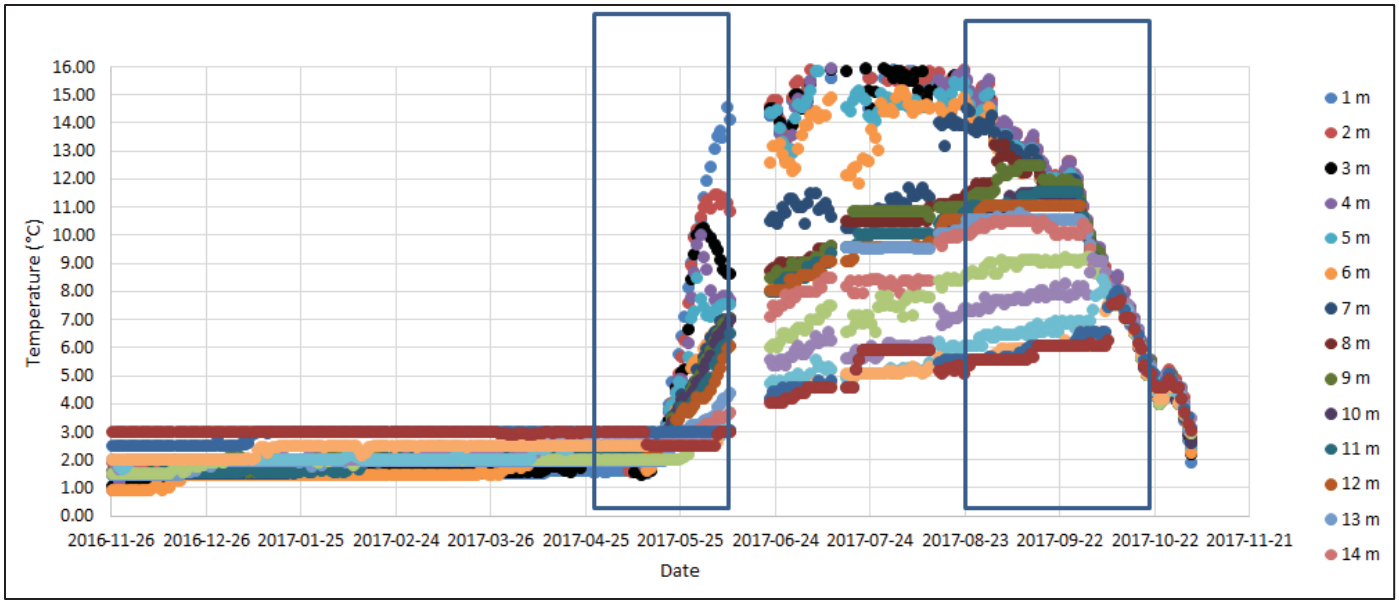



**Figure 3.12 Temperature in water column at station AQR69**

## 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 planned in the Global Certificate of Authorization.

The work included four main activities:

- Monitoring environmental measures for vegetation and wetlands;
- Monitoring plant regrowth (agronomic monitoring);
- Monitoring wetlands;
- Implementing the compensation measures in the wetlands compensation plan, in compliance with the Global CA.

### 3.7.1 Application of mitigation, compensation and vegetation restoration measures

***Revegetation – Mine site***

Gradual revegetation officially began in 2016. The area restored in 2016 was just over 20,000 m². This area was monitored in 2017 (see Section 3.7.2). In 2017, the slope and part of the former R170 construction road were restored, for a total of nearly 4,000 m² (Photo 3.11).

**Photo 3.11 Vegetation restoration in 2017 – slope and former R170 construction road (May 2017)**

The preferred vegetation restoration technique in this area was natural regeneration, which involved spreading a 20 to 30-cm thick layer of topsoil on the ground without planting or seeding. The topsoil used for natural regeneration was stripped from the work areas and transported to the revegetation sites without being put into the overburden stockpile. The soil was therefore not compacted, which is better for natural plant regrowth. In fact, the growth of indigenous plants initially contained in the soil used was confirmed when vegetation regrowth was monitored in 2017.

### 3.7.2 Plantation performance by restored area

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

Vegetation regrowth was first monitored in 2017 in the mine areas that were restored in 2016. The first survey was conducted in spring after the thaw when plant sprouting had just begun. A second survey was done in August when the growing season was in full swing.

The number and location of monitoring sites were selected from a map of the areas restored in 2016. The agronomic monitoring sites were marked on the ground as permanent 100-m² plots (circle with a radius of 5.64 m) where the variables in Table 3.9 were measured and recorded.

The spring survey was conducted from May 22 to 27, 2017, and the summer survey from August 9 to 17, 2017. Progress between the May and August surveys was evident in terms of the number of plants, plant size, ground area covered by vegetation and the percentage of live plants (photos 3.12 and 3.13). Most of the plants that appeared dead in May were still dormant. The limited percentage of cover and the small number of plants per plot in spring can mainly be explained by the fact that the growing season had scarcely begun when the survey was conducted. In fact, according to the Environment and Climate Change Canada website, the growing season begins after 10 days of average daily temperatures above 5°C, which occurs at the end of May at the mine site.

Plant regrowth will be monitored for five years. In the first year, in 2017, monitoring was done in spring and summer. For the next four years, monitoring will be done only once a year in late spring. As recommended by a specialized consultant, the spring monitoring will be done at the end of June in order to be more representative of the beginning of the growing season at the Renard mine.

**Table 3.9 Agronomic monitoring variables and methods**

| Variables | Method |
|---|---|
| **Herbaceous species** | |
| Percentage of plant cover | Visual inspection |
| Percentage of live and dead plants and spatial distribution | Visual inspection |
| Plant height (mean in cm) | Measurement |
| Presence of outside disturbances and signs of disease | Visual inspection |
| **Tree species** | |
| Percentage of plant cover | Visual inspection |
| Number of live and dead plants and spatial distribution | Visual inspection |
| Plant height | Measurement |
| Diameter at breast height | Measurement |
| Crown width | Measurement |
| Signs of disease | Visual inspection |


**Photo 3.12 Vegetation regrowth monitoring – Station VGR2-01 (May 2017)**


**Photo 3.13 Vegetation regrowth monitoring – Station VGR2-01 (August 2017)**

### 3.7.3 Wetland compensation program

Stornoway suggested that the MDDELCC develop and conduct a scientific research project specifically to determine the social and biophysical criteria for measuring the ecological value of boreal bogs and fens in the Eeyou Istchee-Baie-James region. This research project acts as a wetland compensation program for Stornoway's Renard Diamond Project.

Mine construction for the Renard Diamond Project unavoidably caused wetland loss. A knowledge acquisition project on the region's bogs and fens was proposed and accepted as a compensation measure under the *Act respecting Compensation Measures for the Carrying out of Projects Affecting Wetlands or Bodies of Water*.

This research project has two parts. The first involves compiling knowledge about the hydrological and biogeochemical functions of bogs and fens 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) and economic reasons (infrastructure flooding, road erosion). The second part will use traditional knowledge to develop compensation measures so that the needs of the native communities that use the land can be incorporated into future compensation projects in northern and boreal areas.

A decision-making tool will be based on the research results from both projects with a view to targeting environmental services and the most appropriate locations for compensation. All of the new knowledge and tools will guide and improve analysis of future proposed compensation measures for northern environments.

The first part of the research project began in 2016. This project will reconstitute Holocene paleohydrology and paleoecology (hydrological and ecological conditions in recent millennia) based on analysis of sediment from the two peatlands in the Centre-Nord-du-Québec region (near the Renard mine site) in order to document the processes that influenced hydrological imbalances experienced by the peatlands.

In July 2016, two UQAM students and a professor characterized and sampled the peatlands in the Renard mine site vincinity (Figure 3.13). Information about a number of parameters was collected during these projects, including vegetation identification and sampling, peat thickness, identification of the type of peat and core samples of peat for radiocarbon dating.

In September 2017, a second field survey, based on the 2016 work, assessed the hydrogeological situation and the nature of the sediment beneath the peat, and installed observation wells in the peatlands.

The preliminary results show an ecohydrological imbalance in the peatlands similar to those documented in the northeastern watershed of the La Grande River (54°00'N - 54°00'N), (54°05'N) and confirm the importance of studying their ecohydrological vulnerability to natural and anthropogenic pressure in terms of hydrology and future greenhouse gases (mainly carbon dioxide and methane). Going forward, the research project aims to quantify changes in the hydroclimate that may have influenced the ecohydrological imbalance phenomenon in northern peatlands. To achieve this, UQAM will reconstitute the quantitative Holocene (geological epoch over the last 10,000 years) paleoclimate (climate over a thousand years ago) by studying pollen and plant macrofossils and reconstituting the water table. This will support water-dynamics modeling in the peatlands, (including groundwater exchanges) to identify the most sensitive parameters that influenced the widespread aqualysis phenomenon in northeastern Canada in recent millennia. These results will support development of a biological integrity index for vulnerable peatland systems in view of current northern development.

The UQAM students will continue their research project in 2018.

SWY also partnered in setting up a university industrial research chair (created in early 2018), the NSERC-UQAT Industrial Research Chair on Northern Biodiversity in a Mining Context. 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.

Two teams of UQAT students will go to the site in 2018. The overall objective of their research is to avoid risks by developing environmental planning tools. A specialized wildlife team will visit the site in June and July, and a specialized plant team will be there in August.

### 3.7.4 Wetland monitoring (Route 167)

When Route 167 North was extended, some construction works had an impact on certain wetlands in the road right-of-way. SWY signed an agreement with the MDDELCC to rectify the situation quickly.

At the end of the 2016 growing season, SWY surveyed the wetlands where remedial work had been done. This survey showed that plant regrowth was successful in most of the wetlands. The regrowth covered at least 80% of all the sites, except five sites where plant regrowth was less than 70%.

It was agreed with the MDDELCC that if natural regrowth was insufficient after the 2016 growing season, indigenous species would be planted. At the end of the 2016 growing season, SWY considered that remedial work was needed in the five wetlands where plant regrowth was less than 80%. In 2017, remedial work was done on the five wetlands identified in 2016.

The corrective measures consisted of seeding the wetlands with indigenous species to promote vegetation regrowth where the wetlands border the road (Photo 3.14).

**Photo 3.14 Wetland seeded in 2017**

The wetlands seeded in 2017 will be monitored for plant regrowth at the end of the 2018 growing season.

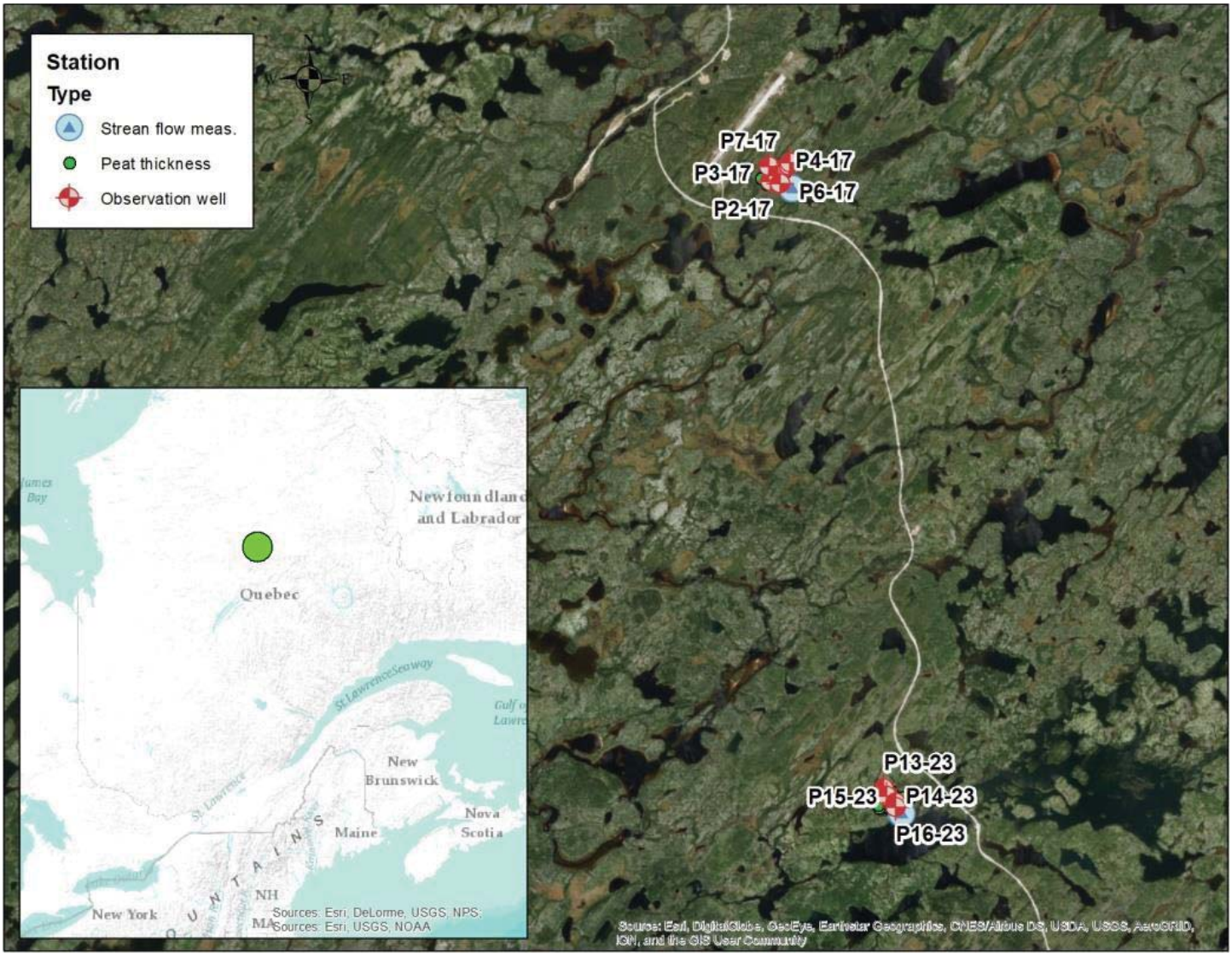



**Figure 3.13 Peatlands characterized and sampled in 2016 and 2017 by the UQAM research team**

## 3.8 Fish and Benthic Communities (EEM)

The Renard Diamond Mine Project Environmental Monitoring Program requires the components of the Lake Lagopede ecosystem to be monitored, specifically fish populations. Although Stornoway is not subject to the Metal Mining Effluent Regulations (MMER), the company has committed to monitoring in compliance with the requirements of these regulations and the various recommendations in the Metal Mining Environmental Effects Monitoring (EEM) Technical Guidance Document (Environment Canada, 2011). The monitoring activities will assess the impacts of the treated mine effluent discharged into Lake Lagopede on fish and their habitat and on potential use of water resources.

To implement this monitoring program, a study plan was prepared for the first biological monitoring cycle and submitted for authorization. The study plan describes the methods for studying the impacts on fish, assessing potential use of the fish, and studying benthic invertebrate communities. This study plan also includes a summary of the previous biological monitoring studies and effluent and water quality monitoring, as well as information about environmental site characterization, including the study results on the effluent plume's limits.

The study plan outline submitted for authorization in 2017 and the study that will be conducted in 2018 are described in subsections 3.8.1 to 3.8.6.

### 3.8.1 Study area

The study area for fish and benthic communities is Lake Lagopede, which has received the treated mine effluent discharged since April 2016. The exposed area was positioned near the permanent mine effluent discharge point, within the dilution plume. The control area is located in the west bay of Lake Lagopede, about 1.7 km upstream from the discharge point and the mine site. The surveys in the control and exposed areas prior to the beginning of the effluent discharge showed that the habitats were similar in terms of surface water quality, sediment, water depth, and benthic community composition (Norda Stelo, 2015).

### 3.8.2 Fish study

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, white sucker (58.7%) and northern pike (22.1%) accounted for over 80% of all fish caught. It was therefore decided to study sexually mature white suckers.

The impact indicators used to determine whether the effluent had caused changes in fish are growth, reproduction, condition and survival of individuals. Table 3.10 shows the monitoring indicators measured during the study of fish populations.

The fishing equipment selected to catch mature white suckers is the large-mesh experimental net. This type of net is used to catch fish over 20 cm long, which corresponds to the size of mature white suckers. Fishing stations to catch white suckers will be located in the exposed area and the control area. Sampling should be done when the gonad tissues are sufficiently developed, which is in fall for white suckers.

### 3.8.3 Analysis of potential use of fish

For the MMER monitoring studies, it is necessary to measure the mercury concentration in fish flesh if the total mercury concentration measured during effluent characterization is equal to or greater than 0.1 µg/l. The first mine effluent quality results show that mercury concentrations in the final mine effluent ranged from <0.0019 µg/l to 0.005 µg/l. Consequently, fish mercury concentration does not need to be measured in this first monitoring survey.

**Table 3.10 Environmental indicators measured during the fish population study**

| Indicator | Expected Precision | Statistics to Provide |
|---|---|---|
| Total length | ± 1 mm | Mean, median, standard deviation, standard error, minimum and maximum values in the sampling areas |
| Total body weight (fresh) | ± 1.0% | Mean, median, standard deviation, standard error, minimum and maximum values in the sampling areas |
| Age[1] | ± 1 year | Mean, median, standard deviation, standard error, minimum and maximum values in the sampling areas |
| Gonad weight (if the fish is sexually mature)[2] | ± 0.1 g | Mean, median, standard deviation, standard error, minimum and maximum values in the sampling areas |
| Weight of 100 eggs (if the 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 the 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[2] | ± 0.1 g | 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 fish species and ± 0.001 g for small fish species.

### 3.8.4 Benthic invertebrate community study

Benthic invertebrate communities are mainly studied for the purpose of assessing fish habitat and benthic communities serve as precursor indicators of changes caused by the project. A control/impact (or reference/exposure) sampling plan was chosen to detect possible differences in benthic community richness and abundance between the exposed area and the control area. Both sampling areas in Lake Lagopede contain five stations. At each station, three subsamples (triple benthos sample) will be taken. The benthic community will be studied in the fall at the same time as fish. This is the season of maximum biodiversity and the organisms' development level facilitates identification.

The subsamples from each station will be obtained randomly from a watercraft using a standard Ponar grab. Samples will be screened in the field with a 500 µm mesh screen. The material collected on the screen will be placed in a container labeled for each station. The samples will be preserved in an 85% ethanol solution. The benthic organisms will be identified in the laboratory to the family taxonomic rank.

### 3.8.5 Supporting environmental variables

As part of the Environmental Monitoring Program, Renard mine is currently monitoring surface water quality, sediment and effluent. The monitoring results will be discussed in more detail in the interpretation report because this information will be used to interpret the biological monitoring results.

### 3.8.6 Interpretation report

The first interpretation report will be submitted to the provincial and federal authorities in 2019, within twelve months of completion of the 2018 monitoring activities.

## 3.9 Fish Habitat

Condition 5.1 of Fisheries and Oceans Canada (DFO) authorization No. 2014-002 required monitoring the project's medium and long-term impacts on fish and fish habitat.

To meet this requirement, the Environmental Monitoring Program includes monitoring fish and fish habitat to achieve the following objectives:

- Assess if fish habitat conditions are maintained in Lake F3298;
- Ensure that fish passage is maintained in watercourses south of the mine (from the Lake F3300 outlet to the tributary of Lake F3301);
- Ensure that hydraulic conditions remain suitable for brook trout spawning and incubation in the tributary of Lake F3301;
- Assess if the downstream migration of fish in the diversion canal at the Lake F3298 outlet is maintained.

### 3.9.1 Maintaining fish habitat conditions in Lake F3298

During the first monitoring phase in the summer of 2016, it was difficult to determine the Lake F3298 water renewal time based only on measurement of the outflow from Lake F3298.

In 2017, the water levels in Lake F3298 were measured with a water-level sensor and a ruler that were installed in fall 2016 (Photo 3.15). During the 2018 survey, a stream discharge relationship be calculated from water-level data and lake outflow data. Since watercourse flows are generally variable, this data will be measured periodically to obtain a representative picture of seasonal flow variations. It will then be possible to estimate the average water renewal time for Lake F3298 over one year. Also, the level and flow measurements can be compared with the modeled values (Golder, 2012) for losses of runoff into the lake caused by the reduction of part of its watershed and drawdown of the water table in that area.

As for monitoring that fish habitat conditions are maintained in Lake F3298, no monitoring was scheduled for 2017. The next monitoring phase is planned for the end of the summer in 2018. More specifically, fish populations will be monitored to determine whether the lower water levels have an impact on the fish populations in Lake F3298 and whether there are any differences in abundance, size structure and fish condition. The following parameters will be measured for fish caught during the fishing campaigns:

- Species identification;
- Total length (mm);
- Body weight (g);
- Sex;
- Fecundity (if dead or pregnant/soft roe);
- General condition (anomaly, deformation, injury, parasite, etc.).

Non-lethal fishing equipment will be used for experimental fishing in Lake F3298 (Alaska fish trap, bait nets or other). Physico-chemical parameters will also be measured at some stations in the lake.

**Photo 3.15 Ruler used to measure the water level in Lake F3298**

### 3.9.2 Free fish passage through watercourses south of the mine (Lake F3300 outlet to the Lake F3301 tributary)

The first phase of monitoring the effects of the Renard Diamond Project on fish passage through the outlets of lakes F3300, F2607 and F3301 was completed in September 2016. No impediments to fish passage were observed during the first monitoring.

The next monitoring phase is scheduled in 2018. Consequently, no monitoring was done in 2017.

### 3.9.3 Appropriate hydraulic conditions maintained for brook trout spawning and incubation in the Lake F3301 tributary

The conditions in the natural spawning ground in the Lake F3301 tributary were monitored in September 2016. As in 2010, mature brook trout were observed during monitoring, which suggests that the spawning ground is still in use.

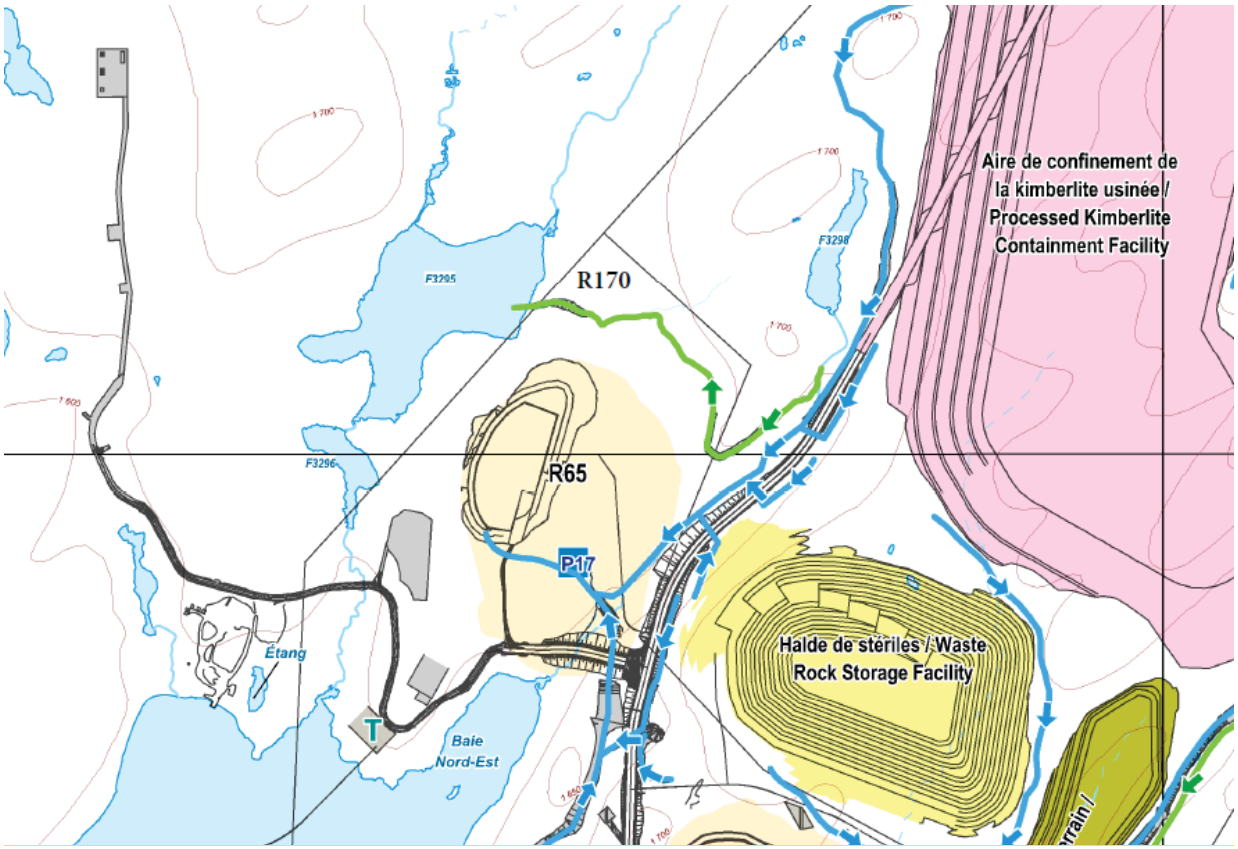
No monitoring was scheduled for 2017. The next monitoring phase will be in summer 2018.

### 3.9.4 Diversion canal – Lake F3298 outlet

To develop and operate open pit R65 safely, the Lake F3298 outlet had to be diverted. To prevent runoff from being affected by mine operations or flowing into the perimeter ditches around the mine, part of the stream was diverted in 2015 to Lake F3295 (Map 3.3).

To check the stream's efficiency, free fish passage (downstream migration) has been monitored in the diverted section of Lake F3298's outlet each spring since its construction.

Something new was observed during monitoring in 2017. When ditch F115 and the PKC were built in fall 2016, the surface water sources of Lake F3298 ran into ditch F115, as provided in the water management plan and modeled by Golder in 2012. As a result, the flow into Lake F3298 dropped. The flow at the lake's outlet, into the diversion canal, also decreased after ditch F115 was built.




**Map 3.3 Water from the Lake F3298 outlet diverted to Lake F3295 via stream R170**

Stream R170 was visited several times in 2017, during the low-flow period (Photo 3.16, August 2017), during the flood, or following heavy rain, and fish are able to migrate down the stream. At times, as in June 2017, some stretches of the stream are less suitable for fish migration (Photo 3.17, June 2017)

As described in Section 3.8.1, thorough hydrological monitoring will be conducted in Lake F3298 in 2018. Stream R170 will be visited during each hydrology survey to assess downstream fish migration in the stream. A stream discharge relationship will then be constructed to determine at what water level fish migration in the stream is possible.

**Restoration of vegetation**

A section of the R170 streambank was restored following the construction of ditch F115. Topsoil was spread on the top of the ditch slope (former construction access road) to promote natural regeneration of vegetation. Also, green alders and black spruce were planted to speed up regrowth in the riparian strip along the stream.

**Photo 3.16 Stream R170 under low-flow conditions (August 2017)**


**Photo 3.17 Stream R170 in June 2017**

## 3.10 Fish Habitat Compensation

To offset fish habitat damage and loss caused by construction of Route 167 North and Renard Project activities, two separate compensation programs were approved by the DFO.

First, a compensation program was developed to offset fish habitat loss during construction of Route 167 North. SWY agreed to carry out compensation work within the stretch of road for which it was responsible: six sites spread along kilometre 553 and totaling 1,011.9 m² of fish habitat. This work was done in summer 2014. The monitoring results for this part of the compensation program are provided in Section 3.11.

Second, the Renard project compensation program involves five operations in two different geographic areas: the Renard mine area and the Mistissini area. The operations for each area are:

- Renard mine area:
  - Development of 600 m² of brook trout habitat in four watercourses (2015);
  - Enlargement (additional 300 m²) of a lake trout spawning ground in Lake Lagopede (2016).
- Mistissini area:
  - Development of a 600-m² walleye spawning ground in Lake Mistassini (2018);
  - Development of 100 m² of brook trout habitat in a Lake Mistassini tributary (2018);
  - Development of the diversion canal from the former Icon-Sullivan mine site, with a target gain of 15,000 m² (2019).

### 3.10.1 Integrity and use of developed brook trout habitat at the mine site (outlets of lakes F3293, F3294, F2604 and F3301)

Riffle-Pool -spawning ground type development provided access to and improved the quality of brook trout habitat by creating feeding areas, shelter and spawning grounds 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 in the four targeted watercourses.

The integrity and use of the developed brook trout habitats were monitored in 2016. The DFO subsequently commented that some developed spawning grounds would not be functional because the gravel was not thick enough or they were exposed during the winter. The DFO therefore recommended that Stornoway:

- Take the necessary remedial action, insofar as possible, to stabilize and maintain the integrity of the existing spawning grounds;
- Make sure that the gravel in the spawning grounds remains thick enough (between 15 and 30 cm);
- Identify and locate new gravel accumulation areas (new deposits) created by floods and check whether the conditions are suitable for spawning (gravel thickness, water depth during the incubation period, etc.).

In summer 2018, Stornoway will assess the possibility of remedial action for some of the current developed spawning grounds and will look for additional development sites to compensate for the reduction in developed spawning ground area and achieve the DFO's objectives.

## 3.10.2 Monitoring of the Lake Lagopede lake trout spawning ground

The second component of the Fish Habitat Compensation Program involved enlarging an existing lake trout spawning ground in Lake Lagopede near the Renard mine, which was done in 2016. Enlargement of the lake trout spawning ground expanded the spawning habitat area by more than 450 m², which is 150 m² more than the DFO required.

This development was first monitored in fall 2017. The monitoring activities consisted in checking the spawning ground's condition, its use by spawning lake trout, and the water quality.

### 3.10.2.1 Spawning ground integrity

Monitoring the integrity of a lake trout spawning ground means making sure that the spawning substrate remains on the slope, verifying the presence of sediment deposits in the substrate and looking for any anomalies that could hamper lake trout spawning. An underwater camera was used to check the spawning ground's condition.

Since the developed spawning ground is a deposit of stones around a shoal in a water body far from any source of current, the likelihood of stones being moved is practically zero. In fact, the layer of stones does not appear to have budged since 2016. No sand or silt has accumulated on the spawning ground substrate. Only a thin layer of periphyton has formed on the stones (a natural phenomenon) and this should not interfere with lake trout spawning.

### 3.10.2.2 Use of the spawning ground

***EGG TRAPS***

The overall use of the developed spawning ground was documented by means of egg-collection equipment (artificial substrate) set in the developed spawning ground. This equipment was installed at the beginning of the survey and left in position for several weeks to catch eggs that may have been deposited in the spawning ground between September 20 and October 29, 2017.

The egg traps are made of a wood frame, 60 cm by 60 cm, to which a solid screen is attached. A mat of artificial turf covers the mesh (Photo 3.18). This mat traps the eggs that are deposited on the artificial substrate. Stones were then placed on the artificial turf mat to complete the artificial substrate. The egg traps were positioned horizontally at the base of the slope in the developed spawning grounds to ensure that the stones would remain in place throughout the survey.

When the egg traps were collected, each stone was scrupulously inspected and the artificial turf mat was cleaned in a pail of water (Photos 3.19 and 3.20). The water was filtered through a kick net (500-µm mesh) to recover the eggs and the mats were inspected to make sure that no eggs were caught in the artificial turf fibres (photos 3.21 and 3.22).

**Photo 3.18 Egg traps before stones were added and before deployment**

**Photo 3.19 Retrieved egg trap**

**Photo 3.20 Cleaning the artificial turf to collect eggs**

**Photo 3.21 Cleaning water is filtered to recover eggs**

**Photo 3.22 Eggs are counted, identified and measured when present (no eggs were collected at this station)**

No eggs were collected in the egg traps during the 2017 monitoring. The location of the egg traps at the base of the slope probably explains the lack of eggs in the eight egg-collection traps.

Different techniques will be explored for the next monitoring operation in 2019.

***Observations***

Observations were recorded several times during the lake trout spawning season between October 1 and 14. Since lake trout generally spawn in the evening, all the observations were made after 6 p.m. An aquascope and an underwater camera were used for the observations.

A number of fish were observed during the observation sessions. Lake chub were captured by the camera at several locations in the developed spawning ground in addition to one longnose sucker. However, no lake trout were seen during the observation times.

***Spawning ground accessibility***

Spawning ground development can be challenging because water levels can vary substantially over the years and seasons, depending on the hydrological conditions. One challenge is to make sure that fish can access the spawning ground during the spawning period and that the eggs will be submerged throughout their incubation. For lake trout, the spawning period lasts from the end of September into the second half of October and incubation then lasts until May. Water levels were measured at the spawning ground in winter 2017 and fall 2017 to cover the incubation and spawning periods. Also, the water levels at the Lake Lagopede water-level station were consulted to estimate the water level in the spawning ground.

In October 2017, the water level was quite low during the spawning period. An area of about 400 m² could not be accessed by lake trout for fall spawning or could only be accessed with great difficulty (water depth ranging from 5 to 30 cm). In fact, during the winter low flow, this area is almost entirely exposed in winter. Consequently, this year, in October 2017, only 150 m² of the spawning ground was actually accessible to lake trout during the lake trout spawning period.

Ice thickness and water depth in the spawning ground were monitored on April 5, 2017, only four days after Lake Lagopede's lowest water level in winter 2017. Based on water-level data for Lake Lagopede, there were potentially 3 cm of water covering the high point of the spawning ground. Three holes were drilled in the ice, two in the shallow area and one by the slope in the developed spawning ground. There were 55 to 66 cm of ice on the developed spawning ground (Photo 3.23). In the shallow area, the ice touched the tops of the stones in one place and there was about 1 cm of water under the ice at the other place. It is therefore difficult to confirm the presence of water throughout the substrate (submerged eggs) over the entire shallow part of the spawning ground.

At the hole drilled by the spawning ground slope, there was nearly 1.9 m of water under the ice.

**Photo 3.23 Ice thickness on the developed spawning ground (April 2017)**

The winter monitoring showed that the average water depth in the shallow part of the spawning ground is not always adequate for egg incubation. Stornoway will do remedial work in the summer of 2018. During the low-flow period, stones in the shoal will be moved manually to the slopes of the developed spawning ground. That will increase the water-column depth above the shoal and improve lake-trout access to a larger spawning area. This work will also provide an adequate water depth for egg survival throughout the incubation period.

#### 3.10.2.3 Water quality in the spawning ground

Since the lake trout spawning ground is at the upper edge of the modelled mine effluent plume, the DFO required long-term environmental monitoring of the developed spawning ground. A baseline was established in 2015-2016 (before mine effluent was discharged into Lake Lagopede) with quarterly sampling covering each season.

The water was sampled twice near the bottom at three different locations in the developed spawning ground (about the same stations as for the baseline). The first sampling survey was conducted on September 20, 2017, before lake trout spawning and on October 29, 2017, after lake trout spawning. Surface-water quality data was compared with provincial criteria and Canadian surface-water quality recommendations by the Ministry of Sustainable Development, Environment, Forests and Parks (MDDEFP, 2013a; CCME, 2013). Then, the data was compared with the baseline results for the spawning ground and with the surface-water quality monitoring results for Lake Lagopede.

Most of the parameters complied with the provincial and federal surface-water quality criteria. These results are comparable to the spawning ground baseline (2015-2016), and the surface-water quality monitoring results for Lake Lagopede. The water quality conditions measured in 2017 in the developed spawning ground are adequate and enable lake trout to complete their reproduction activities (spawning, incubation, hatching and rearing).

The next water quality monitoring in the lake-trout spawning ground is scheduled for 2018.

### 3.10.3 Development of a walleye spawning ground near Mistissini

Development of a walleye spawning ground in Lake Mistassini is the third component of the compensation program. Prior to beginning construction, a detailed project development design was submitted for approval in early 2017.

The target location for construction of this spawning ground is west of Mistissini, specifically where Lake Mistassini narrows between Baie du Poste and the main part of the lake farther north. All the water in Baie du Poste has to flow through this canal 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.

Once approval is received from the DFO (2017) and COMEX (pending), the work will be completed in 2018 during the low-flow period.

### 3.10.4 Development of brook trout habitat in a Lake Mistassini tributary

Development of brook trout habitat in a Lake Mistassini tributary is the fourth component of the compensation program. Prior to beginning this project, a detailed development design was submitted to the DFO for approval.

The proposed development involves rebuilding a stream crossing on a forest road south of Lake Mistassini. The objective is to enable fish to pass through the crossing and take advantage of the pool downstream of the existing culverts. More specifically, the work will involve:

- Replacing two existing culverts with RNI (Regulation Respecting Standards of Forest Management) compliant culverts that support fish migration;
- Building three rock weirs upstream and downstream of the culverts;
- Laying gravel upstream and downstream of the weirs to create spawning grounds with an area of about 100 m².

The final plans and specifications were submitted to the DFO for approval and construction is planned during the low-flow period in summer 2018.

### 3.10.5 Baseline for the diversion canal at the former Icon-Sullivan mine site

Development of the diversion canal at the Icon-Sullivan site (Waconichi River) is the last of the five components in 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 operated in the 1960s and 1970s which may still have the potential to influence water and sediment quality in the diversion canal.

As required by the DFO, the initial physico-chemical characterization of the spawning habitat to be developed was completed before development began (initial characterization in 2012 and additional characterization in 2016). In general, the 2016 surface water and sediment quality results are comparable to 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 physico-chemical properties at the development sites will not pose any problem for walleye development or reproduction.

The 2012 and 2016 results will serve as the baseline for the next phases of environmental monitoring to ensure that the physico-chemical quality of the developed spawning grounds is maintained over the long term. It will also take into account the natural variations in water and sediment quality that are associated with hydrological events and local environmental conditions.

## 3.11 Segments C and D on the Extension of Route 167 (Mine Road)

### 3.11.1 Free fish passage monitoring at stream crossings

All stream crossings along Route 167 where free fish passage is required were surveyed in 2014 by a consultant. Since the 2014 survey results showed that free fish passage was ensured at all the crossings, no other monitoring is planned under the Monitoring Program.

However, in 2017, COMEX expressed some reservations about the long-term impact on free fish passage of sediment accumulation at the ends of three culverts.

Stream simulation is the design approach selected to ensure free fish passage through the three culverts identified by COMEX (chainages 208+494, 226+628 and 229+256). This approach maintains continuous flow by recreating the substrate and flow conditions found in the natural parts of the stream. The presence of a preferred flow channel maintains free fish passage even during low-flow conditions.

To check fish habitat development quality, the three culverts were visited in summer 2017 to assess the stability of the accumulated sediment and ensure that fish will be able to pass through the culverts over the long term.

#### 3.11.1.1 KM 208+494 culvert (actual chainage KM 618+200)

The substrate and sediment upstream of the culvert remained stable and form an integral part of the substrate. In fact, in nearly three years, almost no sediment has shifted downstream in the stream bed (Photos 24 and 25). The preferred channel was not blocked over time and a minimum water depth of a dozen centimetres was maintained. Also, the sediment in the culvert has supported aquatic vegetation growth, which provides continuity of the fish habitat. Free fish passage is therefore ensured in this culvert.

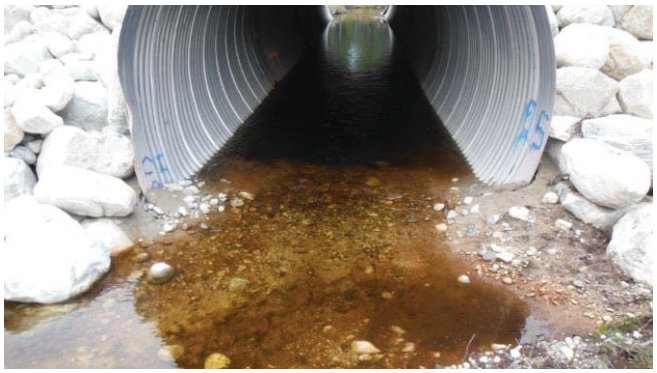


**Photo 3.24 Upstream end of the culvert during installation (September 24, 2014)**

**Photo 3.25 Upstream end of the culvert after three years (June 28, 2017)**


**Photo 3.26 Fish habitat continuity – view upstream (June 28, 2017)**

#### 3.11.1.2 KM 229+256 culvert (actual chainage KM 638+980)

This culvert was installed with a gentle slope and is well buried in the substrate. Consequently, the flow backs up to upstream of the culvert (no slope and flow acceleration). The presence of sand at both ends of the culvert (photos 27 and 28) and organic matter inside the culvert provide continuous fish habitat and do not impede fish movement.

**Photo 3.27 Sand at the culvert entrance when installed (September 24, 2014)**

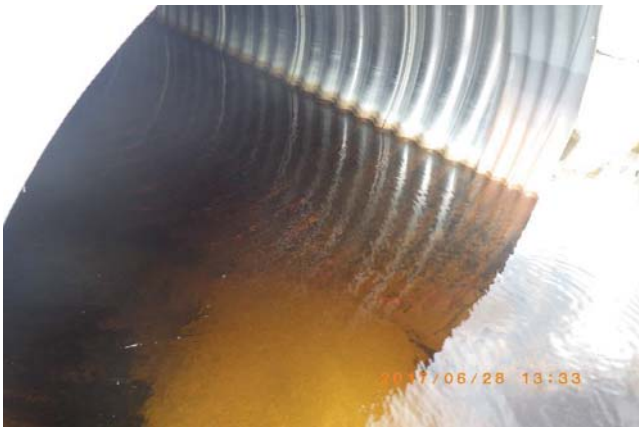



**Photo 3.28 Sand at the culvert entrance after three years (June 28, 2017)**

All in all, inspection of the three culverts developed with stream simulation confirmed that sediment accumulation remained stable nearly three years after installation. The substrate in the culverts does not hamper water flow and fish can pass through freely year-round.

### 3.11.2 Monitoring of developed fish habitat

***Monitoring results***

As required by the DFO authorization, the fish habitats developed were monitored for a second and final time in September 2017. The environmental monitoring measured the compensation project's efficiency and ensured that the structures remained stable and reconstituted fish feeding, rearing and spawning habitats, in addition to supporting free fish movement.

After the third year following construction, the compensation habitats built along the mine road connecting Route 167 to the mine site remained stable.

For example, the rock weir at site C-22 remained stable (photos 3.29 and 3.30) and the gravel upstream is still present and available for brook trout spawning. The rebuilt sections of the stream allow fish to travel freely.

**Photo 3.29 Habitat developed in 2014 – site C-22 (September 2014)**

**Photo 3.30 Habitat developed in 2014 – site C-22 (September 2015)**

**Photo 3.31 Habitat developed in 2014 – site C-22 (September 2017)**

Non-lethal fishing, in compliance with permit No. 2017-08-10-143-10-G-P to catch fish at the compensation sites for scientific, educational or wildlife management purposes, recorded various fish species, including sculpin, burbot, lake chub, pearl dace and brook trout (Photo 3.32). The areas developed for the compensation program are therefore used by the local species for which the habitats were intended.

**Photo 3.32 Electrofishing during monitoring of developed habitats (September 2017)**

To compensate for the lack of vegetation on the banks of some developed habitats, corrective measures were implemented in 2016 and topsoil was added on some banks to facilitate plant regrowth. In addition to the topsoil, green alders were planted and the banks were seeded with grasses to promote development of riparian vegetation. During the summer 2017 monitoring of the fish habitats developed, the vegetation regrowth observed was successful. The alders have grown and grass cover has become established since 2016 (photos 3.33 and 3.34).

**Photo 3.33 Planting and seeding to promote plant growth in the riparian strip along the stream (C-25 August 2016)**

**Photo 3.34 Plant regrowth after one year (C-25 September 2017)**

## 3.12 Land Animals and Birds

Wildlife is monitored to achieve the following specific results:

- 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 that they are protected;
- Assess the efficiency of the mitigation measures in minimizing the number of road accidents involving big game;
- 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 efficiency of the mitigation measures to prevent animal intrusion on the mine site and all forms of poaching.

### 3.12.1 Big game monitoring

To measure the changes observed in big game population distribution since the construction phase, the opening of the mine road and the beginning of mine operations, aerial surveys of big game were conducted in March 2011 and 2015. As scheduled in the Environmental Monitoring Program, a new survey was completed in March 2017. The results of this survey were then compared to the previous survey results. These surveys cover the mine study area (140 km²), the airstrip study area (29 km²), the control zone (no mining; 100 km²) and the mine road study area (300 km²).

The results of the 2017 moose survey indicate an upward trend in the moose population density in the mine study area and the control zone (Photo 3.35). In fact, the moose density recorded in the mine study area was 2 moose/100 km², whereas no moose were sighted in 2011 and 2015. In the control zone, moose density was 7 moose/100 km², nearly double the March 2011 result (4 moose/100 km²), and similar to the March 2015 result (5 moose/100 km²). However, no moose were found in the airstrip study area in 2011, 2015 or 2017. In the mine road study area, one moose and an old trail network were observed in 2011 and 2015, but no moose were sighted in 2017.

**Photo 3.35 Moose sighted in control zone (March 2017)**

As in March 2011 and 2015, no caribou were observed during the March 2017 big game survey in the mine, airstrip, control or mine road study areas.

In March 2017, many wolf tracks were recorded near the mine site, airstrip, especially around the trench landfill (TLS) and along the mine access road. Numerous wolves were also reported in the log of observations documented by users along the road and concentrated near the TLS.

#### 3.12.1.1 Forest-dwelling caribou

The MFFP monitored the Temiscamie herd (the closest to the Renard project) in March 2015 and March 2017, in cooperation with Stornoway. The objectives were (1) track groups of forest-dwelling caribou in suitable habitat areas and (2) capture some animals and put GPS-Argos collars on them. Fifteen transmitter collars were put on caribou in 2015.

Two groups of caribou were sighted in 2015, 40 km south of the mine site and 5 km west of the mine road. Telemetric data for caribou monitored since 2015 were processed according to the different seasons and the

animals' ecological needs and still do not confirm the presence of the forest-dwelling ecotype in the Renard mine area in 2017. However, the data did show that the Eastmain River corridor has been used in all three years. The fifteen animals with transmitter collars are mostly concentrated south of the Renard mine, along Route 167 from km 530 to km 640, with one observation recorded less than 25 km south of the airstrip in spring 2016. Furthermore, according to the telemetric data processed since 2015, the caribou generally maintain a distance of at least 10 km from Route 167, on either side of the road.

#### 3.12.1.2 Interview with the tallymen

Interviews were conducted with the tallymen in November 2017 to document their perception of the issues related to large animals and big game hunting. The main points raised were:

(1) Concern about the increased numbers of bears and wolves frequenting the area near the TLS;

(2) The harmful impact on moose populations in trapline M16, of predators and helicopter flights by the various mining companies and the MERN for exploration and mapping;

(3) The tallymen's willingness to participate in local control of predators by increasing hunting pressure.

The perception of moose population abundance differs according to the M11 tallyman (Swallow family) and the M16 tallyman (Matoush family). The Swallows observed that moose have returned to the mine study area. The Matoush family is concerned that they have scattered away from the road that runs through their trapline. As previously reported in 2015, and according to the tallymen, the road's presence has changed moose behaviour in the mine road area and the animals have migrated farther north, away from the road.

With regard to caribou, the tallymen of traplines M11 and M16 maintain that the number of caribou in the area has dropped since the early 2000s, even though recent sightings of small groups and caribou carcasses have been reported on trapline M11 and three (3) caribou were killed on trapline M16 in 2017.

Finally, according to the Swallow family, the mine does not have any negative impact on the abundance of local big game populations. The Matoush family, however, is concerned about the low abundance of moose on their trapline, which they believe is partly the result of the aerial exploration in recent years. Both families share the same concern regarding the increased predator populations, especially wolves, and accepted to step-up local hunting pressure in order to control this species.

#### 3.12.1.3 Black bears

Some black bears were sighted at the mine site in spring and summer 2017. They were simply frightened off the site. In mid-July, a more persistent bear prowled near the housing complex. It was seen at the mine on six consecutive days. A crescendo of scare tactics were used to frighten the intrusive bear away from the site: a horn and siren, cayenne pepper, a distress flare, a bear banger, and a paint gun. Since the intrusive bear continued to roam around the workcamp after six consecutive days of attempts to frighten it away, the animal had to be killed by a security guard to keep the workers safe.

A number of bears frequented the TLS throughout the summer in 2017 (Photo 3.37). The mine biologist held some discussions with a MFFP biologist (a black bear specialist) to improve black bear management strategies at the TLS. According to his recommendation, a functional electric fence is the best deterrent for bears, as long as they come into contact with the energized wires instead of crawling under the fence.

In 2017, the electric fence was checked regularly to make sure it operated properly throughout the season. Also, whenever bears dug new holes under the fence, stones were buried in them to block the bears' path.

At the recommendation of a specialized big game consultant, two surveillance (hunting) cameras were installed at the edge of the TLS in late 2017 to film intrusive animals visiting the landfill (wolves, bears, etc.). The information collected by the cameras (number of animals, visit frequency, etc.) will help to develop efficient management measures for intrusive animals at the TLS.

#### 3.12.1.4 Awareness

The workers have been informed not to feed wild animals, especially the foxes that visit the site occasionally. An awareness bulletin was posted in common areas (e.g., the cafeteria) and the topic has been discussed in coordination meetings.

It was agreed with the MFFP biologist that he would visit the Renard mine in late spring in 2018, just before the bears wake up, to provide management advice and information on how workers should behave when they encounter a black bear.

**Photo 3.36 Bear at the TLS in summer 2017**

#### 3.12.1.5 Wildlife sightings

In order to document wildlife sightings along Route 167, the gatehouse security guards systematically ask all truck drivers if they have seen big game animals along the road. All sightings are recorded in a log. The log also includes workers' sightings of big game. In 2017, 33 wildlife sightings were recorded. Bears are the species most frequently reported along the road. Some caribou and moose were observed between km 440 and km 620 of Route 167 North.

A caribou migration corridor was identified near the Eastmain River during big game monitoring. Since the sightings log was started in 2016, some of the wildlife observations corroborate this information. Caribou and wolves (a caribou predator) have been reported in this area.

***Incident on 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 drive there. Road users are informed of the safety rules to follow, including speed limits and the firearm prohibition. In addition to keeping road users safe, these measures have limited road accidents involving big game animals. No poaching has been reported.

In December 2017, two accidents involving moose occurred on Route 167. On December 5, a collision with a moose occurred at km 471. The animal got up and disappeared into the forest. The second accident happened on December 11 near km 596. A young male moose, about two years old, was struck and killed by a trucker on his way to the mine (Photo 3.37). The animal was taken to the Cree cultural centre at the mine site and was butchered by the Crees for food. These were the first incidents with big game since construction began in 2014.


**Photo 3.37 Moose killed on Route 167 North**

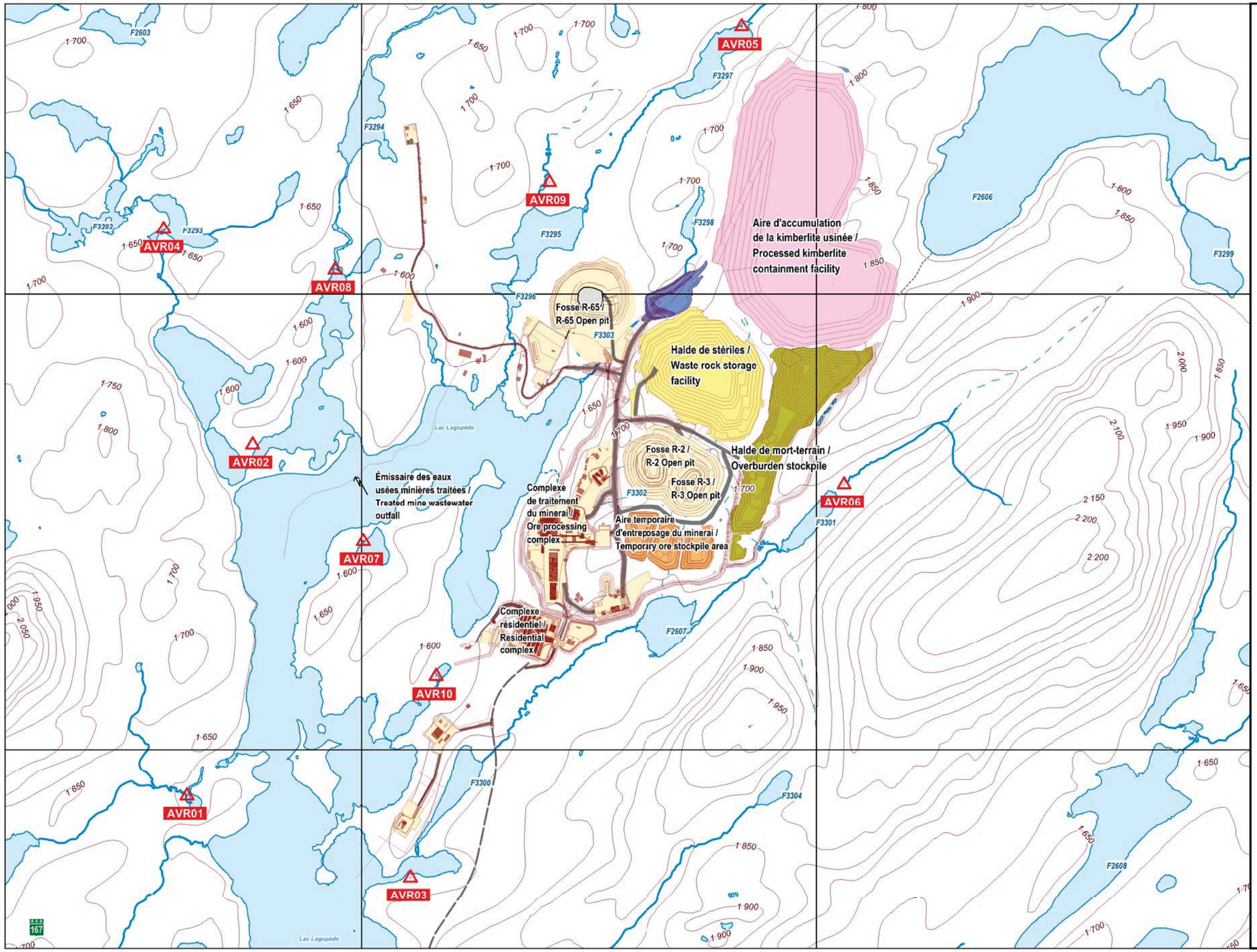
## 3.12.2 Bird monitoring

### 3.12.2.1 Duck nesting boxes

In compliance with the Canadian Environmental Assessment Agency's instructions, waterfowl nesting boxes were installed around Lake Lagopede and small neighbouring lakes. The species intended to use these boxes is a small black and white duck, Barrow's goldeneye. The locations selected are suitable for Barrow's goldeneye breeding, 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 (Figure 3.14).

After the waterfowl migrate south, each nesting box is visited twice. The first visit documents use of the boxes (signs of presence and identification of the species that nested there). Although the intended species is Barrow's goldeneye, other species may use the nests, such as common mergansers, owls or squirrels. The second visit is for nest box maintenance before spring (cleaning or replacing cedar chips and repairing the boxes when necessary).

The ten nesting boxes were still in good condition after the 2017 breeding season. One nesting box was used by a bird species in winter 2017. The box contained a few feathers, which were not sufficient to identify the bird species, other than it was a waterfowl.




stornoway

**Mine diamantifère Renard / Renard Diamond Mine**

Infrastructure (7 juil. 2015; mise à jour 4 mai 2018) / Infrastructure (July 7, 2015, updated May 4, 2018)

Cours d'eau permanent / Permanent watercourse

Cours d'eau intermittent à écoulement de surface et souterrain / Intermittent watercourse, surface runoff and groundwater

Écoulement souterrain / Groundwater flow

F3293 Numéro d'identifiant de lac CEHQ / CEHQ lake ID number

Nichoirs à canard / Duck nesting boxes

0 250 500 m

Échelle / Scale : 1 : 17 500
UTM, zone 18 (NAD83)

*Courbe de niveau ( intervalle de 50 pieds) / Contour (50-foot intervals)*
*Carte de base / Base map : Stornoway, 2010;*
*CanVec, 1: 50 000, 33A16-33A09, RNCan, 2010*
*Fichier / File : 61470-050_F3-14_Emplacement_nichoirs_canard_180828.WOR*

**Août 2018 / August 2018**

**Emplacement des nichoirs à canard / Location of duck nesting boxes**

NORDA STELO

**Figure 3.14**

In fall 2017, feathers and an eggshell were found in one nesting box (Photo 3.38). In 2018, the feathers will be sent to an ornithologist to identify the species that nested in the box.

**Photo 3.38 Feathers and eggshells from a bird that visited a nesting box in 2017**

Monitoring will continue in 2018. Depending on the 2018 results, some nesting boxes may be moved to other locations near the Renard mine that are suitable for Barrow's goldeneye.

#### 3.12.2.2 Monitoring of breeding of migratory birds or special-status species

The birds most often sighted at the mine are gray jays and crows in all seasons, tree swallows in summer and willow ptarmigan in winter (Photo 3.39). No nests of migratory or special-status birds were found at the mine site in 2017. As recommended by the Canadian Wildlife Service, limited clearing was done around the processed kimberlite containment facility outside the forest birds' breeding season, which runs from May 1 to August 15 in the area. No clearing was done in 2017. The cleared areas were not disturbed or stripped so they would be attractive hunting grounds for some raptor species. Motor boat users at the mine were also asked to avoid the sheltered bays in spring and summer as they have high potential for common loon nesting and rearing. Boating on Lake Lagopede is limited to two or three outings per month.

**Photo 3.39 Willow ptarmigan near the mine (December 2017)**

Since 2015, bald eagles (vulnerable according to the MFFP) have been sighted annually at the TLS. Young eagles have also been observed at the TLS (Photo 3.40), which suggests that the 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 will be taken year after year to determine whether the bald eagle has come back and if it still nests near the TLS.

**Photo 3.40 Juvenile bald eagle sighted several times at the TLS in 2017**

## 3.13 Water Management and Mine Effluent

The Renard mine 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 activities.

Water that comes into contact with mine facilities is intercepted by a network of perimeter ditches and culverts that channel water to pit R65 retention basin, from where it is directed to treatment facilities before the treated water is discharged into Lake Lagopede (Map 3.4).

The ditch network was well used during certain periods in 2017, with more than 2,900,000 m³ of water intercepted by the perimeter ditches and then treated in the mine wastewater treatment plant (MWTP).

### 3.13.1 Mine effluent quality

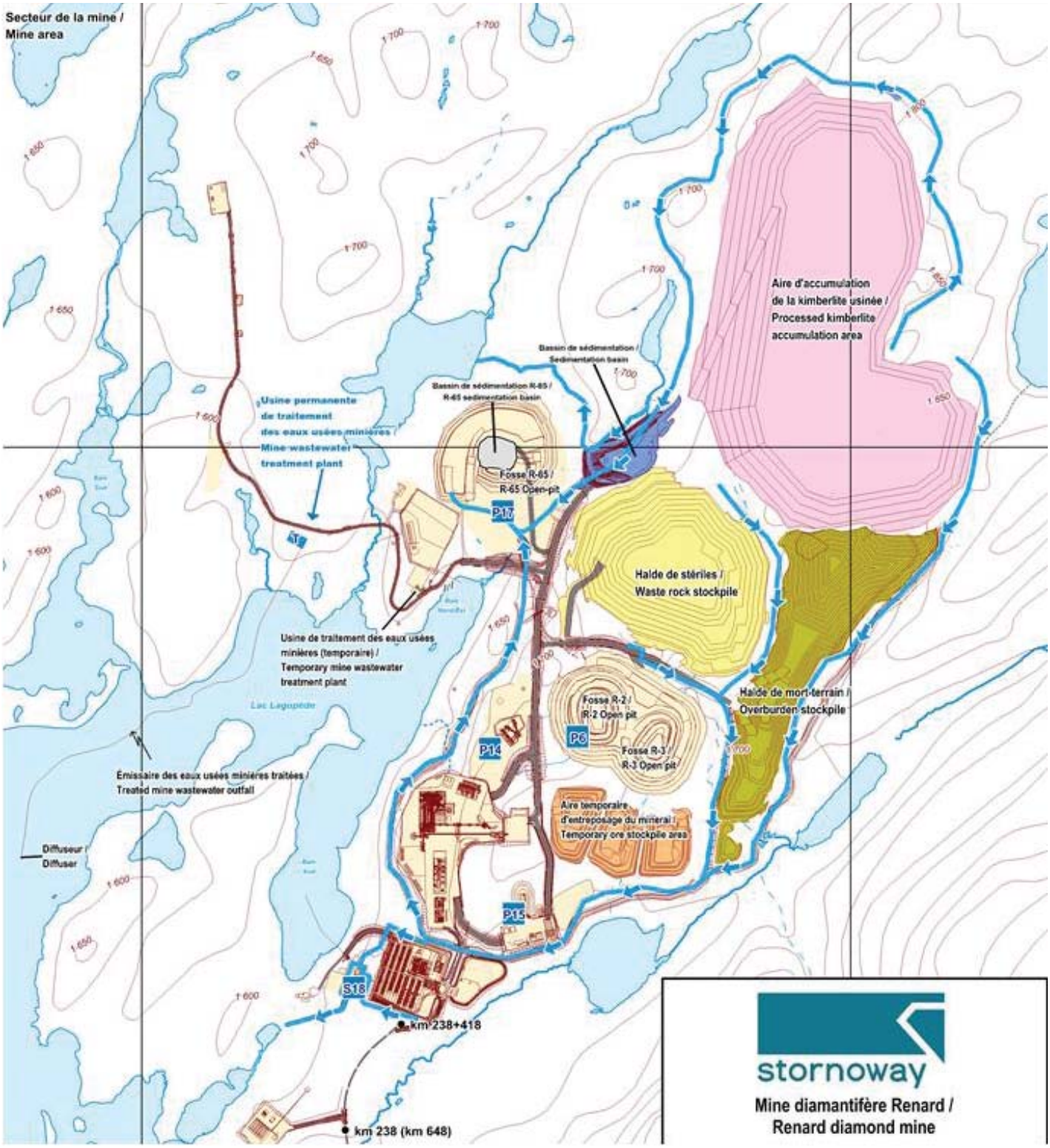
The objective of mine effluent monitoring is to track effluent quality and ensure compliance with Directive 019 requirements at all times, while making every effort to achieve EDOs established specifically for the Renard project by the MDDELCC. EDOs are used to determine the contaminant load a receiving environment can absorb without compromising its sustainability and its uses. Monitoring therefore helps protect the receiving aquatic environment, i.e., Lake Lagopede, by regularly assessing mine effluent quality (also called “final effluent” in Directive 019).

Table 3.5 provides a summary of the results of analyses performed to assess mine effluent quality, in addition to comparing observed influent and effluent values. In 2017, provincial and federal standards were all met at all times. The values are largely within the Directive 019 standards, and no rainbow trout and daphnia acute lethality (toxicity of less than 1 per sample) was observed. Photo 3.41 shows the quality of the water at the outlet to the lamellar clarifier, and Photo 3.42 compares turbidity in influent (A) and effluent (E), showing that the effluent turbidity is very low.

**Photo 3.41 Visual of the treated water at lamellar clarifier outlet**

**Photo 3.42 Effluent turbidity (left beaker) as compared with influent turbidity (right beaker)**

Mean concentrations for the various monitoring parameters (Table 3.5) comply with Directive 019, as well as the environmental discharge objectives (EDOs) for the parameters monitoried except in the case of nitrites. In 2017, Stornoway made an effort to reduce the nitrogen content in mine effluent. A training and awareness program was launched in the last quarter of 2017, to present the best techniques for loading blasting holes and reducing the quantity of explosives in the water to be treated at the MWTP.




**Map 3.4 Network of perimeter ditches**

To ensure the durability of the facilities, preventive maintenance is carried out on a regular basis on the operational, mechanical and electrical components at the MWTP. 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 efficiency of preventive measures. A total of 2,902,203 m³ of water was treated in 2017, 2,280,448 m³ of which was discharged into the final effluent outfall. The residual portion was re-used as service water, specifically for dissolving reagents required in the treatment process as well as supplying the ore processing plant.

Continuing plant operations while preventive maintenance work is under way is feasible owing to the 100% redundancy of the equipment. The plant as a result achieved an availability rate of 94.1% in 2017.

### 3.13.2 Temporary treatment plant

SWY uses a modular treatment plant during the spring thaw to treat the water generated during that critical period of the year. The plant has a capacity of 350 m³/h and is equipped with Geotube® filtre bags, as shown in Photo 3.43, to recover total suspended solids in the water to be treated. This technology was used successfully in 2015 and 2016, before the MWTP was brought on line. The modular unit was in operation in May and June, during the peak flood period. A total of 128,950 m³ of water was treated during that period, discharging treated water into the environment that met 100% of the quality criteria set out in Directive 019.

**Photo 3.43 Modular treatment plant with Geotube® filter bags**

### 3.13.3 Water withdrawal

Under the MDDELCC'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 subject to this regulation.

Water withdrawals are attributed, in decreasing order of importance, to the dewatering of the underground mine and open pits, the ore processing plant's freshwater requirements, production of drinking water for the worker's camp, the production of explosives in the form of emulsions, and finally the Renard mine airport's sanitary facilities. Freshwater to produce drinking water and meet the ore processing plant's additional requirements in the first year's of mining operations is drawn directly from Lake Lagopede, whereas water for explosives and the airport's sanitary facilities is drawn from artesian wells. A total of 2.75 million m³ of surface and ground water was withdrawn in 2017.

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 runnoff collected in the water retention pond near the processed kimberlite containment facility. Efforts made in this regard are described in Section 3.13.4.

### 3.13.4 Water re-use

The water balance for the mine site was updated in 2017. A mine wastewater and process water flow diagram is illustrated in Figure 3.15. The water balance documents water flows that were observed or estimated during the year on the mine site.

Significant flows that have been identifed are as follows:

- The activities that require water include process water for ore processing plant operations, drinking water for the mine camp 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 and pumped wells for dewatering the underground mine;
- Water that is re-used from pit R65, where runoff from the mine site is collected and then treated as well as water from dewatering and from the water retention pond near the processed kimberlite containment facility;
- Runoff;
- Evapotranspiration and evaporation of surface water at the mine site;
- Water discharged into the final effluent outflow in Lake Lagopede.

Overall, in 2017, the various water flows described above are divided into three main categories as set out in Directive 019. The water balance at the Renard mine is summarized as follows:

- 0.57 million m³ of freshwater withdrawn from Lake Lagopede to supply the Renard camp and the ore processing plant and from underground wells to supply the airport and the explosives facility;
- 0.80 million m³ of water that is re-used (water collected and treated water from R65 pit retention basin and water from the water retention pond at the foot of the processed kimberlite containment facility);
- 2.42 million m³ of mine effluent including final treated runoff discharged into Lake Lagopede (as well as water treated at the MWTP and the temporary wastewater treatment plant).

With the water retention pond in operation, the site increased its use of mine wastewater (in relation to its freshwater use) from 46% (in January to August) to 79% (in September to December). The annual usage of mine wastewater at the Renard mine site in 2017 was an estimated 58%. In 2017, the increase in usage was limited owing to the processing plant's water quality requirements for the diamond recovery system.

The mine wastewater usage efficiency rate (in relation to final effluent discharged) at the Renard mine site for 2017 was an estimated 25% (18% from January to August and 40% from September to December). The improved efficiency as of September 2017 is attributable to the construction of the water retention pond at the foot of the process kimberlite containment facility. Three additional measures were put in place in early 2018 to improve the water management plan by completely eliminating the use of freshwater from Lake Lagopede, except for drinking water and fire protection requirements; hence the objective bieng to use only treated mine water as process water.

The first measure involved installing measuring instruments on the water retention pond, specifically a turbimeter and water level probe to certify water quality meets clean water requirements and hence maximize use of the water retention pond.

The second measure entailed reorganizing the underground dewatering management system. Clean water from surface wells and underground drains from these sources is sent to the ore processing plant, as required or in emergency cases.

The third measure involved partially supplying the plant with underground drainage water, which would be treated at the plant prior to use.

**Table 3.11 Analysis of mine effluent quality (MWTP) in relation to applicable standards and discharge objectives**

| PARAMETRES | UNITS | Mean Concentration in Influent | MDDELCC Directive 019 | MDDELCC Environmental Discharge Objectives (ODOs) | Mean Concentration in Effluent | Mean Monthly Load (kg) |
|---|---|---|---|---|---|---|
| **Physico-chemical** | | | | | | |
| pH | -- | 7.82 | >6 and <9.5 | >6.5 | 7.03 | -- |
| Total suspended solids | mg/L | 76 | 15 | 15 | 1.3 | 290.265 |
| **Nutrients and ions** | | | | | | |
| Total ammonia nitrogen ($NH_3$+$NH_4$) | mg/L of N | 1.76 | -- | 5.92 | 1.65 | -- |
| Total Kjeldahl nitrogen (TKN) | mg/L of N | 1.61 | -- | -- | 1.73 | -- |
| Nitrates ($NO_3$) | mg/L of N | 6.30 | -- | 14.34 | 9.7 | -- |
| Nitrites ($NO_2$) | mg/L of N | 4.13 | -- | 0.08 | 0.27 | -- |
| Total phosphorus | mg/L of P | 0.0465 | -- | 0.075 | <0.0006 | -- |
| Chlorides | mg/L | 41.9 | -- | 1,149 | 39.7 | -- |
| Fluorides | mg/L | 0.57 | -- | 0.8 | 0.53 | -- |
| Sulphates | mg/L | 44.8 | -- | 2,495 | 65.4 | -- |
| **Total extractable metals and metalloids** | | | | | | |
| Aluminium | mg/L | 2.2 | -- | 0.132 | 0.01 | -- |
| Arsenic | mg/L | 0.006 | 0.2 | 0.105 | 0.0003 | 0.049 |
| Barium | mg/L | 0.07 | -- | 0.17 | 0.04 | -- |
| Cadmium | mg/L | 0.00002 | -- | 0.00022 | 0.00001 | -- |
| Total chromium | mg/L | 0.0163 | -- | 0.064 | 0.0003 | -- |
| Copper | mg/L | 0.00277 | 0.3 | 0.005 | 0.00009 | 0.022 |
| Iron | mg/L | 3.76 | 3 | 3 | 0.24 | 57.431 |
| Manganese | mg/L | 0.039 | -- | 1.28 | 0.024 | -- |
| Nickel | mg/L | 0.035 | 0.5 | 0.034 | 0.011 | 2.206 |
| Lead | mg/L | 0.00327 | 0.2 | 0.00057 | 0.00003 | 0.005 |
| Zinc | mg/L | 0.015 | 0.5 | 0.077 | 0.011 | 2.047 |
| **Organic compounds** | | | | | | |
| Hydrocarbons ($C_{10}$-$C_{50}$) | mg/L | 0.14 | -- | 0.05 | <0.1 | -- |
| **Toxicity testing** | | | | | | |
| Acute toxicity (trout) | Uta | -- | <1 | <1 | <1 | -- |
| Acute toxicity (daphnia) | Uta | -- | <1 | <1 | <1 | -- |

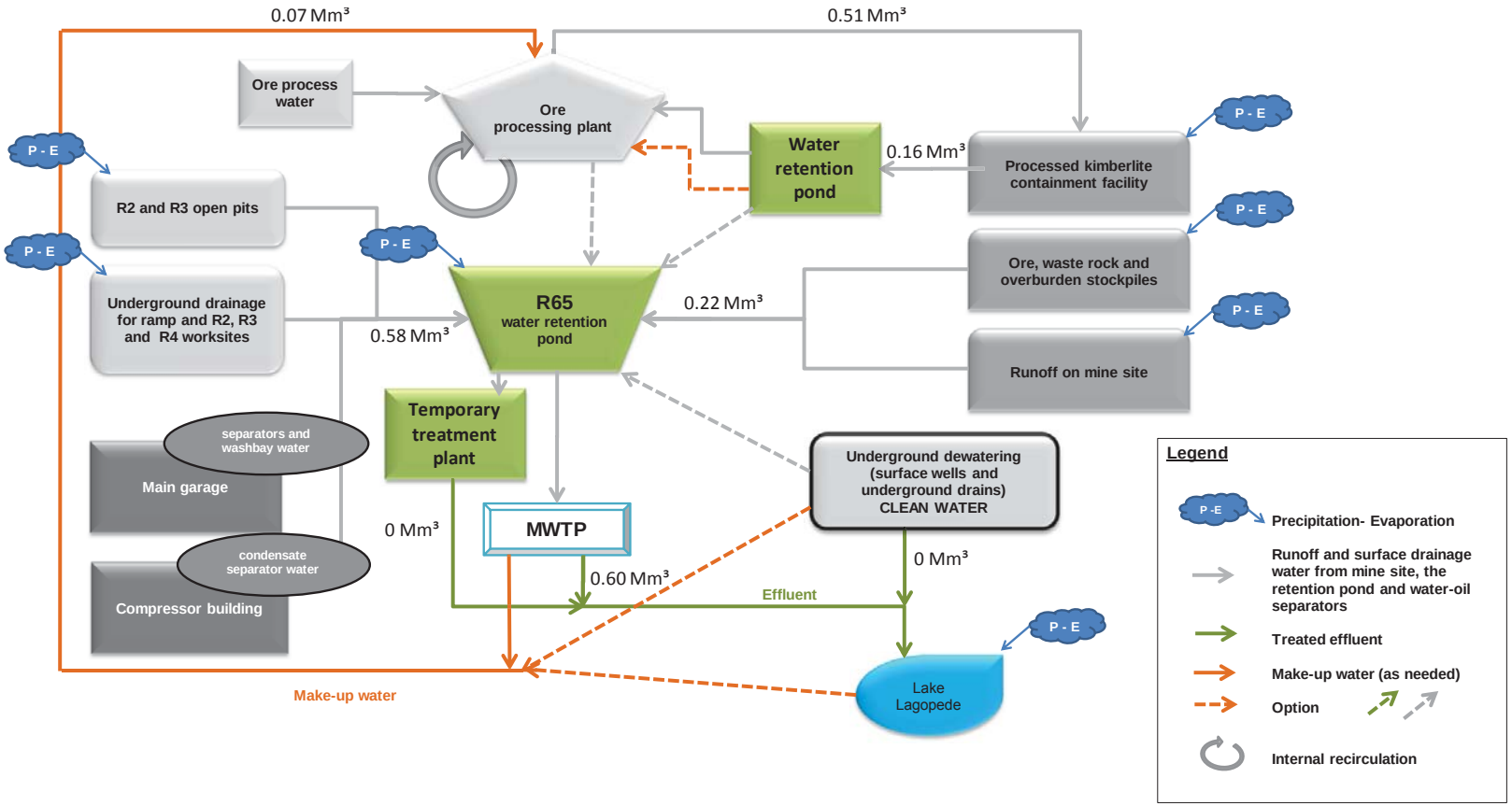



**Figure 3.15 Mine wastewater and process water flow diagram**

## 3.13.5 Domestic wastewater

The objective of monitoring domestic wastewater quality is to ensure compliance with applicable regulations, specifically the federal Wastewater Systems Effluent Regulations and the Fisheries Act, as well as the effluent discharge objectives (EDOs) established for the Renard project by the MDDELCC. EDOs are not standards per se, but are concentration and maximum load values for a given contaminant that will protect the uses of the receiving environment, primarily through compliance with water quality criteria at the limit of an effluent mixing zone. Monitoring EDOs helps protect the receiving environment, i.e., Lake Lagopede, by regularly monitoring domestic effluent quality.

The domestic wastewater treatment plant (DWTP), which consists of a SMBR bioreactor, a $BOD_5/NH_4$ bioreactor and a membrane clarification system, treated close to 33,151 $m^3$ in 2017, of which 32,252 $m^3$ were discharged as effluent into Lake Lagopede, and posted a 100% availability rate. The residual portion was re-used as service water specifically for dissolving reagents used in the treatment process. The difference between the volume treated at the DWTP and the drinking water distributed is attributed to water consumption by the x-ray system at the ore processing plant. This water is eventually discharged into Lake Lagopede but as mine effluent. Changes are planned in 2018 to eliminate this drinking water requirement. In 2017, an average unit flow rate of 286 litres/person/day was directed to the DWTP via the wastewater collection system, whereas the anticipated average unit flow rate was 440 litres/person/day, which confirms that the DWTP operates well within design criteria.


**Photo 3.44 Domestic wastewater treatment plant**

### 3.13.5.1 Domestic influent and effluent quality

The 2017 analytical results outlined in Table 3.12 show that domestic effluent values meet the standards set out by the Wastewater Systems Effluent Regulations. The criteria with regard to five-day carbonaceous biochemical oxygen demand ($CBOD_5$), i.e., the part that does not include nutrification activities, total suspended solids (TSS) and un-ionized ammonia ($NH_3$) have been met at all times since the commissioning of the DWTP. A 149% reduction in total suspended solid concentrations was observed between the influent and effluent (Table 3.12). No effluent toxicity was found in toxicity testing carried out on rainbow trout and daphnia.

The effluent analytical results all show that the domestic wastewater treatment process produces an effluent that meets all of the environmental discharge objectives (EDOs) established by the MDDELCC, for both concentrations and load allocations. Ammoniacal nitrogen concentrations are largely below allowable limits, in both summer and winter, which is synonymous with good nitrification even in colder temperatures. The bacteriological values observed for fecal coliforms are minimal and well within the standards.

Note that the quality of treated domestic wastewater effluent discharged into Lake Lagopede is compliant with federal and provincial requirements as well as with EDOs on exiting the plant, hence well before it is discharged into the receiving environment and the authorized dilution.

Finally despite the fact that no related standard exists, regular monitoring is performed to asses the performance of the DWTP in removing total extractible metal concentrations. A comparison of influent and effluent concentrations confirms that there has been a significant reduction in total extractible metal concentrations, thereby demonstrating the efficiency of the domestic wastewater treatment plant.

### 3.13.5.2 Domestic sludge management

Monitoring of post-treatment pressed sludge was initiated in 2016, and continued in 2017 so as to collect sufficient data for a complete characterization of domestic sludge. The characterization is intended to determine whether the allowable limits set out in the guide for the recycling of fertilizing residual materials (*Guide sur le recyclage des matières résiduelles fertilisantes*) have been met, which would make it feasible to stock and use dehydrated sludge in the progressive rehabilitation of the mine site.

A characterization performed by an agronomist confirmed that the sludge could in fact be used in site restoration work, provided that a certificate of authorization was obtained by the MDDELCC.

To ensure the sustainability of the facilities, preventive maintenance is performed regularly at the DWTP to address operational, mechanical and electrical issues. Observations are logged to facilitate the analysis of situations that need to be addressed with a view to upgrading the system and preserving 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 adverse impacts on DWTP operations.

The two membrane filtration units at the DWTP are each washed on a monthly basis to prevent the membranes from clogging. In September, in addition to these washing procedures, the units underwent a complete maintenance check by a qualified technician associated with the equipment supplier. The membranes represent a physical barrier between the water and the impurities transported by the water. During filtration, the permeate is sucked under pressure through the membrane leaving the impurities on the outside surface of the membrane, thereby creating enhanced resistance to permeation. The enhanced resistance in turn increases the amount of transmembrane pressure required for the operation. This comprehensive maintenance process is primarily aimed at removing the build-up of undesirable deposits and dirt that could adversely impact the effectiveness of the treatment process in addition to carrying out required repairs on the membrane fibres and improving their efficiency.

A visual inspection was conducted to detect wear on the membrane in the form of broken or severely damaged fibres. Bubble or membrane integrity tests were conducted to detect leaks. And finally, deposits were carefully removed.

This maintenance procedure confirmed that the membranes had not been subject to any major damage despite the amount of material removed from them. A few damaged fibres were repaired and a net improvement in operating pressure was subsequently observed.

**Table 3.12 Analysis of domestic wastewater quality in relation to applicable standards and discharge objectives**

| PARAMETERS | UNITS | Mean Concentration in Influent | CRITERIA | | Mean Concentration in Effluent | Allowed Load (kg/j) | Load (kg/j) |
|---|---|---|---|---|---|---|---|
| | | | Wastewater Systems Effluent Regulations | MDDELCC's EDOs Allowed Concentration | | | |
| **Physico-chemical** | | | | | | | |
| pH | mg/L | 7.27 | NRP | NRP | 7.65 | NRP | NRP |
| $CBOD_5$ | mg/L | 255 | 25 | 25 | 2.0 | NRP | NRP |
| $BOD_5$ | mg/L | 224 | NRP | NRP | 2.0 | 4 | 0.18 |
| COD | mg/L | 633 | NRP | NRP | 15.6 | NRP | NRP |
| TSS | mg/L | 209 | 25 | 25 | 1.4 | 8 | 0.12 |
| **Nutrients and ions** | | | | | | | |
| Non-ionized nitrogen ($NH_3$) | mg/L of N | 0.64 | 1.25 | NRP | 0.03 | NRP | NRP |
| Ammonia nitrogen ($NH_3$+$NH_4$) | mg/L of N | 43.3 | NRP | 12.02 (1)<br>18.82 (2) | 0.36 (1)<br>1.19 (2) | 1.9 (1)<br>3.0 (2) | 0.11 (1)<br>0.13 (2) |
| Total phosphorous | mg/L of P | 8.91 | NRP | 0.1 | 0.017 | NRP | NRP |
| **Bacteriological** | | | | | | | |
| Fecal coliforms | UFC/100mL | 313,750 | NRP | 10,000 | 1.9 | NRP | NRP |
| **Toxicity testing** | | | | | | | |
| Acute toxicity - daphnia | Uta | NRP | NRP | <1 | <1 | NRP | NRP |
| Acute toxicity - rainbow trout | Uta | NRP | NRP | <1 | <1 | NRP | NRP |
| **Total extractable metals and metalloids** | | | | | | | |
| Aluminium (Al) | mg/L | 0.69 | NRP | NRP | 0.11 | NRP | NRP |
| Arsenic (As) | mg/L | 0.003 | NRP | NRP | 0.001 | NRP | NRP |
| Barium (Ba) | mg/L | 0.0177 | NRP | NRP | 0.0044 | NRP | NRP |
| Cadmium (Cd) | mg/L | 0.01309 | NRP | NRP | 0.00008 | NRP | NRP |
| Chromium (Cr) | mg/L | 0.0059 | NRP | NRP | 0.0004 | NRP | NRP |
| Copper (Cu) | mg/L | 0.055 | NRP | NRP | 0.004 | NRP | NRP |
| Iron (Fe) | mg/L | 0.98 | NRP | NRP | 0.20 | NRP | NRP |
| Manganese (Mn) | mg/L | 0.028 | NRP | NRP | 0.016 | NRP | NRP |
| Nickel (Ni) | mg/L | 0.0129 | NRP | NRP | 0.0073 | NRP | NRP |
| Lead (Pb) | mg/L | 0.0048 | NRP | NRP | 0.0019 | NRP | NRP |
| Zinc (Zn) | mg/L | 0.23 | NRP | NRP | 0.14 | NRP | NRP |

(1) Summer season (June 1st to November 30)
(2) Winter season (December 1st to May 31)
NRP: Non-regulated parameter

**Photo 3.45 Inspection and cleaning of a membrane filtration unit**

### 3.13.6 Water-oil separators

Two water-oil separators were installed to treat water from the mechanical maintenance garage and the airstrip garage. Gravity is used to intercept oils as well as non-soluble and non-emulsive hydrocarbons in wastewater from these maintenance areas. In fact, contaminated water resulting from various maintenance operations, such as vehicle oil changes, must be managed appropriately.

A third water-oil separator was installed in the second quarter of 2017 in the underground mine fresh air raise (FAR) building (Photo 3.46) to recover oil from the compressor condensate, since small quantities of oil are transported by compressed air. The condensate is depressurized in an expansion chamber and the emulsified oil-water mixture is absorbed by a series of oleophilic filtres that retain only the oil and active carbon filters that absorb residual oil from the condensate.

Water at the outlet to the separators is sampled quarterly to ensure compliance with the 15 mg/l requirements. Results to date are on average 9.5 mg/l for the garage, 0.29 mg/l for the airport and 0.37 and 0.62 mg/l respectively for the two fresh air raise treatment units; hence a clear indication of the effectiveness of the systems in place.

**Photo 3.46 Fresh air raise (FAR) condensate separator**

Oil recovered from the separators is collected, stored in designated containers and transported off site for disposal or reclamation at authorized sites in compliance with applicable regulations, such as those listed in Section 2.2 on hazardous residual materials. Disposal dates and volumes are logged in a registry.

Quarterly inspections of these facilities are conducted by a building technician. These inspections involve measuring the height of oil in the separator and oil storage tank, and the amount of sludge. The technician also records the presence or absence of liquid in the containment tray and indicates whether the oil has been emptied. This information is all logged. The environment

technician samples the water at the water-oil separator outlet to measure the concentration of petroleum hydrocarbons ($C_{10}$-$C_{50}$).

## 3.14 Hydrogeological system 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 high-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 the mining infrastructure considered to be at-risk 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.

To meet these objectives, a network of 42 observation wells (Photo 3.47) were used to cover the entire mine site, the TLS and the airstrip. 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 confinement facility area (UWR5): eight wells;
  - Waste rock stockpile (UWR8): three wells;
  - R65 pit (UWR4): three wells.


**Photo 3.47 Observation 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 (UWP2): 11 wells.
- Sector 5
  - Airstrip (UWP1): five wells.

A piezometric water level reading was also performed in all the wells as part of 2017 sampling campaigns.

The groundwater quality criteria used for at-risk facilities are the criteria set out in Directive 019 (MDDEP, 2012), whereas the TLS criteria are those listed in Section 57 of the REIMR and compliance with the provisions of Section 58 in the same regulation. The analytical results were also compared with the alert thresholds and local background levels determined in the groundwater background levels study (baseline) conducted at the Renard project site (Norda Stelo, 2017).

Before the mine site was even set up, natural groundwater background levels measured at the Renard project site (2010 to 2016) (Norda Stelo, 2017) revealed natural concentrations of several parameters that exceeded the resurgence criteria set out in the MDDELCC's guide. The results were all compared to local background levels, the alert thresholds, and the resurgence and sewer infiltration criteria set out in the MDDELCC guide. The higher values between the resurgence criteria and background level was used to compare with the results shown in tables 3.13 to 3.16.

Groundwater samples collected in observation wells (Photo 3.48 and Photo 3.49) installed at at-risk facilities were analyzed to determine concentrations of various physical-chemical parameters defined in Directive 019 (MDDEP, 2012): 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, fecfal 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. Descriptive statistics for the analytical results determined for the entire mine site in 2017 (sectors 1, 2 and 3) are shown in tables 3.13, 3.14 and 3.15. The 2017 results for these three sectors show mean concentrations mostly well within the highest standards. Some mean concentration values for copper, maganese, iron, calcium and zinc exceeded the criteria. These values were however similar to those observed in 2015 and 2016. It should be noted that even before the at-risk facilities were installed natural groundwater background levels measured at the Renard project site (Norda Stelo, 2017) revealed natural concentrations of these five metals that exceeded the resurgence criteria set out in the MDDELCC's guide. More stringent monitoring will be carried out to track changes in the concentration of these metals in 2018.

The quality of groundwater samples collected in sector 4 (TLS) since 2015 has remained stable (Table 3.15). The 2017 results show mean concentrations that meet applicable standards.

As in sector 4, samples from sector 5 present mean concentrations that meet applicable standards (Table 3.17). There is therefore no sign of an increase in any metal concentration.

**Photo 3.48 Groundwater sampling (July 2017)**

**Photo 3.49 Observation well rinse procedure (July 2017)**

**Table 3.13 Groundwater quality descriptive statistics for sector 1 in 2017**

| Parameter | Unit | Sector 1 - Mine - Overburden | | | Secteur 1 - Mine - Rock | | |
|---|---|---|---|---|---|---|---|
| | | Applicable Standard | Source of Criteria (*) | Mean Concentration | Applicable Standard | Source of Criteria (*) | Mean Concentration |
| Petroleum hydrocarbons (C10-C50) | mg/L | 2.8 | R | 0.0761 | 2.8 | R | <0.1 |
| Conductivity | µS/cm | - | - | 36.5 | - | - | 82 |
| pH | pH units | - | - | 6.59 | - | - | 7.06 |
| Bicarbonates (HCO3) | mg/L-CaCO3 | 50 | F | 13.2 | 94 | F | 20.2 |
| Sulphates (SO4) | mg/L | 19 | F | 2.141 | 51.2 | F | 2.8134 |
| Calcium (Ca) | mg/L | 19.885 | F | 2.924 | 59.4 | F | 6.385 |
| Magnesium (Mg) | mg/L | 3.61 | F | 0.661 | 2.94 | F | 1.1982 |
| Potassium (K) | mg/L | 5.865 | F | 0.859 | 109.6 | F | 3.843 |
| Sodium (Na) | mg/L | 10.6 | F | 1.736 | 52 | F | 3.79 |
| Aluminium (Al) | mg/L | 0.982 | F | 0.0290 | 0.653 | F | 0.0839 |
| Silver (Ag) | mg/L | 0.00049 | F | 0.000060 | 0.00026 | F | 0.000043 |
| Arsenic (As) | mg/L | 0.34 | R | 0.000204 | 0.34 | R | 0.000736 |
| Barium (Ba) | mg/L | 0.108** | R | 0.00839 | 0.108 | R | 0.00811 |
| Chromium (Cr) | mg/L | 0.0072 | F | 0.000297 | 0.048 | F | 0.000817 |
| Copper (Cu) | mg/L | 0.057 | F | 0.0182 | 0.009 | F | 0.010537 |
| Iron (Fe) | mg/L | 2.908 | F | 0.031 | 1.46 | F | 0.04662 |
| Manganese (Mn) | mg/L | 0.6** | R | 0.0338 | 0.6 | R | 0.0615 |
| Nickel (Ni) | mg/L | 0.023 | F | 0.00790 | 0.025 | F | 0.0146 |
| Lead (Pb) | mg/L | 0.0044** | R | 0.000055 | 0.0044 | R | 0.000086 |
| Zinc (Zn) | mg/L | 0.078 | F | 0.03022 | 0.017 | F | 0.0347 |

* [R] Resurgence criteria - Beaulieu, Michel. 2016. Guide d'intervention - Protection des sols et réhabilitation des terrains contaminés. Ministry of Sustainable Development, the Environment and the Fight against Climate Change. ISBN 978-2-550-76171-6, 210 p.

[F] Natural background levels in target sector as specified in "Calculation of the Local Geochemical Background of Groundwater", a study conducted on the Renard project site (Norda Stelo, 2017b)

** Criteria determined using a hardness of 10 mg/L of $CaCO_3$

**Table 3.14 Groundwater quality descriptive statistics for sector 2 (overburden) in 2017**

| Parameter | Unit | Applicable Standard | Source of Criteria (*) | Mean Concentration |
|---|---|---|---|---|
| Petroleum hydrocarbons (C10-C50) | mg/L | 2.8 | R | <0.1 |
| Conductivity | µS/cm | - | - | 96 |
| pH | pH units | - | - | 5.75 |
| Bicarbonates (HCO3) | mg/L-CaCO3 | 57 | F | 18.0 |
| Sulphates (SO4) | mg/L | 18 | F | 15.591 |
| Calcium (Ca) | mg/L | 12.7 | F | 6.48 |
| Magnesium (Mg) | mg/L | 2.7 | F | 1.174 |
| Potassium (K) | mg/L | 13.72 | F | 3.287 |
| Sodium (Na) | mg/L | 9.8 | F | 2.57 |
| Aluminium (Al) | mg/L | 1.135 | F | 0.286 |
| Silver(Ag) | mg/L | <0.0001 | F | <0.00004 |
| Arsenic (As) | mg/L | 0.34 | R | 0.0003 |
| Barium (Ba) | mg/L | 0.108** | R | 0.035 |
| Chromium (Cr) | mg/L | 0.0022 | F | 0.00088 |
| Copper (Cu) | mg/L | 0.04815 | F | 0.0285 |
| Iron (Fe) | mg/L | 37 | F | 5.92 |
| Manganese (Mn) | mg/L | 0.636 | F | 0.1512 |
| Nickel (Ni) | mg/L | 0.0067** | R | 0.01 |
| Lead (Pb) | mg/L | 0.0044** | R | 0.0017 |
| Zinc (Zn) | mg/L | 0.033 | F | 0.023 |

* [R] Resurgence criteria - Beaulieu, Michel. 2016. Guide d'intervention - Protection des sols et réhabilitation des terrains contaminés. Ministry of Sustainable Development, the Environment and the Fight against Climate Change. ISBN 978-2-550-76171-6, 210 p.

[F] Natural background levels in target sector as specified in "Calculation of the Local Geochemical Background of Groundwater", a study conducted on the Renard project site (Norda Stelo, 2017b)

** Criteria determined using a hardness of 10 mg/L of $CaCO_3$

**Table 3.15 Groundwater quality descriptive statistics for sector 3 in 2017**

| Parameter | Unit | Sector 3 – Plants and Fuel - Overburden | | | Secteur 3 – Plants and Fuel - Rock | | |
|---|---|---|---|---|---|---|---|
| | | Applicable Standard | Source of Criteria (*) | Mean Concentration | Applicable Standard | Source of Criteria (*) | Mean Concentration |
| Petroleum hydrocarbons (C10-C50) | mg/L | 2.8 | R | <0.1 | 2.8 | R | <0.1 |
| Conductivity | µS/cm | - | - | 166 | - | - | 170 |
| pH | pH units | - | - | 6.50 | - | - | 7.36 |
| Bicarbonates (HCO3) | mg/L-CaCO3 | 62 | F | 55.5 | 74 | F | 57.0 |
| Sulphates (SO4) | mg/L | 9.3 | F | 6.7239 | 27 | F | 8.3755 |
| Calcium (Ca) | mg/L | 16.55 | F | 17.37 | 29.52 | F | 21.8 |
| Magnesium (Mg) | mg/L | 2.495 | F | 2.98 | 3.77 | F | 3.28 |
| Potassium (K) | mg/L | 2.89 | F | 2.19 | 14.76 | F | 2.26 |
| Sodium (Na) | mg/L | 7.16 | F | 4.70 | 31.05 | F | 6.22 |
| Aluminium (Al) | mg/L | 0.122 | F | 0.044 | 1.449 | F | 0.346 |
| Silver (Ag) | mg/L | <0.0003 | F | <0.00004 | 0.0004 | F | <0.00004 |
| Arsenic (As) | mg/L | 0.34 | R | 0.00123 S | 0.34 | R | 0.00048 |
| Barium (Ba) | mg/L | 0.108** | R | 0.019 | 0.108** | R | 0.023 |
| Chromium (Cr) | mg/L | <0.005 | F | <0.0005 | 0.009 | F | 0.00099 |
| Copper (Cu) | mg/L | 0.137 | F | 0.0052 RF | 0.075 | F | 0.00621 |
| Iron (Fe) | mg/L | 2.01 | F | 3.15 | 1.384 | F | 0.5928 |
| Manganese (Mn) | mg/L | 2.74 | F | 1.0243 | 0.6** | R | 0.1344 |
| Nickel (Ni) | mg/L | 0.013 | F | 0.013 | 0.045 | F | 0.006 |
| Lead (Pb) | mg/L | 0.0062 | F | 0.00010 | 0.0047 | F | 0.00214 |
| Zinc (Zn) | mg/L | 0.09 | F | 0.0080 | 0.078 | F | 0.0105 |

* [R] Resurgence criteria - Beaulieu, Michel. 2016. Guide d'intervention - Protection des sols et réhabilitation des terrains contaminés. Ministry of Sustainable Development, the Environment and the Fight against Climate Change. ISBN 978-2-550-76171-6, 210 p.

[F] Natural background levels in target sector as specified in "Calculation of the Local Geochemical Background of Groundwater", a study conducted on the Renard project site (Norda Stelo, 2017b)

** Criteria determined using a hardness of 10 mg/L of $CaCO_3$

**Table 3.16 Groundwater descriptive statistics for sector 4 (overburden) in 2017**

| Parameter | Unit | Applicable Standard | Source of Criteria (*) | Mean Concentration |
|---|---|---|---|---|
| Petroleum hydrocarbons (C10-C50) | mg/L | - | - | 0.0541 |
| Conductivity (labo) | µS/cm | - | - | 26.04 |
| pH (labo) | pH units | - | | 6.56 |
| BOD5 | mg/L-O2 | <4 | F | <2 |
| COD | mg/L-O2 | 65 | F | 10.4 |
| Chlorides (Cl) | mg/L | 250 | M | 0.400 |
| Sulphates (SO4) | mg/L | 500 | M | 1.254 |
| Total sulphides (S2-) | mg/L-S-2 | <0.1 | F | 0.016 |
| Total cyanides (CN) | mg/L-CN | 0.2 | M | <0.003 |
| Ammonium nitrogen (N-NH3) | mg/L-N | 1.5 | M | 0.0119 |
| Nitrates-Nitrites (N-NO3-NO2) | mg/L-N | 10 | M | 0.292 |
| Sodium (Na) | mg/L | 200 | M | 1.298 |
| Boron (B) | mg/L | 5 | M | <0.02 |
| Cadmium (Cd) | mg/L | 0.01 | M | 0.0000446 |
| Chromium (Cr) | mg/L | 0.05 | M | 0.00027 |
| Copper (Cu) | mg/L | 0.013 | F | 0.00159 |
| Iron(Fe) | mg/L | 0.3 | M | 0.0366 |
| Manganese (Mn) | mg/L | 0.114 | F | 0.00206 |
| Mercury (Hg) | mg/L | 0.001 | M | 0.000023 |
| Nickel (Ni) | mg/L | 0.035 | F | 0.0008 |
| Lead (Pb) | mg/L | 0.01 | M | 0.00009 |
| Zinc (Zn) | mg/L | 5 | M | 0.0032 |
| Fecal coliforms | UFC/100mL | - | | 0.7 |
| Benzene | mg/L | 0.005 | M | <0.0003 |
| Ethylbenzene | mg/L | 0.0024 | M | <0.0003 |
| Toluene | mg/L | 0.024 | M | <0.001 |
| Xylenes (o,m,p) | mg/L | 0.3 | M | <0.001 |
| 2,3,4,6-Tetrachlorophenol | mg/L | - | - | <0.001 |
| Tetrachloro-2_3_5_6 | mg/L | - | - | <0.001 |
| 2,3-Dichlorophenol | mg/L | - | - | <0.001 |
| 2,4 + 2.5-Dichlorophenol | µg/L | - | - | <1.0 |
| 2,4,5-Trichlorophenol | mg/L | - | - | <0.001 |
| 2,4,6-Trichlorophenol | mg/L | - | - | <0.001 |
| 2,4-Dimethylphenol | 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 |
| 4-Nitrophenol | mg/L | - | - | <0.001 |
| o-Cresol | mg/L | - | - | <0.001 |
| m-Cresol | mg/L | - | - | <0.001 |
| p-Cresol | mg/L | - | - | <0.001 |
| Pentachlorophenol | mg/L | - | - | <0.001 |
| Phenol | mg/L | - | - | <0.001 |

* [M] Limit values as specified in Section 57 of the Regulation respecting the Landfilling and Incineration of Residual Materials (Chapter Q-2, r. 19)

[F] Natural background levels in target sector as specified in “Calculation of the Local Geochemical Background of Groundwater”, a study conducted on the Renard project site (Norda Stelo, 2017b)

**Table 3.17 Groundwater descriptive statistics for sector 5 (overburden) in 2017**

| Parameter | Unit | Applicable Standard | Source of Standard (*) | Mean Concentration |
|---|---|---|---|---|
| Petroleum hydrocarbons (C10-C50) | mg/L | 2.8 | - | 0.064 |
| Conductivity | µS/cm | - | - | 62 |
| pH | pH units | - | - | 6.16 |
| Bicarbonates (HCO3) | mg/L-CaCO3 | 86 | F | 28.1 |
| Sulphates (SO4) | mg/L | 16 | F | 2.23 |
| Calcium (Ca) | mg/L | 8.35 | F | 3.17 |
| Magnesium (Mg) | mg/L | 3.025 | F | 1.220 |
| Potassium (K) | mg/L | 9.6 | F | 2.7 |
| Sodium (Na) | mg/L | 36.15 | F | 4.03 |
| Aluminium (Al) | mg/L | 0.722 | F | 0.1485 |
| Argent (Ag) | mg/L | <0.0003 | F | 0.0000147 |
| Arsenic (As) | mg/L | 0.34 | R | 0.001119 |
| Barium (Ba) | mg/L | 0.108 | R | 0.02532 |
| Chromium (Cr) | mg/L | 0.0018 | F | 0.000780 |
| Copper (Cu) | mg/L | 0.0093 | F | 0.003265 |
| Iron (Fe) | mg/L | 15.95 | F | 6.51485 |
| Manganese (Mn) | mg/L | 0.929 | F | 0.8555 |
| Nickel (Ni) | mg/L | 0.02 | F | 0.004554 |
| Lead (Pb) | mg/L | 0.0044 | R | 0.000123 |
| Zinc (Zn) | mg/L | 0.052 | F | 0.02001 |

* [R] Resurgence criteria - Beaulieu, Michel. 2016. Guide d'intervention - Protection des sols et réhabilitation des terrains contaminés. Ministry of Sustainable Development, the Environment and the Fight against Climate Change. ISBN 978-2-550-76171-6, 210 p.

[F] Natural background levels in target sector as specified in "Calculation of the Local Geochemical Background of Groundwater", a study conducted on the Renard project site (Norda Stelo, 2017b)

** Criteria determined using a hardness of 10 mg/L of $CaCO_3$

## 3.15 Accumulation Area Monitoring

The objective of monitoring accumulation areas is to control the integrity and, hence, stability of geotechnical structures, to verify the application of the processed kimberlite deposition plan, to track changes in the structures over time, and to identify any maintenance work required to ensure the structures are in good working order. For this, various weekly, quarterly and annual inspections are carried out along with specific inspections as required.

Tailings generated as part of normal mining operations at the Renard mine site are considered low risk as was anticipated. There is in fact no metal leaching, which is consistent with the results of the laboratory leaching tests conducted as part of the Environmental and Social Impact Assessment. No major spill has been recorded on accumulation areas except leaks from mechanical equipment which were immediately contained and recovered.

Visual inspections have been carried out on a regular daily basis by supervisors and technical services, as well as by surveyors during the construction of the containment berm. Construction reports are secured on the computer network and are available on request. Quality control inspections were also conducted by the design consultant and no changes were made to the containment berm inspection

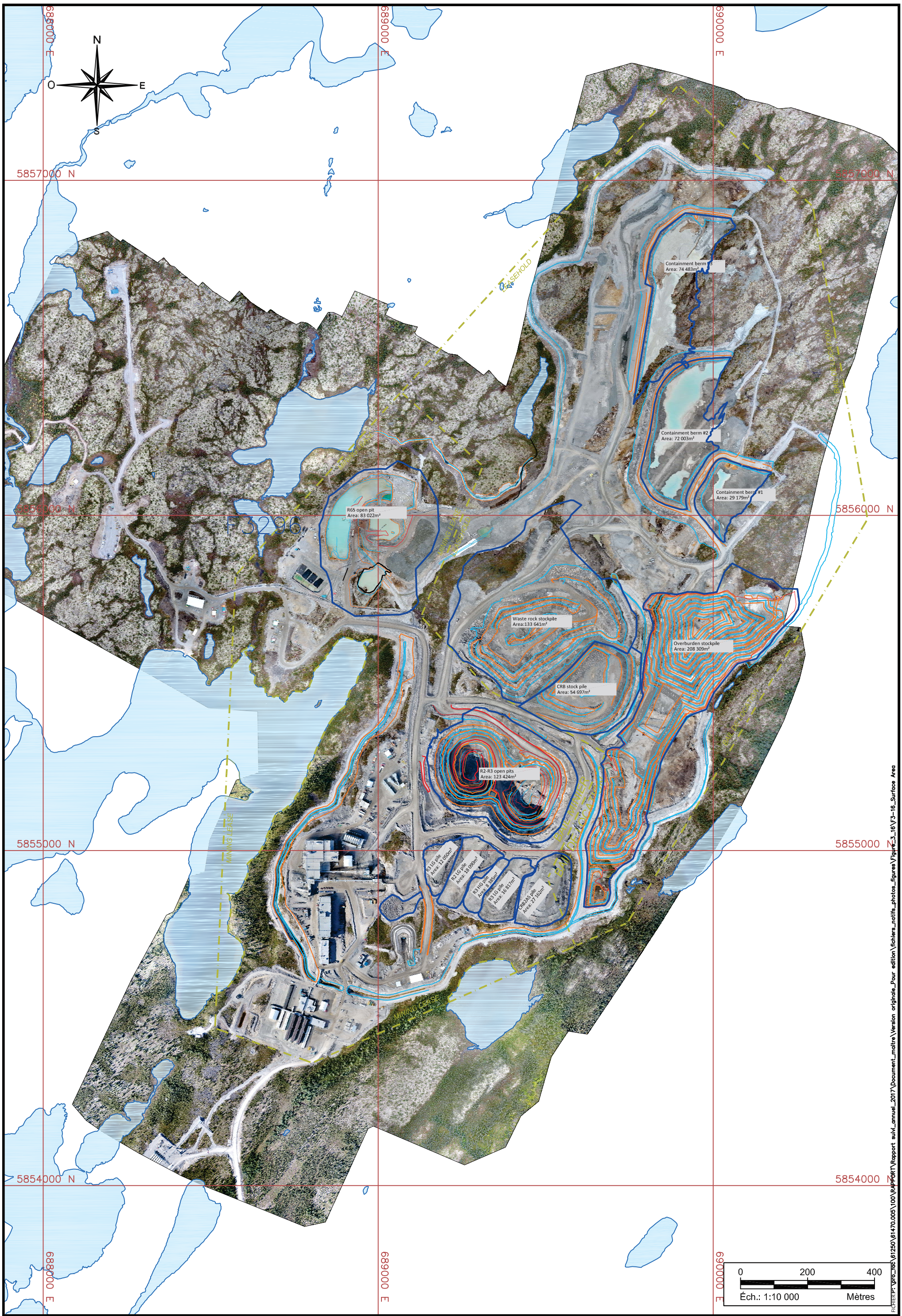
Every type of material produced as part of current operations at the Renard mine site is stored in designated accumulation areas, in compliance with the deposition plan.

These accumulation areas include ore stockpiles, the waste rock pile, the overburden stockpile and the modified processed kimberlite containment (MPKC) facility. In 2017, changes were made to the design of the PKC creating the modified processed kimberlite containment (MPKC) facility. Changes to the tailings site have made it possible to accommodate two fractions produced by the plant: the coarse fraction (coarse PK), which is transported by truck to the MPKC; and a second finer fraction, which is hydraulically pumped and discharged onto the MPKC. The coarse fraction consists of 65% of the material produced whereas the fine fraction represents the balance, 35%.

Overburden is transported to the overburden stockpile located northeast of R2/R3 pit, and the ore to be stockpiled is transported to the ore piles south of R2/R3 pit. Waste rock is transported to the waste rock pile, north of R2/R3 pit, whereas ore processed at the ore processing plant is taken from the open pit, ore stockpiles and a very small amount from the underground mine.

The coarse kimberlite fraction is used to build containment berms in the areas where the kimberlite is hydraulically deposited. Waste rock is also used to build MPKC berms, in addition to being used for road maintenance and civil engienering work. An estimated 400,000 tonnes of rock is crushed to meet requirements.

The open pit and underground mines are operated on a daily basis year round. Table 3.18 illustrates the quantities of materials extracted from the open pit and underground operations respectively as well as the ore processed at the plant and materials transported to the MPKC. The areas involved and tonnage of materials in each accumulation area are shown in Tables 3.18 and 3.19.




| DESSINÉ PAR: Y. DUGUAY | DATE: 2018-02-13 | PROJET: RENARD MINE | | NUMÉRO DE DESSIN: |
|---|---|---|---|---|
| APPROUVÉ PAR: | DATE: | TITRE: SURFACE AREA OF THE ACCUMULATION AREAS | stornoway | SUR - 00 - ENV - 000 - SUR - 01 - 03 |
| ÉCHELLE: 1:10 000 | IMPRIMÉ: 2018–08–23 | Figure 3.16 – GENERAL PLAN VIEW | | SECTEUR / DISCIPLINE / DÉTAIL / DESCRIPTION / TRAVAIL / SÉQUENCE / RÉVISION |

FICHIER: P:\pro_toc\61250\61470.005\100\RAPPORT\Rapport suivi_annuel_2017\Document_maitre\Version originale_Pour edition\fichiers_natifs_photos_figures\Figure_3_16\F3-16_Surface Area

**Table 3.18 Tonnage of materials extracted and processed in 2017**

| Description | Tonnage (mt) | | |
|---|---|---|---|
| **Material Extracted** | **Open Pit Mine** | **Underground Mine** | **TOTAL** |
| Overburden | 0 | 0 | 0 |
| Waste rock | 2.384 | 258 | 2.642 |
| Ore | 2.091 | 150 | 2.241 |
| **TOTAL** | **4.475** | **408** | **1.991** |
| **Processed ore** | | | **Tonnage (mt)** |
| Ore | | | 1.991 |
| **Material stored in processed kimberlite containment facility** | | | **Tonnage (mt)** |
| Processed kimberlite transported by truck | | | 1.636 |
| Kimberlite (fine fraction) transported hydraulically | | | 355 |
| **TOTAL** | | | **1.991** |

**Table 3.19 Size and storage capacities of accumulation areas**

| Description | Area | Volume | Quantity | Quantity in 2017 |
|---|---|---|---|---|
| | $m^2$ | $m^3$ | (mt) | (mt) |
| | | | | |
| R2/R3 | 123,000 | 4,642,000 | 12,534,000 | 4,476,000 |
| R65 | 127,000 | 669,000 | 1,805,000 | 0 |
| | | | | |
| Waste rock | 194,000 | 1,949,000 | 3,704,000 | 202,000 |
| Overburden | 208,000 | 2,063,000 | 3,300,000 | 426,000 |
| | | | | |
| CRB | 61,000 | 707,000 | 1,344,000 | 443,000 |
| R2 ore pile | 30,000 | 0 | 0 | -297,000 |
| R3 ore pile | 25,000 | 60,000 | 114,000 | -168,000 |
| CRB-2A | 27,000 | 209,000 | 397,000 | 397,000 |
| | | | | |
| Rockfill blanket | 184,000 | 135,000 | 254,000 | 0 |
| Containment berm No. 1 | 29,000 | 219,000 | 412,000 | 0 |
| Containment berm No. 2 | 72,000 | 664,000 | 1,328,000 | 1,328,000 |
| Containment berm No. 3 | 74,000 | 964,000 | 1,928,000 | 1,928,000 |

# 4 Continuous Improvement in 2017

An environmental management and preventive maintenance procedures system covering all project activities was put in place in conjunction with project implementation. In the field, this approach is visible in the orderly, clearly signposted and safe worksite.

With regard to residual materials management, the residual materials management plan will be updated in 2018 in line with the new permanent infrastructure to be installed. Adopting the *ICI ON RECYCLE !* program will be considered, while prioritizing the 3R-RD (reduce, reuse, recyucle, relcaim, dispose) approach.

- Implement program to reduce nitrogen concentration in final effluent;
- Increase water recirculation rate on site and carry out new optimization of water management in 2018;
- Reduce consumption of drinking water (L/d/pers);
- Work toward achieving Toward Sustainable Mining (TSM) certification.

SWY has acquired environmental database software to further enhance analytical results based on the sampling campaigns undertaken as part of the Environmental and Social Monitoring Program. This software will maximize the use of the data collected, providing a better understanding of the receiving environment and of the environmental impacts of various project activities, and hence increasing early detection capacity and response to specific events.

New environmental induction training is currently being developed and will be deployed by the Environment Department to all employees on a mandatory basis in the first quarter of 2018 (Figure 4.1). In addition, sustained awareness efforts and the ongoing presence of Sustainable Development Department representatives have contributed to ensuring the application of environmental best practices in all company operations.

In the interests of protecting the environment and biodiversity, in keeping with specific features of the local environment, environmental and social monitoring of the Renard project is being conducted collaboratively with project stakeholders to enhance our knowledge of the host environment and the impact of mine operations at various levels.

Mine operations have been planned from the outset to promote progressive restoration of the site and leave the site in a condition comparable with its natural condition. Site restoration work therefore continued in 2017 (see section 6 for more details).

Stornoway is preparing the next generation by providing students with environmental internship opportunities at the mine site. In summer 2017, two university interns and one college student were part of the Environment Department team. They worked along side environmental technicians on assignments in support of the biologist. They took part in sampling campaigns, collected data, and worked on site revegetation operations, etc. (Photo 4.1).

**Photo 4.1 Interns involved in a surface water sampling campaign**

The experience in 2017 was a resounding success, and the Enviroinment Department is set to take on two environmental interns and one water treatment intern in 2018.

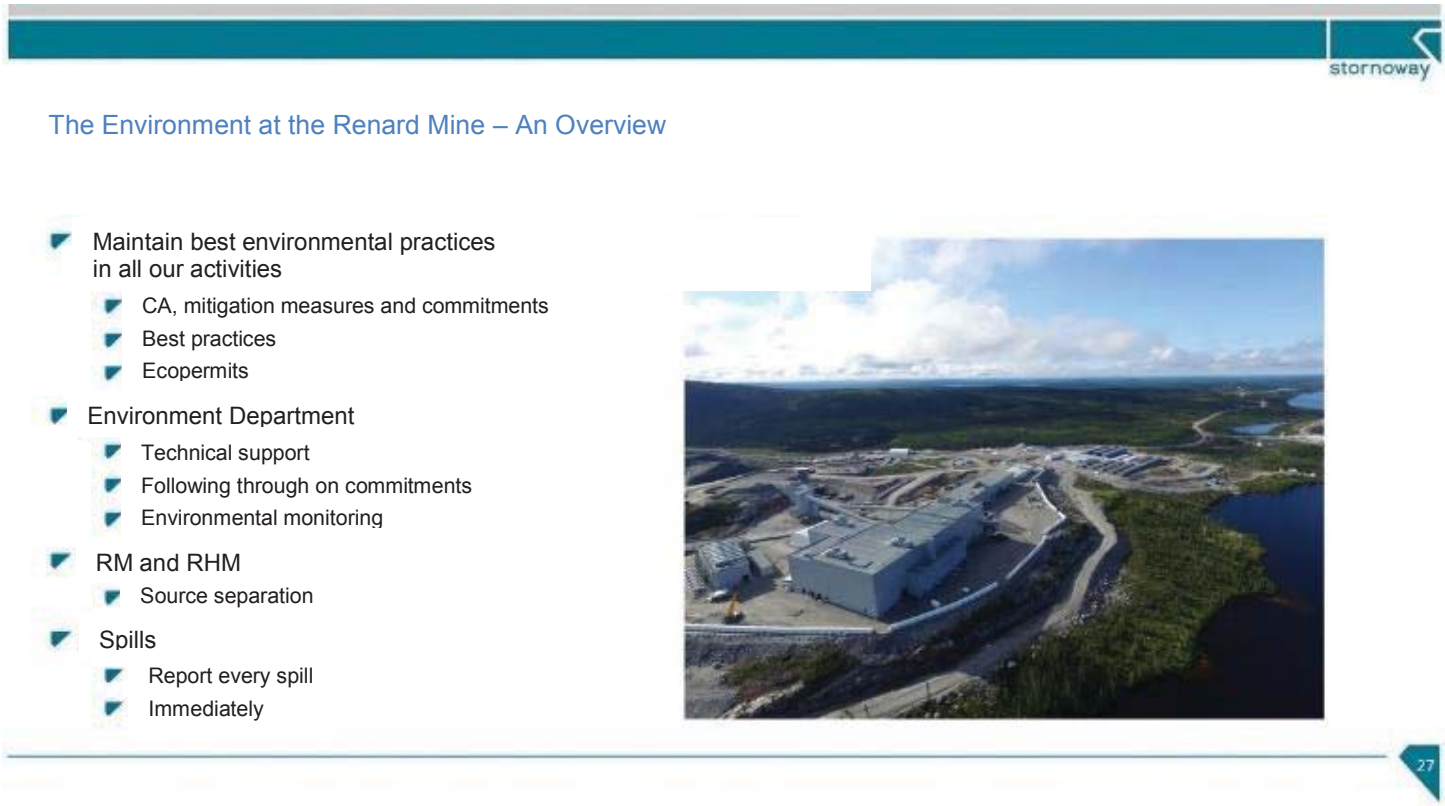



**Figure 4.1 Extract from Environment home page**

# 5 Internal/External Audits

Daily site and workplace inspections are undertaken to ensure compliance with mitigation and control measures and the equipment is in good working order.

Observations from the environmental surveillance program have been recorded in a computer program (IsoVision) since the start of operations at the mine site. Monitoring is carried out to ensure any non-compliant element is immediately addressed.

Figure 5.1 provides a summary of measures carried out by the Environment Department since 2015. A total of 179 planned inspections were performed in 2017. Of these, 44 were compliant and 62 were carried out with a view to putting prevention measures in place. It is therefore clear that environmental management at the mine site is oriented more toward prevention than corrective actions.

Stornoway has always been open to collaborating with others to maintain and share the highest environmental standards. In this regard, a number of inspections were conducted at the Renard mine site. They are shown in chronological order in Table 5.1.

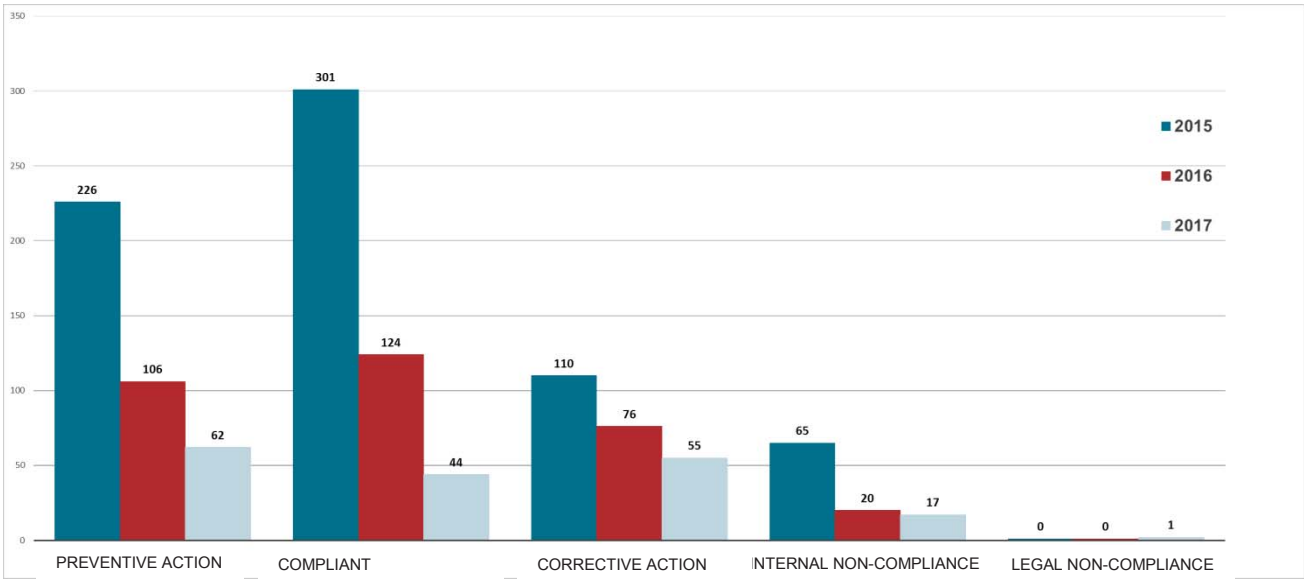



**Figure 5.1 Summary of measures applied by the Environment Department since 2015**

**Table 5.1 Inspections and visits at Renard mine site in 2017**

| Date | Entity | Reason for Visit |
|---|---|---|
| July 6 2017 | Goldcorp mine environmental committee | Collaboration between Renard mine and Éléonore environment committees.<br>Tour of mine site facilities. |
| September 12 to 14, 2017 | MDDELCC | Control inspection:<br>◗ Drinking water treatment plant (DWTP)<br>◗ Mechanical workshop<br>▪ Washbay (WWTS)<br>▪ Oil storage<br>▪ Hydrocarbon separator<br>◗ Planned concrete plant (dome at the mine portal)<br>◗ Power plant<br>◗ Ventilation stack – Compressor and condensate management<br>◗ LNG storage facility, boilers and condensate management<br>◗ Domestic wastewater treatment plant (DWTP)<br>◗ Trench landfill (TLS)<br>◗ Sand pit restoration work<br>◗ Wood bridge and abutment at km 632 – river<br>◗ Former camp site at km 640<br>◗ MPKC – pits – stockpiles<br>◗ R65 pit and dredging<br>◗ Geotube plant<br>◗ Mine wastewater treatment plant (MWTP)<br>◗ Storage of residual and hazardous materials<br>◗ Restoration of former exploration camp<br>◗ Site closure meeting. |
| September 18 and 19, 2017 | MERN | Report on lease compliance. |
| October 24, 2017 | COMEX | Report on relationship with Aboriginal communities and tour of mine site facilities. |
| October 17 to 19, 2017 | Golder | MPKC audit |

# 6 Progressive Restoration

In compliance with commitments made as part of the Restoration Plan for the mine exploration site, SWY initiated rehabilitation work in 2015 on land previously used for exploration and geotechnical drilling work.

To monitor contaminated soil removal work, Phase I and Phase II environmental site assessments were first conducted in 2012 and 2015 by an independent consultant. These assessments helped identify potential sources of contamination that could have impacted various sectors on the property where mining exploration activities took place. They also helped determine the environmental quality of soil and groundwater at the site of previously determined potential contamination sources.

In 2018, the Lagopede dome will be dismantled, and the former mechanical dome will subsequently be dismantled. Decontamination work will then be undertaken in the Lagopede camp sector on the basis of the 2015 Phase I and Phase II reports.

Soil sampling shall be undertaken in compliance with the instructions in Booklet 5 “Soil Sampling” of the Sampling Guide for Environmental Analysis” (MDDEP, 2008) published by the Centre d’expertise en analyse environnementale du Québec (CEAEQ).

Based on the first phase of monitoring of plant regrowth in areas restored in 2015-2016, a number of black spruce (2,000) and alder (100) seedlings were planted over about 18,000 m² near the MWTP facilities. To accelerate plant growth and provide food for animals on the shores of Lake Lagopede, Indigo Graminord seed mix was spread over about 1,000 m². In 2018, there are plans to plant about 12,000 seedlings as part of remedial measures or to revegetate borrow pits along Route 167N.

The closure of borrow pits means that each of the sites where surface mineral substances (SMS) was extracted need to be completely restored, and plant regrowth monitored as required by the Regulation respecting Pits and Quarries. The restoration work or natural regeneration involves stablizing the slopes by reducing the inclines on the perimeter of the borrow pits, spreading soil across the impacted area and replanting the area with native species

A majority of the borrow pits were shut down in 2014 upon completion of the road construction work. Some sections of the borrow pits (D-150, D-161, D-176, D-186, D-207 leases), which have remained in operation for road maintenance purposes, are currently in the process of being shut down.

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. Applying topsoil and planting native species help promote renaturalization of the sites, as illustrated in photos 6.1 and 6.2, which show plant regrowth after just one year. Corrective measures will be applied in the event of unsatisfactory restoration. Generally, it takes three growing seasons to assess the quality of plant growth. SWY will monitor the quality of plantn regrowth, and will continue the monitoring of these sites until the MDDELCC specifies that the restoration of the borrow pits is satisfactory and meets the quality requirements for the company to be released from the lease on the land in the domain of the State.

SWY operates six borrow pits entailing 16 non-exclusive leases for the maintenance of Route 167 and the roads and pads developed on the mine site.

In 2017, a total of 480 m³ of sand and gravel was extracted for winter road maintenance and 38 $m^3$ for mine requirements. The quantities of surface mineral substances are reported to the MERN every year after March 31.

**Photo 6.1 Successfully restored borrow pit – Summer 2016 monitoring**

**Photo 6.2 Successfully restored borrow pit – Summer 2017 monitoring**

# 7 Environmental Incident Management

SWY is committed to respecting and protecting the environment in which the mine was established.

The first step in environmental incident management involves actions at source. In addition to mitigation measures set out in ecopermits, environmental risks have been taken into consideration as of the design phase.

Fuel depots were designed to be safe and prevent leaks and spills into the environment. Fuel tanks (diesel, gas, etc) are all double walled and a fire protection system is in place with hydrants installed on the perimeter of fuel depots.

The site has an ultra modern fuelling station that is equipped with an electronic identification card and a leak detection and recovery system with built-in level control.

In the event of an environmental incident, SWY has an obligation to protect the environment by immediately containing and recovering contaminants.

As specified in sections 8 and 9 of the Regulation respecting Hazardous Materials (Q-2,r.32 of the Environment Quality Act), SWY is legally obligated to report any spills directly to the environmental emergency line Urgence-Environnement (MDDELCC), and to recover contaminated soil and dispose of contaminated material at an authorized site. An incident report is prepared and logged for each event and corrective measures are required to prevent a recurrence of the incidents.

To ensure compliance with these commitments, and applicable laws and regulations, SWY has put an accidental spill clean-up procedure in place. In 2017, information sessions were held by the Environment Department for workers in every department. Everyone is required to apply the procedure rigorously in the event of a spill. Figure 7.1 provides a summary of spills that have occurred since the construction phase (2015) to the first year of operation (2017). In 2017, the number of incidents (153) was slightly higher than in 2016 (114), but in the same order of magnitude as in 2015 (163).

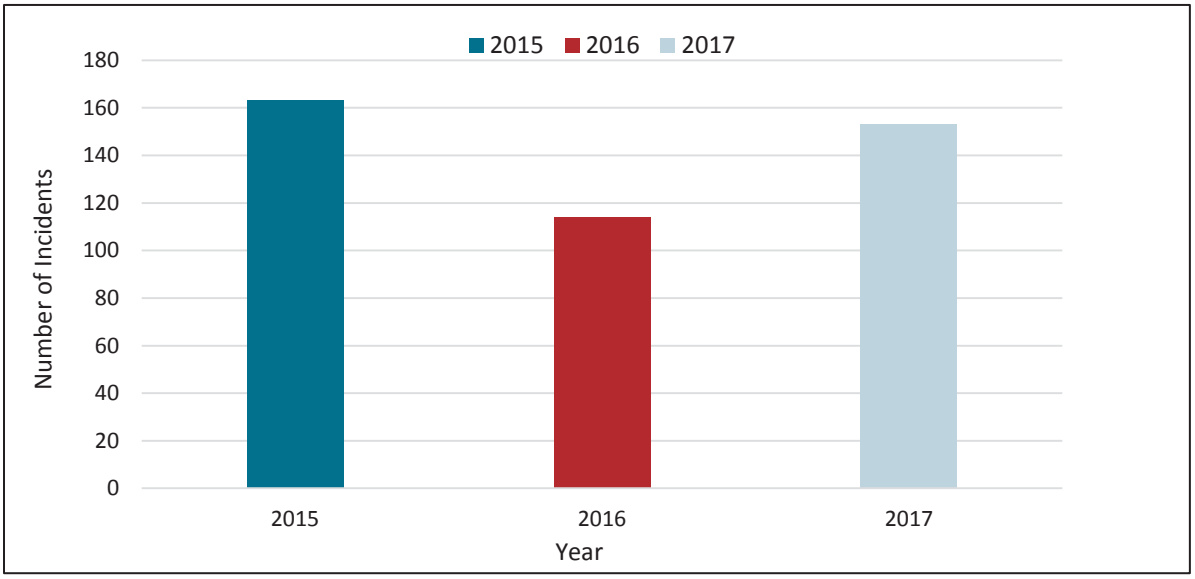



**Figure 7.1 Environmental incidents (including near misses)**

In 2017, the Environment Department reported 149 spills (excluding near misses); however, 77% of these spills involved volumes of less than 20 litres, and only 5% were as high as 100 litres (Figure 7.2).

The main cause of the spills was mechanical failure (Figure 7.3). Statistics in fact show that about 73% of the spills in 2017 were caused by mechanical failure, while 27% were caused by human error. Human error includes but is not limited to improper use of replacement parts and poor handling techniques, which were in fact the primary cause of spills of more than 100 litres in 2017. Henceforth, any environmental incident for which the main cause is identified as human error will be subject to a comprehensive investigation of the fundamental cause after which appropriate preventive and corrective measures will be put in place. To reduce the risk of mechanical failure, a preventive maintenance program is put in place based on hours of use for each piece of equipment. Nonetheless, the extreme James Bay climate and the heavy mining work often mean that mechanical failures are par for the course in mining operations.

Contaminated soil that is recovered following a spill is transported to either the RSI Environnement treatment centre in Saint-Ambroise or the Chibougamau municipal treatment centre depending on the soil particle size and contaminant concentrations. The Saint-Ambroise centre treats all types of soils and concentrations, whereas the Chiboubamau centre is more restrictive.

To reduce response time in the event of a spill on the mine property, spill recovery and containment kits were placed in strategic locations at the mine 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.

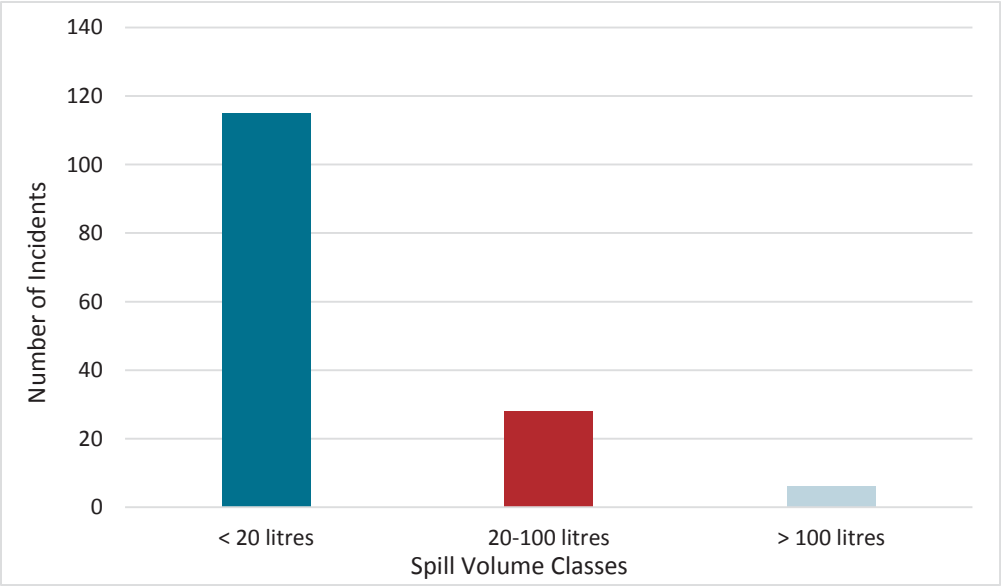



**Figure 7.2 Number of environmental incidents by volume class in 2017**

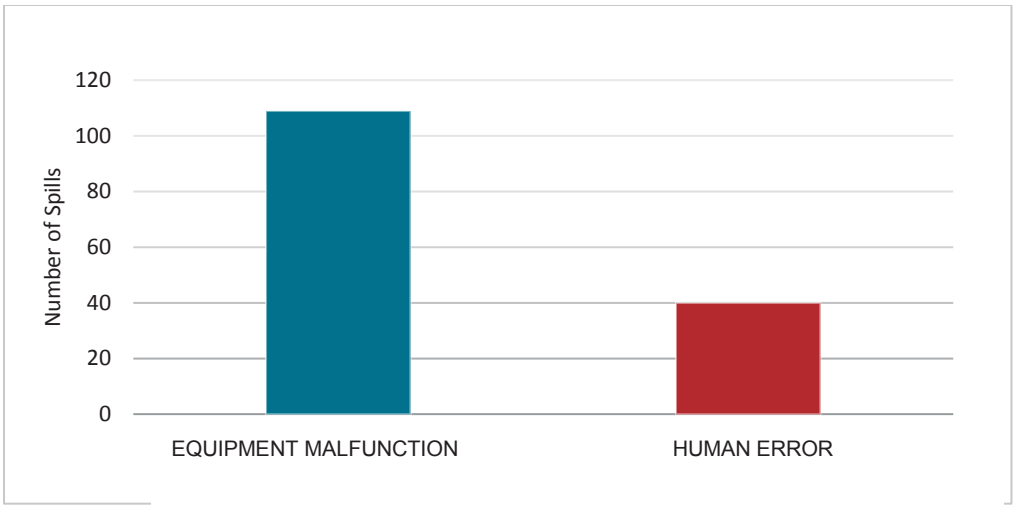



**Figure 7.3 Breakdown of environmental incidents by causal factor in 2017**


**Photo 7.1 Environmental emergency unit**

# 8 Social Monitoring Program

## 8.1 Scope of Social Monitoring

As specified in the Environmental and Social Monitoring Program submitted to government authorities in July 2015, this monitoring concerns the social component in the construction and implementation phase of the project, i.e., from July 2014 to the end of 2017. The process involves the Crees from the Mistissini community (including trapline M11 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 then amended in line with changes to the project. In addition to conditions specified in the CA, the Social Monitoring Program included Stornoway's commitments set out in the Environmental and Social Impact Assessment (ESIA) for the Renard diamond mine project (Roche, December 2011), 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 Mecheshoo Agreement in March 2012 (Stornoway, Cree Nation of Mistissini and the Cree Nation Government (GCC) and the Partnership Declaration signed in July 2012 (Stornoway, Chibougamau and Chapais).

The monitoirng covers:

- Recruiting, including job types and numbers;
- Cree worker integration;
- Land use by M11 trapline users (including conditions governing the Cree use of Lake Lagopede natural resources);
- Local and regional economic spinoffs (including goods and services contracts awarded to local companies).

The report also provides a snapshot of the communications plan put in place for 2017.

**Photo 8.1 Rodney Petawabano – pit foreman**

## 8.2 Recruiting and 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 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 has made a number of commitments to train Cree individuals and increase their employability. These commitments have been 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 recruiting, 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 moreover 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 cities of Chibougamau and Chapais, and by extension to all James Bay residents, in compliance with the desires expressed by these two communities who are signatories to the July 12 Partnership Declaration.

The objectives of monitoring recruiting, and job types and numbers are as follows:

- Document the distribution of mine employment opportunities to Cree communities, both regionally and elsewhere;
- During construction, operation and closure phases, document the type (job category) and changes in jobs created by the Renard Diamond Project for the Crees of Mistissini (including members of the M11 trapline family), on the one hand, and the Crees from other communities, on the other hand;
- During construction, operation and closure phases document the type (job category) and changes in jobs created by the Renard Diamond Project for the 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 members of the M11 trapline family in the various environmental monitoring activities;
- Validate the employment objectives achieved among the Cree in construction (short term), and operations (long term), as specified by the Renard Committee (Mecheshoo Agreement);
- Document the effectiveness of recruiting 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 corrective measures.

Indicators used in this monitoring are shown in Table 8.1.

***DISSEMINATION OF MONITORING RESULTS***

Under the Mecheshoo Agreement, relevant documents are submitted and presented to the Renard project Training & 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 (December 4, 2012), the results of monitoring recruiting, job types and numbers will also be distributed to 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 Recruiting

### 8.2.2.1 Recruiting activities and information

In 2017, Stornoway organized or participated in a number of regional job information and recruiting sessions:

- **May 4, 2017** – Recruiting Day in Rouyn-Noranda;
- **May 5, 2017** – Recruiting Day in Val d'Or;
- **May 10, 2017** – Northern Quebec Jobs and Training Day in Chibougamau;
- **May 30, 2017** – Annual Open House in Mistissini;
- **May 31, 2017** – Career Day in Waswanipi;
- **June 1, 2017** – Recruiting Day in Ouje-Bougoumou;
- **August 15, 2017** – Recruiting Day in Chisasibi;
- **August 16, 2017** – Recruiting Day in Wemindji;
- **August 17, 2017** – Recruiting Day in Waskaganish;
- **October 1, 2017** – Launch of new Stornoway office in Mistissini;
- **November 8 and 9, 2017** - Regional Career Fair in Waswanipi;
- **November 8, 2017** – Recruiting Day in Timmins;
- **November 9, 2017** – Recruiting Day in Rouyn-Noranda.

These information and recruiting events considerably enhanced the visibility of the Renard mine and helped promote job opportunities at the mine.

Recruiting continued to represent a concern, particularly among candidates from Cree communities. Some candidates, for example, had difficulty producing an updated, complete CV in support of their application, or completing the necessary forms in time to fill the position at the mine. Even though in many cases candidates had the appropriate qualifications and were clearly interested, these administrative procedures represented a challenge. A number of candidates also withdrew their application during the hiring process. These issues have however become less of a concern with the appointment of Minnie Coonishish, as Agreement Implementation Officer and manager of the Mistissini office, and the considerable support she is providing Cree candidates and the human resources team. In addition, Charlie Awashish's involvement as Integration and Diversity Officer at the mine site is providing definite support, as is the invaluable collaboration of CHRD employment officers. These issues are of concern for Stornoway and the company continues to work with the Mistissini Training & Employment Committee on finding solutions and improving the processes.

**Table 8.1 Indicators selected for monitoring recruiting as well as job types and numbers**

| Topics | Potential Indicators | Comments |
|---|---|---|
| **Training and recruiting** | Number of outreach and information activities | *Concerns activities to disseminate information to Crees regarding employment opportunities* |
| | Types of programs put in place and their success rate | |
| | Funding provided by the company and the Cree for training | *If approval to publish these numbers is granted by both parties* |
| | Projects implemented through the M*istissini/Renard* Joint Training Fund | *Number, types and results of projects* |
| | Types of participants | *Could also include a demographic and social characterization of Cree participants (see similar studies for specific indicators); should also distinguish members of the M11 trapline family from other members of the Cree Nation of Mistissini* |
| | Compliance with *Mecheshoo Agreement* terms and commitments | *Should consider commitments made by both Stornoway and Cree signatories* |
| **Employment** | Relative proportion of jobs for Crees (Mistissini, Eeyou Istchee) and Non-Crees / total | *Refers to the short- and long-term commitments arising from Mecheshoo Agreement.*<br>*This activity is also designed to distinguish:*<br>*a) members of the M11 trapline family, other members of the Cree Nation of Mistissini and those from other Cree communities;*<br>*b) residents of Chibougamau and Chapais, Jamesians and other residents of the province* |
| | Type, nature and duration of employment | *Including turnover rate* |
| | Sociodemographic profile of workers (men/women) | |
| | Compliance with the Mecheshoo Agreement terms and conditions | *Expected to include hiring order for Cree candidates with equal skills, employment targets, etc.* |
| **Integration, advancement and retention** | Measures implemented to promote integration, advancement and retention of Cree personnel | *Only for operations phase* |
| | Ongoing training programs developed by the company | *Nature and number of programs* |

#### 8.2.2.2 Recruiting details

***MAY 4 AND 5, 2017 – RECRUITING DAYS IN ROUYN-NORANDA AND VAL D'OR***

On May 4 and 5, 2017, Stornoway held recruiting sessions in Rouyn-Noranda and Val d'Or in Abitibi.


**Photo 8.2 Recruiting Day in Rouyn-Noranda (May 4, 2017)**

**Photo 8.3 Recruiting Day in Val d'Or (May 5, 2017)**

***NORTHERN QUEBEC EMPLOYMENT AND TRAINING DAY IN CHIBOUGAMAU (MAY 10, 2017)***

The Stornoway team took part in the Northern Quebec Employment and Training Day that was organized by the James Bay Centre de formation professionnelle, Chibougamau Centre d'études collégiales, Business and Community Services, Emploi-Québec, Attraction Nord, the Société du Plan Nord, and the Chibougamau-Chapais Chamber of Commerce, and was held at the Chibougamau arena. Stornoway's booth received a fair amount of traffic with openings in a number of departments, including the open-pit mine, underground mine, maintenance shop and plant. A few hundred individuals attended the event and stopped by the booth for information or to submit their CV.


**Photo 8.4 Northern Quebec Employment and Training Day in Chibougamau (May 10, 2017)**

***2017 OPEN HOUSE IN MISTISSINI (MAY 30, 2017)***

On May 30, 2017, Stornoway held its sixth annual Open House at the Mistissini Youth Center. The objective of the event was to update information on the Renard mine for stakeholders in the community and address as much as possible the community's questions, expectations and concerns. More than 100 individuals attended the event from 1 to 7 pm, during which a particular emphasis was placed on recruiting. A number of information stations were set up covering various aspects of operations at the Renard mine including mining processes, ore processing, the environment, water management as well as human resources, specifically recruiting. A questions and answers session was held during which expectations and concerns were openly discussed. Then to cap it all off, a traditional Cree meal featuring goose, beaver and moose was prepared and served at the end of the day by Kenny Loon and Charlotte Matawashsish, to the great enjoyment of about 50 of the participants.

Photo 8.5 Mining booth at the Open house in Mistissini

Photo 8.6 Mineral resources at the mining booth

Photo 8.7 Open discusion in Mistissini

Photo 8.8 Traditional lunch in Mistissini


**Photos 8.5 to 8.9 2017 Open House in Mistissini (May 30, 2017)**

### *Career Day in Waswanipi (May 31, 2017)*

A career day, organized by the local CHRD officer, was held on May 31, 2017, at the Waswanipi sports complex. A number of mining companies and regional service suppliers attended the event to promote their companies and recruit regional candidates. About 10 Stornoway employees were on hand to explain job openings at the Renard mine.


Photo 8.10 Stornoway team at Career Day in Waswanipi

**Photos 8.10 to 8.11 Career Day in Waswanipi (May31, 2017)**

### *Recruiting Day in Ouje-Bougoumou (June 1, 2017)*

A recruiting day was held at the Capissisit Hotel in the community of Ouje-Bougoumou on June 1, 2017. About 30 candidates and visitor, including Grand Chief Matthew Coon Come, attended the session. Interviews were held with candidates who had the qualifications for jobs at the Renard mine.


Photo 8.12 Matthew Coon Come at Career Day in Waswanipi

**Photo 8.13 Recruiting Day in Ouje-Bougoumou (June 1, 2017)**

### *Recruiting days in Chisasibi, Wemindji and Waskaganish*

From August 15 to 17, 2017, a team of Stornoway recruiters embarked on a three-day trip to three Cree communities, Chisasibi, Wemindji and Waskaganish, on the James Bay coast. Their objective was to recruit qualified candidates primarily for upcoming openings in the underground mine. About 50 candidates attended the Chisasibi and Waskaganish sessions, and about 25 showed up for the Wemindji session. Preliminary interviews were held with candidates who had the greatest potential for the advertised positions.


**Photo 8.14 Recruiting Day in Chisasibi (August 15)**


**Photo 8.15 Recruiting Day in Wemindji (August 16)**


**Photo 8.16 Recruiting Day in Waskaganish (August 17)**

### *Opening of the new Stornoway office in Mistissini - October 2017*

In October 2017, Stornoway officially opened its new office in Mistissini. It is located on the ground floor of the new Business Centre at 168 Main Street, a central, high profile location in Mistissini. Mecheshoo Agreement Implementation Officer Minnie Coonishish is managing the office, which serves as a hub for information and meetings in the community. One of the office's primary roles is to support the Human Resources Department in recruiting local Cree candidates. Minnie Coonishish is actively involved approaching candidates with potential for the Renard mine and supporting them through the hiring process. The presence of the Stornoway office in the Mistissini community is a major asset that will help with the recruiting process.


### *Regional Cree Career Fair in Waswanipi (November 8 and 9, 2017)*

On November 8 and 9, 2017, the 10th annual Regional Cree Career Fair was held at the Waswanipi sports centre. The Stornoway team was represented by Minnie Coonishish and Charlie Awashish. The Career Fair was a great success, and we extend our congratulations to the organizer's, the CHRD team, as well as the Waswanipi representatives.

**Photo 8.17 Regional Cree Career Fair 2017 in Waswanipi (November 8 and 9, 2017rhwe )**

***Stornoway's presence at various conferences, such as the Québec Mine, Explore and PDAC conferences, are other activities that have helped the company recruit interesting candidates.***

Stornoway also makes use of local and regional print media and radio to announce job openings, in addition to advertising openings on job search sites and social media such as Facebook and LinkedIn. Stornoway also relies on its partners including the CHRD, Emploi-Québec, the Comité sectoriel de main-d'œuvre mines (CSMO Mines), the various committees associated with agreements, and its own employees, to get the word out on job openings.

Finally, Hélène Robitaille communicates these openings through her presence on various boards and committees as:

- the representive of the regional mining sector on the Regional Labour Market Board (appointed by the Minister of Employment and Social Solidarity);
- the chair of the Table jamésienne de concertation minière for the past five years;
- a member of other mining-related boards and consulting committees.

***Results of recruiting activities***

Recruiting in 2017 made a considerable impact on hiring. Although a number of workers left in 2017, Stornoway brought 213 new employees on board, increasing the total number of employees on the team to 429, as at January 1, and to 505 as at December 31, 2017, including the Vancouver, Toronto, Chibougamau and Longueuil offices. Working with passion, respect and integrity, they are contributing to everyone's prosperity.

Stornoway applies hiring best practices including an onboarding step enabling new employees an opportunity to acquire the knowledge, skills and behaviours needed to become effective and engaged members of the organization. Company rules set out in the Human Resources Management Manual are also explained during the onboarding process.

### 8.2.3 Employment

In 2017, Stornoway had 505 active employees, including 437 at the Renard mine, 13% of which were from Cree communities and 26% from Chibougamau and Chapais.The project provided these individuals with different cultural backgrounds and work experience an opportunity to work together toward the same goal, namely the success of the project. The Human Resources and mine management teams worked closely together on developing and implementing policies and procedures aimed at ensuring that all employees work efficiently, in an environment that is healthy, safe and fair for everyone.

**Photo 8.18 Hélène Robitaille, Director, Human Resources and Talent Development**

One of the five values we live by at Stornoway is team work. We believe that our people are our strength. And we strive to be an exemplary employer, one who:

- sustains fair relationships;
- sets up and promotes stakeholder committees;
- communicates proactively and transparently;
- promotes the development of skills and aptitudes.

We focus on recruiting talented individuals with the top potential in the industry. In addition we are committed to hiring and developing members from our host communities, namely the Cree, Chapais and Chibougamau communities.

We are proud of the fact that our local and national stakeholders see Stornoway as a company that seized the incredible opportunity to develop a diamond mine using the wealth of experience its employees from different cultures and backgrounds have brought to the table. Our efforts to build on this, continue on a daily basis and are central to our approach to managing work teams.

As at December 31, 2017, 505 Stornoway employees were working at different sites and offices, in Longueil (head office), Toronto, Vancouver, Chibougamau, Misstissini and of course the Renard mine. By the end of 2018, the Stornoway team is expected to include close to 600 employees, with the addition of about 80 kitchen and janitorial employees to the team built by our supplier, Kiskinshiish Camp Services, most of whom are from the Cree Mistissini community.

Some 76 new positions that have been filled were mainly positions in the underground mine, which started production in 2017, along with maintenance and plant

operator positions. In addition, other openings resulting from worker turnover were also filled during the course of the year.

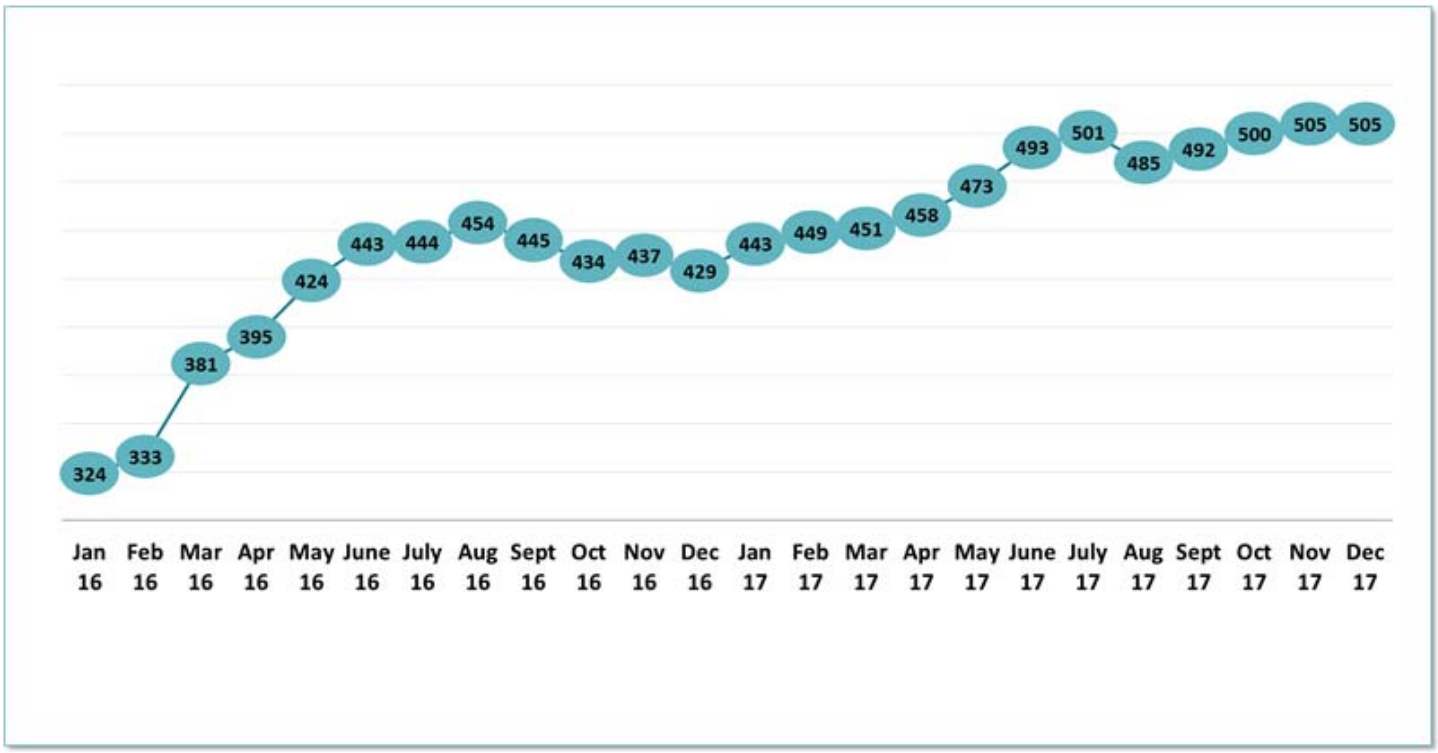




**Figure 8.1 Deployment of workforce for Renard project from January 2016 to December 2017**

*TOTAL STORNOWAY WORKFORCE*

**Table 8.2 Distribution of active workforce as at December 31, 2017**

| Active Workforce as at December 31, 2017 | Number of Employees | Cree (%) | Chibougamau / Chapais (%) |
|---|---|---|---|
| **Development Team – Head Office and Regional Office** | | | |
| Operations | 43 | 2.33% | **13.95% (6)** |
| Projects and development | 4 | 0.00% | 0.00% |
| **TOTAL** | **47** | **2.13%** | **12.77%** |
| **Renard mine site** | | | |
| **Operations** | **437** | **12.13% (53)** | **26.09% (114)** |
| Construction | 7 | 0.00% | 0.00% |
| **TOTAL** | **444** | 11.94% | 25.68% |
| **Corporate - North Vancouver** | 7 | - | - |
| **Corporate - Toronto** | 7 | - | - |
| **GRAND TOTAL** | **505** | **54** | **120** |

As regards to the the number of personnel involved in Stornoway operations and working at the Renard mine site by the end of 2017, there were a total of 437 employees, including 53 Cree employees most of whom were from Mistissini. Operations personnel also included 114 residents from Chapais and Chibougamau, for a total of 167, plus 17 employees from other James Bay communities, which amounts to a total of 40% from the Eeyou Istchee-James Bay region. Stornoway is operating Quebec's first diamond mine with support from the host communities of Mistissini, Chibougamau and Chapais and that is the reason we continue to prioritize regional hiring. In addition to employees from our host communities, we have workers from throughout Quebec, but primarily from the Abitibi-Témiscamingue, Saguenay-Lac-Saint-Jean, Montreal and Quebec City regions. The table below shows the place of origin of Renard mine employees as at December 31, 2017.

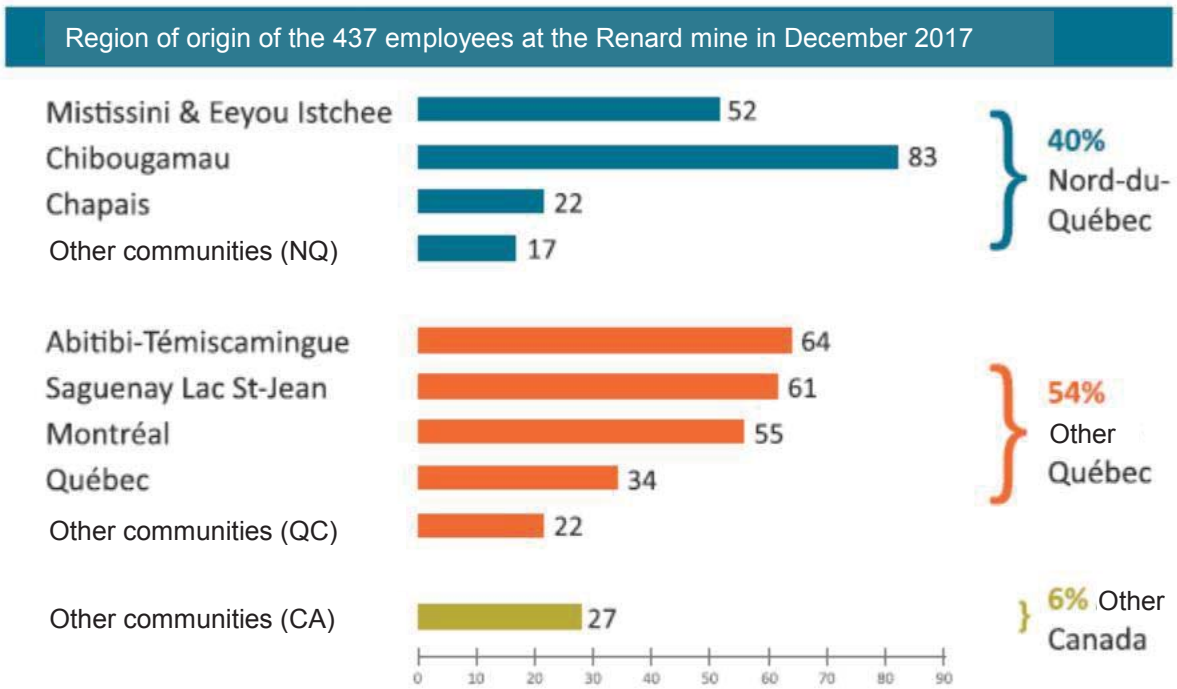



**Figure 8.2 Place of origin of 437 operating employees at Renard mine as at December 31, 2017**

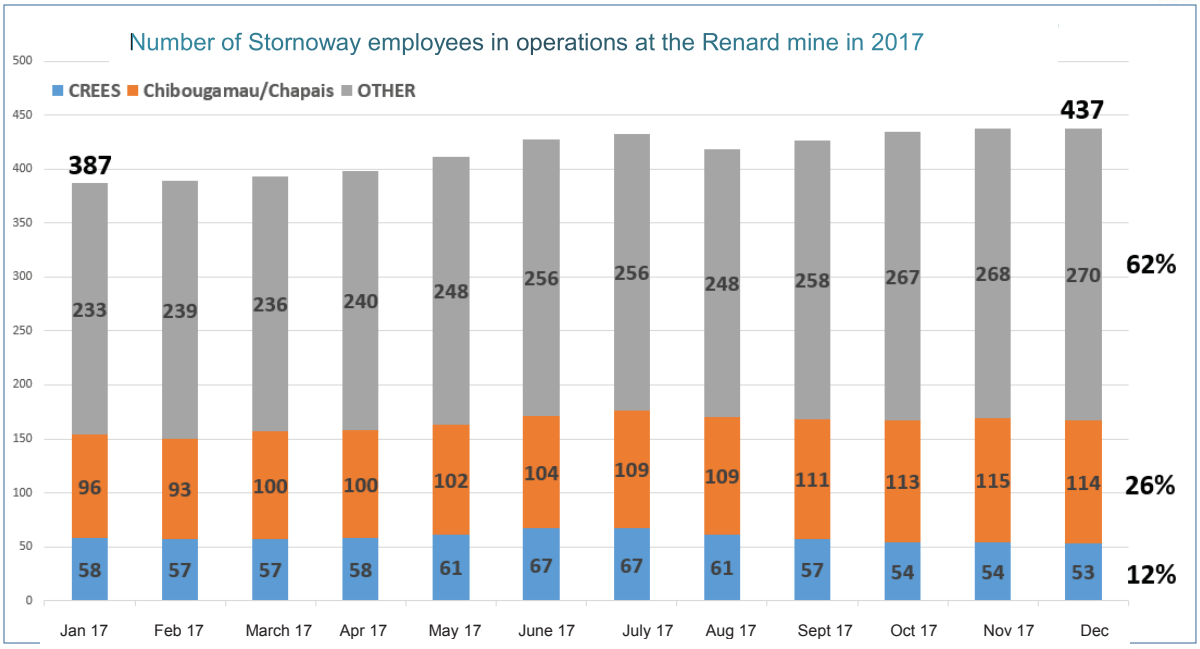



**Figure 8.3 Number of Stornoway employees in Renard mine operations**

As of July 2014, Stornoway faced two major challenges. Although the financial package was in place, the Renard mine as well as the company had to be built. From 40 employees in June 2014, Stornoway gradually increased in size and three and a half years later, by December 2017, it had 505 employees. With staff turnover and retirements, common issues of varying degrees in the Quebec mining industry, the company had to make a concerted effort to hire talented individuals who shared Stornoway's values and to adapt to the expectations and fluctuations in the Canadian mining industry labour pool.

In 2017, the Cree apprentice integration program for the processing plant was put in place. Under the program, seasoned workers are twinned with rookies, Aboriginal workers with non-Aboriginal workers, and Anglophone workers with Francophone workers. The program provides many Cree candidates with an opportunity to become part of the Stornoway team without necessarily having any technical experience in the field. As a result of this program, the processing plant was able from the outset to integrate a number of Cree apprentices who developed their skills and knowledge and now hold coveted positions such as diamond sorter, recovery operator and Large Diamond Recovery (LDR) operator. By the end of 2017, pit operators were being transferred to underground mine operations, including several Cree operators who expressed interest in being transfered. Employees were given a trial period to determine whether working underground suited them. And if not, they were allowed to return to their previous positions.


**Figure 8.4 Distribution of hiring by department in 2017**

In 2017, ten Cree employees in four departments were promoted to key positions. Most started working for the mine as apprentices or newbies. Seven transfers were made, including two to 60-tonne AD truck operator positions underground.

The Human Resources Department, under the responsibility of Hélène Robitaille, worked all out to support this growth. This was achieved in compliance with the commitments made with the Cree under the

Mecheshoo Agreement and with Chibougamau and Chapais as part of the Partnership Agreement. The implementation and adaptation of human resources management policies and procedures, along with everyday efforts to maintain harmonious working relationships made 2017 a resounding success in terms of Stornoway's human resources and talent development objectives. Stornoway is extremely proud of the efforts made to honour the commitments it made with its regional stakeholders and the company remains determined to sustain these efforts in the years to come.

Cultural diversity is part of Stornoway's corporate identity. We have employees from around the world. We have skilled people from more than 30 different countries in Europe, Africa, Asia, Latin America and of course from our home country. Multiculturalism is an asset we need to cultivate as a source of communication, innovation and creativity.

### *EMPLOYEE RETENTION ISSUE*

Employee retention was a major challenge in 2017, especially for employees based in host communities. The Renard mine successfully pursued its local hiring approach in 2017. A total of 58 new employees from Chibougamau, Chapais and Mistissini joined the Renard mine team. But during that same period 53 individuals from these same communities left the company. The 2017 company-wide turnover rate was very high in comparison with previous years and was about 20%, double the Canadian industry rate. This situation is a huge concern for Stornoway.

There are obviously many reasons for the departures; however, the vast majority of departures in 2017 were attributable to employees leaving for other jobs, either with other mining companies (Bloom Lake, Nemaska Lithium, Eleonore, other mines in Abitibi-Témiscamingue whose projects are located near urban centres, etc), or for jobs in Cree communities. Family reasons connected with work schedules were another reason given for the departures. Also, Cree employees leaving to take a job with a Cree contractor is part of the realities of the job market in the area. Crees who work for a Cree contractor benefit from a tax exemption owing to their Aboriginal status, something Stornoway cannot offer under Canadian and Quebec tax laws. In addition a few employees retired and some employees were terminated for cause. In the case of terminations in 2017, Stornoway put a re-hiring policy in place under which an employee who had been terminated could, depending on then seriousness of the grounds for dismissal, re-apply for a position at the mine.

To address the turnover rate, which is of considerable concern for Stornoway, additional measures will be deployed in 2018 to try and deal with the issue, which is hitting the entire mining industry hard.

### *RELOCATION POLICY*

In 2017, Stornoway applied and promoted its relocation policy under which employees who relocate to Chapais or Chibougamau are offered financial incentives. Moving expenses up to $10,000 are reimbursed and a bonus of 15% of base salary is paid to the employee. The objective of this policy is to attract new residents to the region and retain the mining workforce, which is generally easier to accomplish with people who live locally. This policy clearly benefits the host communities of Chapais and Chibougamau, in addition to meeting Stornoway's requirements. In 2017, one Stornoway employee applied for the program. Stornoway has made a commitment to its stakeholders to promote the relocation policy among existing and new employees.


**Figure 8.5 Stornoway relocation policy**

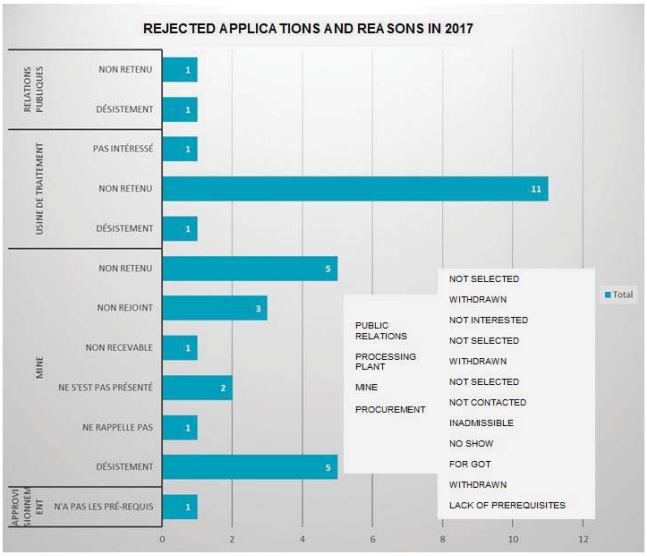



**Figure 8.6 Results of Cree recruiting activities between January and December 2017**

## 8.3 Cree Worker Integration

### 8.3.1 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]) have drawn attention to the challenges associated with integrating Aboriginal workers in the working environment. Aboriginal 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 Cree employees continue working for as long as possible for the company, and that they enjoy the same benefits of advancement as all 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."

The specific objectives of monitoring the integration of Cree workers are to:

- Document Cree workers' experience at the mine;
- Measure the effectiveness of measures applied by the company (e.g., annual leave during goose and moose break periods) to ease their integration into the workforce at the Renard mine project;
- Identify determining factors for the results (successes or failures) and any corrective measures applied, when required;
- Compare the monitoring results with those on other projects to draw useful lessons for the Cree and the mining industry.

The indicators selected for monitoring Cree worker integration are outlined in Table 8.3.

**Table 8.3 Indicators for monitoring Cree worker integration**

| Topic | Potential Indicators |
|---|---|
| Adaptation to work schedule | To be determined |
| Integration of Cree workers | Number of employees enrolled in French or English language courses |
| | Visits to Cree Cultural Centre built by Stornoway to promote the practice of employees' traditional cultural activities |
| | Annual number of recreational, social, cultural and sports activities organized at the mine enabling workers to socialize outside of work |
| | Success rate of system in place enabling workers to submit special requests with regard to their beliefs and their traditional cultural practices |
| | Level of satisfaction vis-à-vis worker transportation system |
| | Level of satisfaction vis-à-vis the system in place to enable workers to return home in the event of extenuating circumstances (e.g., a death or birth) |
| | Level of satisfaction vis-à-vis provisions in place to encourage employees to vote in local and regional elections (including referendums) |
| | Percentage of employees using high speed internet connection available in employee housing |
| | Frequency of use of long-distance telephone service available in employee housing |
| | Level of satisfaction vis-à-vis Cree cultural day organized every year for all workers |
| | Number (or %) of employees who read the information distributed to raise cultural awareness and who took part in cultural awareness activities |

***DISTRIBUTION OF MONITORING RESULTS***

In compliance with the instructions to the proponent set out in Condition 5.3 of the Global CA (December 4, 2012), the results of worker integration monitoring will be distributed to project stakeholders.

Under the *Mecheshoo Agreement*, relevant documents will be submitted and presented to the Training and Employment Committee.

Local and regional Cree organizations whose objectives are to promote local (Mistissini) and regional (Eeyou Istchee) employment will also be informed of the monitoring results.

### 8.3.2 Adapting to work schedules

The work schedule for most Renard mine employees is generally two weeks' working followed by two weeks' leave, and travel to the mine is strictly by air from the St-Hubert, Chibougamau, Timmins or Rouyn-Noranda airports (fly-in/fly-out). This work schedule is now quite widespread in the mining industry and seems to be well appreciated by workers.

Comments specifically from Cree workers on the fly in/fly out schedule were generally very positive, given that the schedule gives them time to practise their traditional activities with their family over an extended period of time on their days off. In addition, when employees plan ahead for their vacation they have an even longer time for traditional activities.

However, in 2017, a number of resignations by Cree employees were due to the work schedule. Workers with a young family at home in some cases were compelled to make this difficult decision. This situation nonetheless does apply equally to Cree and non-Cree employees.

### 8.3.3 Cree worker integration

Since January 2017, Charlie Awashish has held the position of Integration and Diversity Officer. He works closely with the main Human Resources and Training managers on integration and integration project monitoring efforts including mentoring programs. He oversees the monitoring of 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 the best knowledge of Cree culture. He is is also required to make general presentations to employees to promote best practices and work with managers to develop initiatives promoting employee training and advancement. As integration and diversity officer, his role is to evaluate minority representation in the organization and to devise a plan to increase the number of employees in these groups. He works with all employees but specifically minorities in the organization to address their concerns and help management resolve integration-related issues and facilitate the integration of minorities, particularly the Cree, within the team.

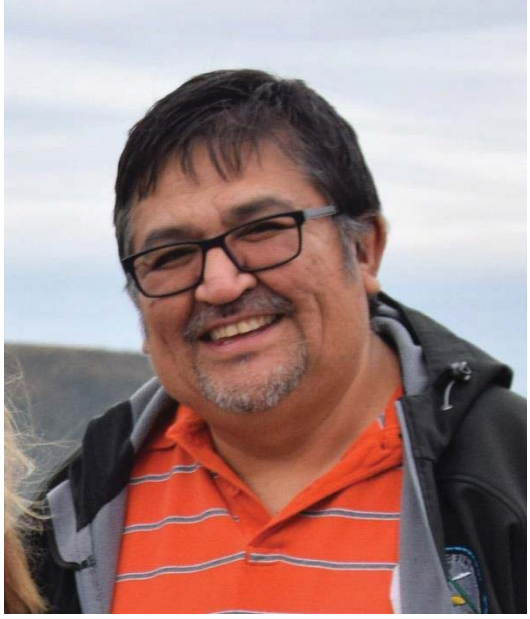


**Photo 8.19 Charlie Awashish – Integration and Diversity Officer**

A Mecheshoo Agreement Implementation Officer is also in place in the Mistissini community to support Stornoway's and its partners' communication efforts with local stakeholders and maximize job-related spinoffs. Freddie Mianscum held this position for two years, and was subsequently replaced by Minnie Coonishish in January 2017. Ms Coonishish is responsible for ensuring smooth operation of Stornoway's Mistissini's office and providing support for the Human Resources Department in Chibougamau.

**Photo 8.20 Minnie Coonishish – Mecheshoo Agreement Implementation Officer**

To promote a culture of integration and diversity, Stornoway was inspired by the history of the Northern Quebec region and took stalk of lessons learned from various other mining companies in the region including the Troilus mine, a prime example of successful Cree workforce integration, which Stornoway intends to emulate.

The Northern Quebec region has supported mining operations for some time and its economy is based on the development of natural resources such as mines, forests and hydroelectricity. The Crees and Jamesians share the territory and have been able to harmoniously combine modern technologies with ancestral practices, making the region a unique place to live.

Over the years, mines in the region have faced workforce recruiting and retention hurdles as well as recurrent fluctuations in metals 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.

In light of this, Stornoway has established structures to promote a culture of integration and diversitiy 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;
- Solidifes 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 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, etc.;

- 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 and entrepreneurship, assuming responsibility, etc.;
- Transfer of mining expertise.

In conclusion, 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.

Testimonial from Leeroy Petawabano

*"It's a privilege for me to be working for this company at Eeyou Istchee's first diamond mine. I started working at the very beginning and I'm planning on staying until the end. I like the Renard camp ambiance, the fact that Aboriginals and non-Aboriginals work together as a team and treat everyone as members of one big family. Stornoway has provided me with opportunities to advance as assistant foreman and I'm doing my best to demonstrate my capacities and share my knowledge with my team."*

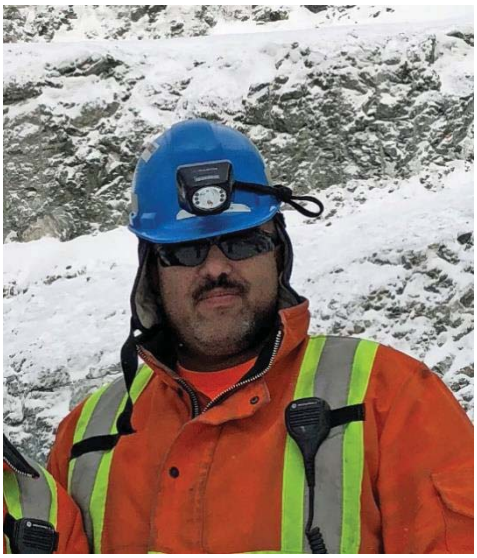


**Photo 8.21** ***Leeroy Petawabano – Assistant Pit Foreman***

Testimonial from Leslie Awashish

A good exampe of integration on the Renard mine team is Leslie Awashish. Leslie, a resident of Mistissini, is a proud, determined worker. He joined the processing plant in July 2017 and works in the lab. As a deaf-mute person, he's overcome his disability to become a fine example of workplace integration and a full-fleged member of the team. His co-workers have made sure that Leslie has access to a safe working environment fully adapted to his needs.

*"I have been very well received by the team and I feel I have everyone's respect. Working at Stornoway is very rewarding and I enjoy it."*

Leslie Awashish, Apprentice Plant Operator.

**Photo 8.22** **Nikamoon Mitchell, Concrete Mixer Operator**

**Photo 8.23** **Training on AD-60 truck**

### 8.3.4 Training

In 2017, 5,739 hours of training were allocated to our Cree employees' professional development in pit functions, the ore processing plant and the underground mine.

These efforts led to 228 certifications and attestations for Cree personnel on various types of equipment used in the open pits, underground mine, the processing plant, and surface and maintenance services. A total of 28 certifications for functions ranging from apprentice plant operator, to recovery operator to AD60 truck or backhoe operator were awarded to Cree personnel along with 208 attestations of successful completionof health and safety related training programs.

The training hours dedicated to Cree personnel resulted in 24 promotions or transfers within the Stornoway team in 2017.

By late 2017, the mining department initiated ongoing underground mining operations, resulting in five pit employees being transferred to underground mining operations, primarily as AD 60 tonne truck, boom truck and loader operators.

Integrating pit operators into the underground mining operations required developing apprenticeship booklets for each underground function within the various employment groups including Services, Mucking, Drilling and Blasting, and Mining. The apprenticeship booklets are the first components required for establishing a continuing education system.

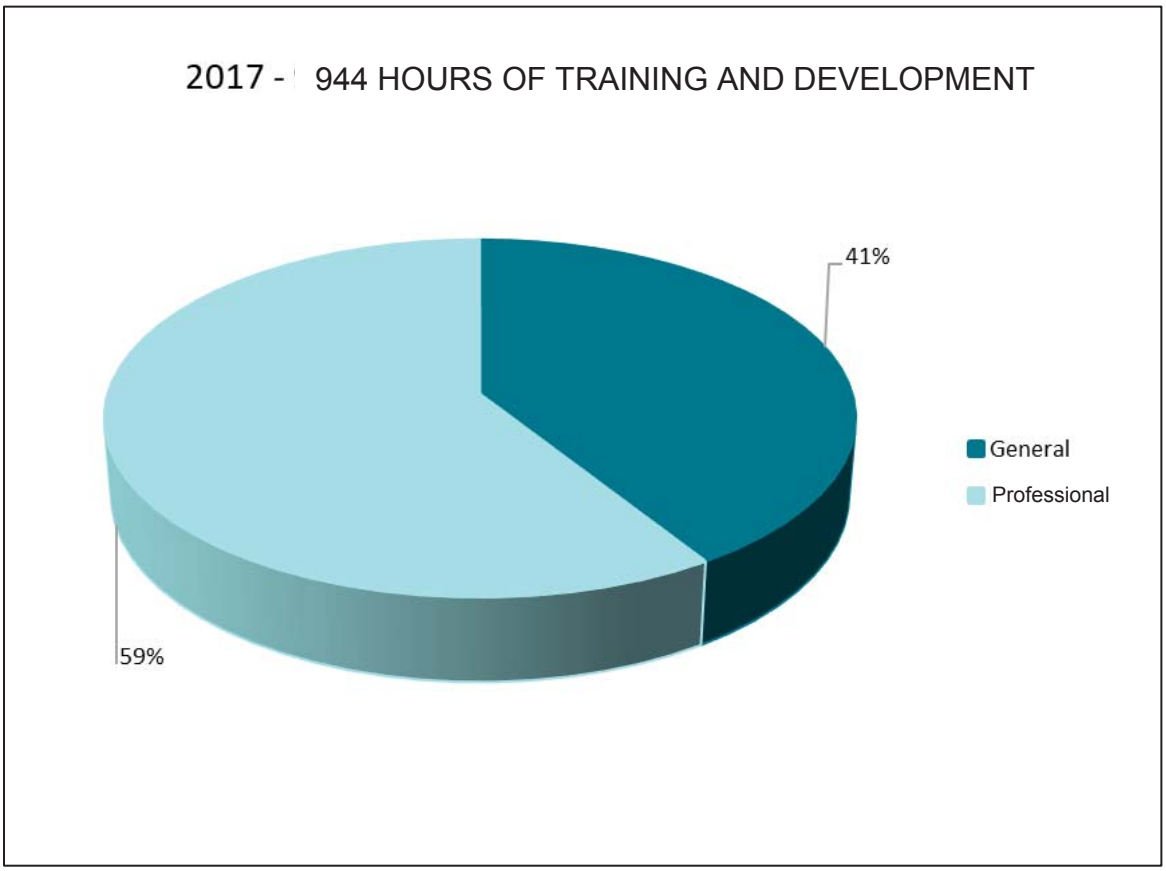



**Figure 8.7 Training deployed in 2017 for Cree employee development – 59% focussed on skills development**

#### 8.3.4.1 Training programs in place and success rate

Stornoway has an employee development strategy in place. The strategy, spearheaded by Director of Organizational Development Diane Marois, sets out guidelines for ensuring the rapid, consistent and fair advancement of employees within their departments.

One of Stornoway's primary objectives is to contribute to the development of employees and help them advance within their departments and become experienced, versatile miners and operators. Enhancing employees' capacities must be accomplished without jeopardizing production objectives and Stornoway has been careful to take this perogative into account in developing the strategy. It has been demonstrated through past experience in mining that workers who become instructors or guides in various industry sectors are better equipped to define the work, and to develop individual or group strategies. They are also better prepared to teach young employees how to manage the many aspects of their future trade. It's clear that having more experienced employees mentor young candidates with little or no experience is a very effective approach.

**Photo 8.24 Solomon Awashish – Recovery Operator in the Red Zone of the plant – A shining example of perseverence.**

Stornoway has therefore put advancement measures in place, an excellent way of promoting a harmonious, multicultural work environment.

***Multidisciplinary integration***

Ranking of skills (individual skills, knowledge and future skills) helps ensure operational profitability and long-term operability.

Stornoway and the Employment and Training 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 an ongoing training system offering a continuous measurement of improvements. The system enables efficient, continuous and sustainable growth of the workforce. The training team is proud of the results achieved to date.

#### 8.3.4.2 Funding allocated by Stornoway and the Crees for training and projects funded under the Mistissini/Renard Joint Training 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 Mistissini Band Council to each invest $200,000 yearly for three years, a joint investment of $1.2 million.

Following this joint commitment, members of the Cree Training and Employment Committee pursued their efforts to obtain additional funding from various institutions. Several millions of dollars were 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 2018, the parties will need to look into the continuation of the program.

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.

#### 8.3.4.3 Recreational, social, cultural and sports activities

At the end of construction, the Stornoway team was able to gradually focus on improving camp life at the Renard mine.

Winter 2016-2017 saw workers at the mine playing hockey, one of their favourite winter activities. A

permanent rink was set up in the mega-dome so that employees could play in winter (ice hockey) and summer (deck hockey). Hockey is very popular among the Cree and many employees at the mine, and it's an activity that brings workers together

In 2017, Stornoway built a trail on the perimeter of the mine site enabling employees to enjoy the outdoors away from the industrial mine site. The three-kilometre loop trail with a trail head at the Cree Cultural Centre runs along a peninsula in Lake Lagopede. The trail is well marked and employees are encouraged to be safe and always go out on the trail with a buddy.

Included among the many other social and sports events organized in 2017 were:

- Christmas party (for each shift);
- National Aboriginal Day;
- Sugaring-off meal;
- Breast cancer fund raiser (pink caps);
- *Minoune* snowmobile team took part 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;
- Canada Day;
- Major investment in fitness room.


**Photo 8.25 Breast cancer fundraising event**

**Photo 8.26 Christmas at Renard Mine**

**Photo 8.27 Walking trail**

**Photo 8.28 Hockey in the megadome**

### *Visits to Cree Cultural Centre*

In the Mecheshoo Agreement, Stornoway committed to building and maintaining a cultural centre on site where employees could store and prepare their traditional foods for personal use as well as traditional activities. The Roderick Swallow Cree Cultural Centre was therefore built in the fall 2015 and is now a place where people gather to share and take part in cultural gatherings and celebrations. The year-round trail built in 2017 with a trail head at the Cree Cultural Centre has moreover increased the Centre's visibility. Kiskinshiish Camp Services employees, most of whom are Cree, are the most frequent visitors to the Centre. They organize traditional meals in the Long House particularly on weekends. The Centre of course also hosts National Aboriginal Day activities every year (see Section 8.4.2.3). In August 2017, the engagement of two members of the Kiskinshiish team, Martin Mianscum and Priscilla Swallow, who work at the Renard mine, was celebrated at the Centre.

**Photo 8.29 Engagement of Martin and Priscilla at the Cree Cultural Centre**

**Photo 8.30 Tipi at the Cree Cultural Centre**

**Photo 8.31 Traditional meal in the Long House**

### *Voting and polling stations*

Under the Mecheshoo Agreement, Stornoway committed to accommodating polling stations at the mine site so that 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.

For the election of the Grand Chief of the Cree held in July 2017, Stornoway housed the scrutineering team and provided an appropriate place for electors to exercise their right to vote.

### *Phone communication and internet access*

Under the Mecheshoo Agreement, Stornoway committed to taking steps to ensure phone calls from the mine camp to Mistissini were local calls. Phones are available in every room in the housing complex, and long-distance calls are free for users.

High-speed internet access is also available free of charge throughout the housing complex. Most of the workers use the internet to communicate with their families and friends via various platforms. Whenever the internet is temporarily down, it is immediately 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 housing complex.

### *Bereavement or other 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, so bereavement leave also applies

in the case of the death of a member of the extended family, as defined in Stornoway's policies.

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.

In 2017, Stornoway was faced with an unusual situation. Everyone at Stornoway was saddened by the death of Harry Gunner. Harry, a Kiskinshiish employee who worked in the kitchen for a number of years, died suddenly in his room at Camp Renard. He was part of the team and everyone appreciated his presence in the cafeteria. With his sunny disposition, kindness and strong work ethic, he contributed to creating a positive working environment at the mine site. To honour his memory, Stornoway kept Harry's room open for weeks after his death so that his friends could congregate there. His family was also invited to the camp a few weeks after his death to gather in the room where he died. These small gestures were greatly appreciated by Harry's friends and co-workers.

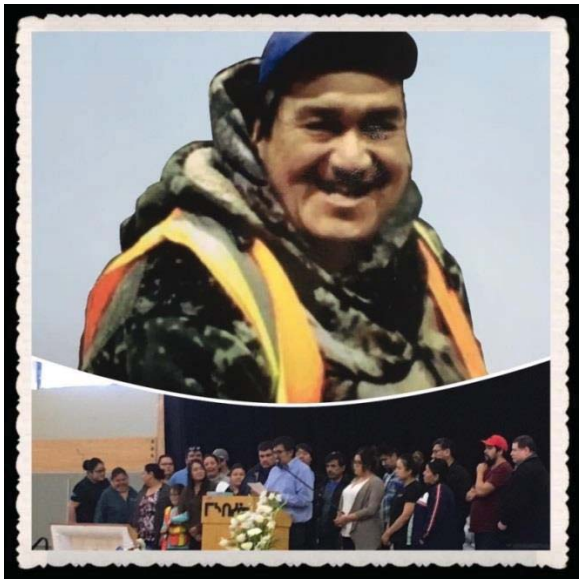


**Photo 8.32 SWY & Kiskinshiish at Harry Gunner's funeral**

Another of our fellow workers, Moreley Rabbitskin of Mistissini, died suddenly in 2017. Morely was a longtime employee of Stornoway who joined the company as a truck driver at the start of mining operations (August 2015). He was respected and beloved by co-workers and well regarded by the company. In a sign of respect, his co-workers had his name printed on his truck.

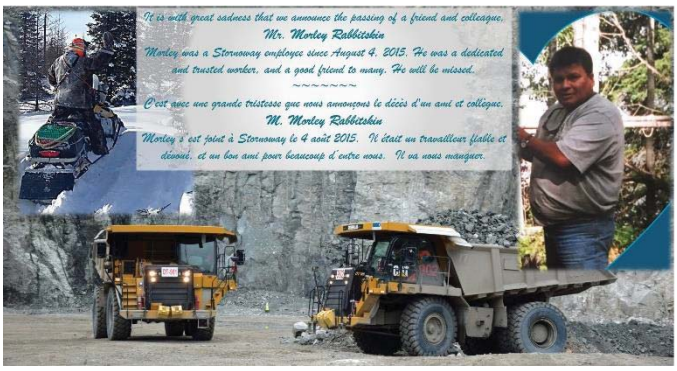



**Photo 8.33 In memory of Morley Rabbitskin**

## 8.3.5 Raising awareness of mining-related jobs among students

### 8.3.5.1 Presentations to secondary students

As part of commitments made under the Mecheshoo Agreement, Stornoway representatives delivered a presentation on the mining industry to secondary 4 and 5 students at Memorial Voyageur School in Mistissini and McLean Secondary School in Chibougamau. The objective of these presentations was to elicit young Cree's interest in a career in the mining industry and possible at the Renard mine.

### 8.3.5.2 Presentations to post-seconday students

Stornoway representatives also organized dinner conferences on the mining industry for post-secondary Cree students at College Algonquin in Ottawa and Cree students in Montreal. The objective again was to promote careers in the mining industry and possibly the Renard mine.

### 8.3.5.3 Prospector training

Stornoway delivered a two-day training course on diamond exploration methods to a group of 15 Cree students involved in a five-week prospector training program offered by the Cree Mineral Exploration Board (CMEB). The two days of additional training were greatly appreciated by the students as well as by CMEB instructor Marlene McKinnon. The plan is to offer this training every summer.

#### 8.3.5.4 Long-term strategy

In addition to activities already under way, Stornoway's community relations team is currently working on developing a long-term strategy to spark interest among young people of various ages in careers in the mining industry. This strategy is expected to be deployed to a greater extent in 2018.

### 8.3.6 Introduction to Cree culture

In the fall 2017, Mecheshoo Agreement Implementation Officer Minnie Coonishish received a mandate to prepare a training session on Cree culture initially for supervisors at the Renard mine and eventually for all mine employees. Minnie Coonishish and Charlie Awashish would deliver the training in 2018 with the primary objective of increasing awareness of Cree culture among Renard mine employees and hence enhancing mutual understanding in the workplace.

In addition, a work session on the Mecheshoo Agreement was developed in late 2017 and will be delivered in early 2018 to members of the various committees. The objectives of this session are to:

- Refresh everyone's memory of commitments under the Agreement;
- Discuss our perspectives on the spirit of the Agreement;
- Understand the expectations of community and Stornoway committee members;
- Continue to improve and develop concrete actions to meet common objectives under the Agreement,
- Strengthen the feeling of belonging and commitment toward the Mecheshoo Agreement.

**Photo 8.34 Work session on the Mecheshoo Agreement**

## 8.4 Land Use by M11 Trapline Users

### 8.4.1 Scope of monitoring

Mine site preparation and development works had the effect of making part of the territory unavailable for natural resources harvesting by M11 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 users needed to alter their hunting, fishing and trapping habits by avoiding the mine sector given the 1 km safety perimeter established around the mine and airstrip facilities.

Stornoway also committed to staying in constant communication with the tallymen to avoid seriously obstructing their traditional activities and make any necessary arrangements to compensate for any potential

or actual disturbances. The mitigation measures in place primarily aim to reduce the negative impacts on M11 trapline users' traditional activities.

Condition 5.1 of the Global CA indicates that the proponent is required to "monitor land use by M11 trapline users" and "monitor conditions under which Cree use Lake Lagopede resources."

The objectives of monitoring land use are to:

- Update data collected previously (EBS and ESIA) regarding M11 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 M11 trapline and Lake Lagopede;
- Identify the main reasons for any changes;
- Document discussions between the proponent and M11 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.

The indicators selected for monitoring land use by M11 trapline users are presented in Table 8.4.

**Table 8.4 Monitoring land use by M11 trapline users**

| Topics | Potential Indicators | Comments |
|---|---|---|
| **Infrastructure** | Camps | *Number, type and location* |
| | Trails | *Number, type (ATV-quad, snowmobile) and location* |
| | Other | |
| **Land access** | Trails (ATV-quad, snowmobile) | *Frequency of use* |
| | Watercourses (navigation routes) | *Frequency of use* |
| | Hunting areas | *Frequency of use* |
| **Hunting, fishing and trapping** | Harvesting reports: hunting fishing and trapping | *Harvesting, small and large animals, fur-bearing animals, fish* |
| | Project implemented by *Mecheshoo Social and Cultural Fund* and project results | *Number of projects and results* |
| **Lake Lagopede** | Fishing | *More specifically brook trout fishing in tributary* |
| | Navigation | *Historical significance along Misask River* |
| | Snowmobile traffic | |
| **Perception of impacts / project-related concerns and comments** | | *Including their opinion on the progressive restoration of the mine site and its gradual re-use by M11 trapline users* |

***DISTRIBUTION OF MONITORING RESULTS***

The results of monitoring land use by M11 trapline users will be 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 will be 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 M11 trapline users may be distributed to other project stakeholders.

## 8.4.2 Infrastructures

### 8.4.2.1 Hunting camp

Aircraft taking off and landing were disruptive to one of the two tallymen (Sydney Swallow). Mr. Swallow's hunting camp was located on the flight path about 2 km northeast of the airport along the Misask River. As compensation and in compliance with the agreement reached between Stornoway and Mr. Swallow,

Stornoway relocated his hunting camp in 2015. The new site selected by the tallyman was about 15 km northwest of Renard mine. Relocating this hunting camp was part of the agreement signed by the parties in January 2012, which included pre-determined funds for the purchase of materials, transportation and the workforce required to build the camp. The materials were transported to the site in the fall 2015 and the new camp was built by members of the Swallow family in summer 2016.

In addition, in 2017 Stornoway used funding from the Environment and Social Fund (Mecheshoo Agreement) to build a 15-km snowmobile trail to Mr. Swallow's new hunting camp.

**Photo 8.35 Sydney Swallowz's new hunting camp**

#### 8.4.2.2 Parking areas

To address Cree concerns raised during the construction of the mine access road, a number of parking areas were built along the road during the construction phase. In winter 2016-2017, snow was regularly cleared from these parking areas as part of the maintenance of the section of road for which Stornoway is responsible (km 552 to km 648).

#### 8.4.2.3 Cree Cultural Centre

As specified in the Mecheshoo Agreement, in 2015, Stornoway built a Cree Cultural Centre near the mine site. The Centre includes a teepee, a traditional longhouse and a public services building (kitchen, appliances and washroom). Employees have the opportunity to cook traditional foods at the centre, and on a number of occasions in 2017, particularly on weekends, it was used by Renard mine employees for community meals. The Cree Cultural Centre is designed as a meeting place to share Cree culture, as well as the many other cultures represented at the Renard mine.

National Aboriginal Day was celebrated at the mine site on June 20, 2017. Employees and contractors enjoyed some traditional Cree fare at one of the three meals (breakfast, lunch and dinner) served in the Longhouse at the Cree Cultural Centre. Our cook Keeny Loon, his right-hand woman Charlotte Matawashish, and assistant cooks impressed everyone with the quality of the food they served throughout the day. The festivities were held on the main shift turnover day at the mine, so that most Stornoway employees could enjoy one of the meals on offer. Everyone loved the food, which included walleye, moose, goose and bear. A "sling-shot" competition open to one and all was also held, and was immensely popular. It was a great day, a day when Cree culture was shared and appreciated by all the participants.

***BIG GAME MONITORING***

Interviews were held on November 1, 2017, with the tallymen from M11 (Sydney Swallow, Emerson Swallow, Gordon Swallow and Nannie Swallow) and M16 (Norman Matoush and Matthew Matoush) traplines, in the presence of Stornoway facilitator and translator Minnie Coonishish and Stornoway Environment Department representative Benjamin Jacob. Two representatives from Norda Stelo also attended the meeting as part of big game monitoring efforts in 2017. The objectives of the interviews were to gather input from the main trapline users as regards the big game monitoring activities that had been planned and carried out, and record their perceptions of the status of big game populations and any changes they made to their hunting patterns since the mine and mine access road opened. The tallymen's opinions and observations are reported in the paragraphs below.

Generally speaking, the tallymen confirmed that their knowledge of the land and wildlife resources are consistent with the densities and distribution of species recorded in the 2017 survey. The key points made by the tallymen essentially involved the significant number of bears and wolves sighted at the trench landfill site (TLS). In their view, the animals are attracted by odours from the waste, an issue that had already been raised in 2015:

- Measures that were implemented such as the electric fence, which works only part of the year, were considered to be ineffective by the tallymen. The participants discussed the possibility of controlling predators by stepping up hunting pressure on wolves, an approach that land users supported.
- Another measure noted in the discussions was to adopt a new organic waste management method, i.e., a composter or incinerator, to control the source of the odours.


Photo 8.36 and Photo 8.37


Photo 8.38 and Photo 8.39

Photo 8.40 and Photo 8.41

**Photo 8.36 to 8.41 National Aboriginal Day – June 20, 2017**

Furthermore, M11 trapline users indicated their willingness to inspect their land outside the study area in the next monitoring survey in 2019, specifically flying over the region southwest of their land, near the Eastmain River so as to validate a group of moose in the sector.

***MEETINGS WITH TALLYMEN***

Regular meetings were held in 2017 with M11 tallymen and some members of their family. A dozen formal meetings were in fact held along with many phone calls throughout the year. The objective of these meetings and calls was to keep members of the Swallow family informed on the status of the work and operations at the Renard mine and address their concerns and questions. The main points of information and discussion in 2017 were:

- Changes in the desin of the processed kimberlite containment (PKC) facility and related issues;
- Addition of an ore/waste sorter to help reduce the diamond breakage problem;
- Renard mine performance (diamond production, processing and sale);
- Implementation of the Social and Cultural Fund and the Swallow family's project requests;
- Performance of family businesses working at the Renard mine (Kiskinshiish Camp Services and Swallow-Fournier);
- Organization of events including participation by the Swallow family (Aboriginal Day, Open House, etc.).

The meetings were mostly held in Stornoway's Mistissini office in January, March (2), April (2), July (2), September, October (2), November and December.

**Photo 8.42 Sydney Swallow - Tallyman**

**Photo 8.43 Emerson Swallow -Tallyman**

### 8.4.3 Land access

In 2017, a significant number of tractor trailers travelled Route 167 to the mine site, which was in operation although some construction work was still in process. Route 167, which was built by people from the region, is a vital link for delivering concrete, steel, fuel, piping, materials, mining vehicles and all manner of 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 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 and this cooperative endeavour 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.

The Renard mine access road was closed twice in 2017 owing to accidents involving heavy duty vehicles. In both cases, Stornoway immediately contacted the local authorities to advise them of the situation so that they could convey the information to residents by way of radio broadcasts and social media. This process worked well and helped prevent delays for land users.


**Figure 8.8 Public safety announcement in the 2017 Sustainable Development Report**

### 8.4.4 Hunting, fishing and trapping

During the negotiation of the Mecheshoo Agreement, discussions were held to find a way to support the traditional way of life on M11 trapline as well as in the Mistissini community.

Under the Agreement, a Mecheshoo cultural and social fund was to be put in place as soon as commercial production of the Renard mine got under way. This milestone was achieved on January 1, 2017, and the fund is now active. It is financed by Stornoway, and will be used by the Mistissini community to:

(a) Initiate Mistissini-approved activities to promote the sustainable economic and community development of Mistissini;

(b) Carry out Mistissini-approved activities that will benefit from the support of M11 tallymen, provided that these activities meet one of the following objectives:

- Promote the continuation and enhancement of traditional Cree activities;
- Diversify the livelihood of Cree users affected by the mine through for example guide and outfitter services;
- Carry out the appropriate work for adopting and implementing wildlife management, conservation and enhancement measures that are not covered by the mitigation measures set out in the Environment and Social Impact Assessment.

In this regard, the Stornoway team has supported the tallymen with regard to the project proposals they've submitted to the Mistissini Band Council under the Cultural and Social Fund. In 2017, the following projects received funding from the Cultural and Social Fund:

- Four Swallow family projects on their traplines:
  - Construction of a 15-km snowmobile trail giving access to Sydney Swallow's new hunting camp;
  - Development of access to Sydney Swallow's hunting camp bordering Route 167 at km 639, along with the installation of a septic tank;
  - Development of access and installation of a pad for Gordon Swallow's hunting camp bordering Route 167 at km 639;
  - Development of a pad for for the construction of Emerson Swallow's hunting camp (incomplete);
- One Matoush family project on their trapline:
  - Development of access to the Eastmain River.
- One Mistissini community project:
  - Financial contribution to 2017 Mistissini Day event held in August 2017.

Other projects were submitted in 2017 but could not be approved because the budget in the Fund had been depleted. Some of these projects will be re-submitted to the Cultural and Social Fund for consideration in 2018.

**Photo 8.44 Development of access road to Sydney Swallow's hunting camp**

### 8.4.5 Lake Lagopede

In 2017, the use of Lake Lagopede by M11 trapline family members was limited to building a snowmobile trail in the winter months. Historically, Lake Lagopede has been a preferred route in winter for accessing different parts of the trapline. To preserve Lake Lagopede's wildlife resources, Stornoway for its part established a very clear policy prohibiting its employees as well as contractors' employees from fishing in any of the lakes in the area.

### 8.4.6 Perception of impacts and project-related concerns and comments

Stornoway has always taken care to keep Sydney and Emerson Swallow, the two M11 trapline tallymen, informed and to be responsive to their concerns. Meetings with individuals or certain members of the Swallow family were therefore held on a regular basis in 2017 to discuss project developments, challenges, and job and contract opportunities. These meetings also provided an opportunity to hear about and take into account their questions, issues and concerns. About a dozen formal meetings were held in 2017 with the tallymen either individually or together, whenever feasible.

As set out in the Mecheshoo Agreement, Stornoway is working on encouraging the development of Cree businesses, particularly the firms run by tallymen's families. Stornoway is proud to have the following companies involved at the Renard site: Kiskinshiish Camp Services (Sydney Swallow), which provides cafeteria and janitorial services, and Swallow-Fournier (Emerson Swallow), which is actively involved in civil construction work (modified processed kimberlite containment facility and sorting plant).

The presence of Kiskinshiish 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 2017, Kiskinshiish provided about 10,000 person days of services, with on average 30 employees on site every day. As part of mine operations, Kiskinshiish has about 90 employees, 80% of whom are Crees primarilry from the Mistissini community. Like Stornoway, Kiskinshiish has to contend with a significant turnover rate and hence faces staff retention issues. Stornoway is working closely with Kiskinshiish 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.

**Photo 8.45 Sydney Swallow – Kiskinshiish**

**Photo 8.46 Kiskinshiish cafeteria staff**

**Photo 8.47 Swallow-Fournier team**

**Photo 8.48 Emerson Swallow – Swallow-Fournier**

## 8.5 Local and Regional Economic Spinoffs

### 8.5.1 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 spinoffs (Mistissini, Chibougamau, Chapais), Stornoway put in place with the Cree and James Bay residents 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.

The indicators selected for monitoring local and regional economic spinoffs are outlined in Table 8.5.

***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), the results of the local and regional economic spinoff monitoring will be submitted and presented to the Renard Committee, as well as the Renard Liaison Committee formed under the Partnership Declaration signed with Chibougamau and Chapais.

The results will also be distributed to the Environment Committee, Environment Discussion 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 2017 Sustainable Development Report, a copy of which was distributed earlier this year to every household in Mistissini, Chibougamau and Chapais.

### 8.5.2 Provisions of the Mecheshoo Agreement and the Partnership Declaration

The Mecheshoo Agreement includes implementation and operating procedures for three monitoring committees: the Renard Committee, which manages the Agreement overall; the Environment Committee, which oversees all environmental issues; and the Training and Employment Committee, which works at maximizing employment spinoffs for Crees.

The Partnership Declaration includes a Monitoring Committee that manages all monitoring files and on which the mayors of Chibougamau and Chapais are members.

Various committee meetings are held at least once quarterly to discuss committee-specific issues, as well as regional spinoffs generated by the Renard mine and to address concerns and questions raised by regional stakeholders.

**Table 8.5 Indicators selected for monitoring local and regional economic spinoffs**

| Topics | Potential Indicators | Comments |
|---|---|---|
| Provisions of the Mecheshoo Agreement and the Partnership Declaration | To be determined | *Refers to Stornoway's commitments as regards economic spinoffs* |
| Contracts | Communication program aimed at distributing information on contract opportunities to local businesses | *Number of communication activities aimed at distributing information on contract opportunities for local (Mistissini, Chibougamau, Chapais) and regional (Eeyou Istchee James Bay) businesses* |
| | Measures implemented by Stornoway to promote regional economic spinoffs | *Nature and type of measures. Perceptions on the effectiveness of measures proposed by Stornoway (Cree and James Bay company representatives, particularly from Mistissini, Chibougamau and Chapais)* |
| | Contracts awarded to Cree and James Bay businesses | *Nature, type and scope of contracts. Relative share (Cree, non-Cree, businesses from other Quebec areas, etc.)* |
| Projects put in place through the Joint Mistissini/Renard Business Development Fund | Number and type of projects | |

**Table 8.6 Meetings of the Renard mine monitoring committees held 2017**

| Renard Project Committees | 2017 |
|---|---|
| Renard Committee (Mistissini & GCC (EI)) | 4 |
| Training and Employment Committee (Mistissini & GCC (EI)) | 4 |
| Environment Committee (Mistissini & GCC (EI)) | 4 |
| Renard Liaison Committee (Chibougamau & Chapais) | 3 |

In 2017, members of the Environment Committee (Mecheshoo Agreement) toured the Renard mine site accompanied by COMEX members. It was the first time members of the James Bay and Northern Quebec Agreement review committee (COMEX) had the opportunity to observe in the field the environmental and social commitments implemented by Stornoway at the Renard mine.

**Photo 8.49 Renard and Eléonore Environment Committees on site tour**

***EMPLOYMENT SPINOFFS***

As regards regional spinoffs, 167 Stornoway employees are from our host communities (including 53 Crees) thereby contributing as at December 31, 2016, in generating annual spinoffs of more than $14 million in salaries for Mistissini, Chapais and Chibougamau.

**Photo 8.50 Marc Tremblay of Chibougamau and Andrew Mianscum of Mistissini**

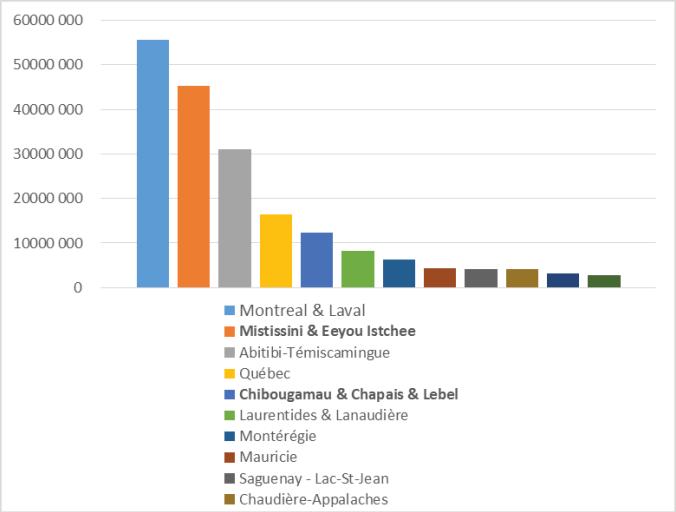
### 8.5.3 Goods and services contracts

In 2017, suppliers from every region of Quebec contributed to the success of operations and construction work at the Renard mine. With sustainable development and the stakeholders in mind, Stornoway has made a point of awarding goods and services contracts to local companies thereby contributing to regional economic growth. Some contracts were in fact divided in response to regional supply. As a result in 2017, $194 million in goods and services contracts were awarded to businesses in Quebec, including $57.7 million to businesses in the Eeyou Istchee James Bay region, or 30% of all goods and services purchased in Quebec in 2017. This amounts to spinoffs of $45.3 million (23%) for Mistissini and Eeyou Istchee communities and $12.3 million (7%) for Chibougamau and Chapais

Table 8.7 outlines the yearly expenses incurred by Stornoway for suppliers in different Quebec regions in 2017 for operations and residual construction-related requirements at the Renard mine.

**Table 8.7 Expenses incurred by the Renard mine in 2017 for Quebec suppliers**

| Quebec Region | Millions $ |
|---|---|
| Montreal – Laval | 55.5 |
| Mistissini – Cree Nation | 45.4 |
| Abitibi-Temiscamingue | 31.0 |
| Québec | 16.5 |
| Chibougamau – Chapais | 12.3 |
| Laurentides – Lanaudière | 8.3 |
| Montérégie | 6.3 |
| Mauricie | 4.4 |
| Saguenay – Lac-Saint-Jean | 4.2 |
| Chaudière-Appalaches | 4.1 |
| Lower St. Lawrence & Gaspé | 3.1 |
| Central Quebec | 1.8 |
| Other | 1.0 |
| **Total** | **194,0** |




Whenever feasible, Stornoway makes a point of awarding contracts adapted to Cree businesses in particular family businesses run by tallymen Sydney Swallow (Kiskinshiish Camp Services) and Emerson Swallow (Swallow-Fournier).

Construction of the Renard mine was completed in 2016 but additional infrastructure was added in 2017 (modified processed kimberlite containment facility and ore sorting plant); consequently, Stornoway continued working with regional suppliers, in particular the Mistissini, Chibougamau and Chapais communities, to complete the work.

In 2017, goods and services contracts worth more than $45 million were awarded to Cree businesses primarily in Mistissini. These expenditures involved 23 Mistissini and Eeyou Istchee suppliers. Nine businesses were awarded contracts totalling more than $100,000 during this period. They are in order of importance: Swallow-Fournier (Emerson Swallow), Crevier-Chiiwetin, Kiskinshiish Camp Services (Sydney Swallow), Air Creebec, Eskan, Makaahikan, Sakhiikan, Matoush-Grimard and M.Y. Surveying.

During the same period, goods and services contracts totalling more than $12 million were awarded to 65 suppliers based in the Chibougamau and Chapais communities. Included among the businesses who were awarded contracts in excess of $100,000 during that period were in order of importance: Transcol/Groupe Robert, M.A.S. Chibougamau, Recyclage Ungava, Soudure GAM, Plomberie Biron, Métallisation du Nord, Commission Scolaire de la Baie James, Chibougamau Automobiles, Jos Ste-Croix & Fils Ltée, Pneus G.B.M., Lavoie & Beaudry, Services Hydrauliques Chibougamau and Ferlac Chibougamau.

In line with its sustainable development approach, Stornoway awards goods and services contracts to competitive local businesses. 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.

In 2017, the daily workforce at the mine site amounted on average to 318 workers (Stornoway and contractor employees), 17.6% of which were Cree workers. The number of workers on site peaked in October and November with 357 and 355 daily workers on site respectively (Table 8.8), as a result of construction work on the ore/waste sorter.

**Table 8.8 Average monthly workforce (Stornoway + contractors) on the Renard site/day**

| | Month | Average number of workers on site/day | SWY | Non-SWY | Cree | Non-Cree | % Cree |
|---|---|---|---|---|---|---|---|
| 2017 | January | 277 | 195 | 82 | 54 | 223 | 19.5% |
| | February | 276 | 199 | 77 | 51 | 226 | 18.5% |
| | March | 274 | 201 | 71 | 53 | 220 | 19.3% |
| | April | 298 | 205 | 92 | 61 | 237 | 20.5% |
| | May | 313 | 203 | 110 | 59 | 254 | 19.0% |
| | June | 329 | 219 | 110 | 60 | 270 | 18.3% |
| | July | 331 | 193 | 138 | 51 | 280 | 15.7% |
| | August | 343 | 217 | 126 | 64 | 282 | 18.7% |
| | September | 337 | 217 | 121 | 57 | 280 | 16.8% |
| | October | 357 | 219 | 139 | 58 | 299 | 16.3% |
| | November | 355 | 230 | 125 | 58 | 296 | 16.5% |
| | December | 324 | 217 | 107 | 39 | 287 | 11.9% |
| **Annual Average** | | **318** | **210** | **108** | **55** | **263** | **17.6%** |

### 8.5.4 Projects carried out with funding from the Mistissini / Renard Business Development Fund

Under the Mecheshoo Agreement, the Business Development Fund was initiated from the time commercial production at the Renard mine began, i.e., as of January 1, 2017.

Every year Stornoway and Mistissini jointly contribute to the Mistissini/Renard Business Development Fund established to support the start-up and development of Mistissini Cree businesses in every sphere of activity. Fund applications are submitted directly by the applicants to the Mistissini Band Council, which manages the Fund. The Renard Committee may then formulate recommendations with regard to the award of funds to the various applicants.

In 2017, a total of $180,000 ($90,000 from each partner) was awarded to five projects submitted to the Mistissini Band Council.

In the 2017 program, the beneficiaries of the program were as follows:

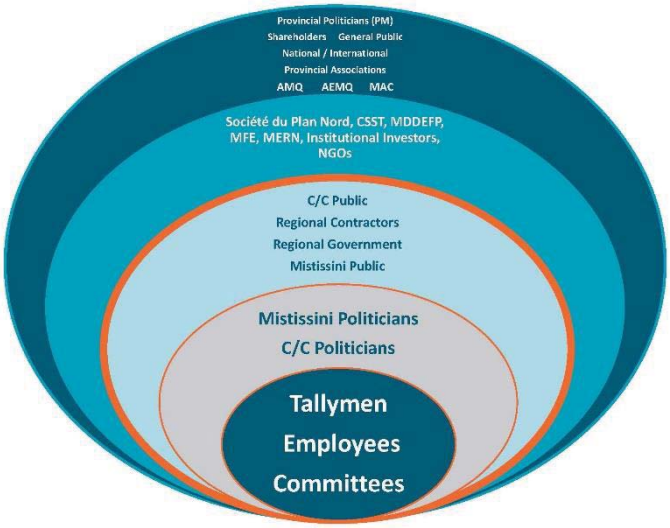
- **Eskan**: $50,000 to prepare a new business development plan;
- **Meechum**: $27,576 for a business expansion project;
- **Louis-Joliet Camp**: $75,000 to improve outfitter infrastructure;
- **Washeshkun Airways**: $7,500 in support of a feasibility study;
- **Urban Agriculture Plan**: $19,924 in support of a study of setting up agricultural projects in the community (in collaboration with MAPAQ).

A policy with regard to this program was put in place by the Mistissini community to establish a formal process for dealing with the applications. In addition, a communications plan will be deployed in 2018 to inform Mistissini residents about the Mistissini/Renard Business Development Fund.

## 8.6 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 spinoffs 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 M11 trapline

tallymen's families. The communications plan was developed with a focus on communicating with specific stakeholders (see figure below). 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 (C/C).




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 on the status of the Renard project to member sof the Mistissini Band Council;
- 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 spinoffs;
- Annual open house in Mistissini with four information booths (mine, plant, environemnt and human resources), in addition to a question and answer session;
- Mine site visit for community members and Mecheshoo Agreement committee members;
- 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 (about a dozen held in 2017) 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 spinoffs and job opportunities broadcast on the local radio station in Chibougamau;
- Renard project presented at local events (Mining Week, recruiting activities, Open House, etc.);
- National Aboriginal Day festivities held at Renard mine to share Cree culture;
- In August, a CBC-North Maamuitaau and Radio-Canada television news team toured the mine site. They primarily covered the employment and integration of Cree workers at Renard mine. A number of Cree employees were interviewed and the Radio-Canada team was truly impressed with what they observed at the site.

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 Grand Council of the Eeyou Istchee Crees. 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.

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# Appendix 3.1
Notes on surface water quality protection criteria and guidelines

**Notes on surface water quality protection criteria and guidelines**

a Thermal stratification: Thermal inputs should not modify thermal stratification and the natural dates of inversion of the receiving waters. Maximum weekly mean temperature: Thermal inputs should not bring temperatures of receiving waters higher than the maximum weekly mean temperature. Short term exposure to extreme temperatures: Thermal inputs should be such that short term exposures to maximum temperatures are not exceeded. The period and frequency of exposures should not affect important species.

b Minimal acceptable dissolved oxygen concentration for warm water biota:
first stages of life cycle = 6.0 mg/l
other stages of life cycle = 5.5 mg/l
For cold water biota:
first stages of life cycle = 9.5 mg/l
other stages of life cycle = 6.5 mg/l.

c Maximum increase of 8 NTUs over natural background levels for short-term exposure (e.g., 24-hour period) and maximum mean increase of 2 NTUs over natural background levels for long-term exposure (e.g., 30-day period). Maximum increase, at all times, of 8 NTUs over natural background levels, when the latter are between 8 and 80 NTUs. This increase must not exceed 10% of natural background levels when the natural background level is 80 NTUs.

d Maximum increase of 25 mg/l compared with natural background levels for all short-term exposures (e.g., 24-hour period) and maximum mean increase of 5 mg/l compared with natural background levels for long-term exposure (e.g., 24 hours to 30 days). Maximum increase of 5 mg/l compared with natural background levels for long-term exposures (for example, entries between 24 h and 30 days). Maximum increase of 25 mg/l compared with natural background levels at any time when natural background levels are between 25 and 250 mg/l. Should not increase by more than 10 % compared with natural background levels when the natural background level is <250 mg/l.

e The phosphorus orientation framework develops guidelines for phosphorus only (it does not provide guidelines for other nutrients). It provides triggering ranges for total phosphorus (for more information, please consult the Information booklet on the Phosphorus orientation framework):
Ultra-oligotrophic: < 0.004 mg/l; Oligotrophic: 0.004 to 0.01 mg/l; Mesotrophic: 0.01 to 0.02 mg/l; Meso-eutrophic: 0.02 to 0.035 mg/l; Eutrophic: 0.035 to 0.1 mg/l; Hypereutrophic: > 0.1 mg/l

f 0.005 mg/l at a pH <6.5 and 0.1 at a pH ≥6.5.

g The CWQG for copper varies with water hardness. When hardness is between 0 and <82 mg of $CaCO_3$/l, the CWQG is 0.002 mg/l.

h The CWQG for nickel varies with water hardness. When water hardness varies between 0 and ≤60 mg of $CaCO_3$/l, the CWQG is of 0.025 mg/l.

i The CWQG for lead varies with water hardness. When water hardness varies between 0 and ≤60 mg of $CaCO_3$/l, the CWQG is of 0.001 mg/l.

j Effluent pH levels must be 6.0-9.5 under the mine directive and most MDDELCC regulations governing industrial discharge. This requirement meets the aquatic life protection objective.

k

| pH range | Effect |
|---|---|
| 3.0 – 3.5 | It is unlikely that fish could survive more than a few hours at this range although certain plants and some invertebrates can be found at lower pH levels. |
| 3.5 – 4.0 | This range is lethal for salmonids. The literature shows that golden shiner, tench, European perch and pike can survive in this range, ostensibly after a period of acclimatization to slightly higher non-lethal concentrations. The lower limit of this range can, however, be lethal for golden shiner. |
| 4.0 – 4.5 | Likely harmful to salmonids, tench, bream, golden shiner, porgies and carp that are not acclimatized to low pH, although their resistance in this range increases with size and age. While fish can adapt to these values, only pike can reproduce (not perch, bream or golden shiner). |
| 4.5 – 5.0 | Likely harmful to salmonid eggs, fry and adults, especially in freshwater environments with low calcium, sodium and chloride concentrations. Can be harmful to carp. |
| 5.0 – 6.0 | Unlikely to be harmful for all species, unless the concentration of free carbon dioxide is higher than 20 mg/l or the water contains freshly precipitated iron salts in the form of ferric hydroxide, whose exact toxicity is unknown. The lower limit of this range may be harmful to unacclimatized salmonids if calcium, sodium and chloride concentrations are low of if the water temperature is low, and may be harmful to the reproduction of golden shiner. |

**Notes on surface water quality protection criteria and guidelines**

| | |
|---|---|
| 6.0 – 6.5 | Likely not to be harmful to fish unless the free carbon dioxide concentration exceeds 100 mg/l. |
| 6.5 – 9.0 | Not harmful to fish, although the toxicity of other fish can be modified by changes in this range. |
| 9.0 – 9.5 | Likely harmful to salmonids and perch, if this range persists. |
| 9.5 – 10.0 | Lethal for salmonids over a long period but tolerable for a short period. May be harmful for the developmental stages of certain species. |
| 10.0 – 10.5 | Tolerable for golden shiner and salmonids for a short period but lethal over a long period. |
| 10.5 – 11.0 | Rapidly lethal for salmonids. Prolonged exposure at the higher limits of this range is lethal for carp, tench, bream and pike. |
| 11.0 – 11.5 | Rapidly lethal for all species. |

**Notes on surface water quality protection criteria and guidelines**

l This is a maximum allowable concentration (MAC) defined for drinking water.

m For clear waters (*), this quality criterion is defined as a maximum mean increase of 2 NTUs over natural or background value (not influenced by a point source that impacts water turbidity, by heavy rain or snowmelt) depending on the context. In turbid waters (*), the quality criterion is defined as: (under review) - by a maximal increase at any time of 8 NTUs over background levels when these vary between 8 and 80 NTU; - by a 10% increase over background levels when these are higher than 80 NTU when measured at any given time. These quality criteria apply to freshwater, estuarian and marine environments.(*) (*) The terms "clear waters" and "turbid waters" refer to a portion of the hydrogram where suspended solid concentration is low (<25 mg/l) or high (>25 mg/l) (Caux et al., 1997). Concentrations can be high because of natural characteristics of the environment (for example the maximum turbid zone in the St. Lawrence) or, periodically, because of weather conditions.

n For clear waters (*), the quality criterion is defined as a maximum increase of 8 NTUs over background levels (not affected by a point source affecting water turbidity, by heavy rain or by thaw) depending on the context. This criterion applies to estuarine, marine and freshwater environments. (*) The term "clear waters" refers to a portion of the hydrogram where suspended solid concentration is low (<25 mg/l) (Caux et al., 1997). Concentrations can be high because of natural characteristics of the environment (for example the maximum turbid zone in the St. Lawrence) or, periodically, because of weather conditions.

o An environment's sensitivity to acidification varies with its alkalinity:
Sensitivity $CaCO_3$ concentration (mg/l)
High ---------- < 10
Average ---------- 10 - 20
Low ---------- > 20

p For clear waters (*), the quality criterion is defined as a mean maximum increase of 5 mg/l over background or ambient levels (not influenced by a point source of suspended solids, by heavy rains or by thaw), depending on context.
In turbid waters (*), the quality criterion is defined as: (under review)
- by a maximal increase of 25 mg/l over ambient levels when these vary between 25 and 250 mg/l;
- by a 10% increase over background levels when these are higher than 250 mg/l when measured at any given time.

This criterion applies to estuarine, marine and freshwater environments.
(*) The terms "clear waters" and "turbid waters" refer to a portion of the hydrogram where suspended solid concentration is low (<25 mg/l) or high (>25 mg/l) (Caux et al., 1997). Concentrations can be high because of natural characteristics of the environment (for example, the maximum turbid zone in the St. Lawrence) or, periodically, because of weather conditions.

q For clear waters (*), the quality criterion is defined as a maximum increase of 25 mg/l over background or ambient levels (not influenced by a point source of suspended solids, by heavy rains or by thaw), depending on the context. This criterion applies to estuarine, marine and freshwater environments. (*) The term "clear waters" refers to a portion of the hydrogram where suspended solid concentration is low (<25 mg/l) (Caux et al., 1997). Concentrations can be high because of natural characteristics of the environment (for example, the maximum turbid zone in the St. Lawrence) or, periodically, because of weather conditions.

r This value corresponds to the maximal tolerable oxygen deficient for aquatic life at a summer average temperature of 21°C.

s The ammonia nitrogen criterion varies with pH and temperature. The values shown for ammonia nitrogen are the most restrictive, given the pH values and temperature were measured in the Renard project area between 2002 and 2010.

t The presence of ammonia nitrogen at higher concentrations can compromise disinfection effectiveness.

u Above this concentration, drinking water's organoleptic or esthetic properties could be altered.

**Notes on surface water quality protection criteria and guidelines**

v Certain factors influence the potential effect of phosphorus. The main physical factors generally mentioned are substrate type, water depth, clearness transparency and water temperature, current speed and shade. Because these characteristics are not reflected in the quality criteria, it is important to use phosphorus quality criteria in keeping with the environment under assessment. The following quality criteria can be used to assess lake deterioration; however, they must not be used to assess phosphorus loads discharged into lakes. - For oligotrophic lakes whose natural concentration is or was under 0.01 mg/l, the quality criterion is defined by a maximum 50% increase over the natural concentration without exceeding 0.01 mg/l. - To limit eutrophication of lakes for which the natural concentration is between 0.01 and 0.02 mg/l, the quality criteria is defined as a maximum increase of 50% compared to the natural concentration, without exceeding 0.02 mg/l. These criteria apply when there is no ice cover. 0.03: This criterion aims to limit excessive growth of algae and aquatic plants in streams and rivers. This protective value for watercourses does not always ensure the protection of lakes downstream.

w This criterion is under review. This value is established based on toxic effects and does not reflect the indirect effects of eutrophication.

x This is a maximum allowable concentration (MAC) defined for drinking water. The total nitrates and nitrites concentration must not exceed 10 mg/l.

y Allowable nitrite concentrations increase with the aquatic environment's chloride concentrations. The value shown is for chloride concentrations <2 mg/l.

z This is an interim quality criterion. This criterion was determined from toxicity data for low hardness (≤ 120 mg of $CaCO_3$/l).

**Notes on surface water quality protection criteria and guidelines**

A This is a maximum allowable concentration (MAC) defined for drinking water. It is however recommended to adjust the fluoride concentration to 1.0 mg/l (the optimal concentration to prevent cavities). A concentration of 1.2 mg/l has to be maintained if the mean annual maximal daily temperature is less than10°C.

B This quality criterion applies to waters whose hardness is < 100 mg/l and whose chloride concentration is < 5 mg/l.

C Above this concentration, drinking water's organoleptic or esthetic properties could be altered. A sulphate concentration greater than 500 mg/l may have a laxative effect on some persons.

D This quality criterion was defined for water that is not very hard (< 10 mg/l) and whose pH is about 6.5. When the aquatic environments does not meet these conditions, this criterion should not be used. When it is used, surface water data must be corrected to reduce the non-bioavailable fraction of the metal associated with the particles. A correction factor of 0.66 is used on data for surface water with an TSS concentration < 5 mg/l. A correction factor of 0.33 is used on data for surface water with an TSS concentration ≥ 5 mg/l. A site-specific criteria can also be determined in some cases. Some good quality surface waters can contain natural levels that are higher than the water quality criterion. In these situations, the natural levels, not the quality criterion, must be considered the reference value.

E There should be no toxic effects at this concentration if the pH is maintained between 6.5 and 9.0.

F Due to limited opportunities to use the data obtained in animal studies as a model for humans and uncertainty in human data, it is impossible to determine a guideline value based on health arguments. However, the optimization process using aluminum-based coagulants in the drinking water treatment facilities has led to the definition of practical limits: 0.1 mg/l or less in major water treatment plants and 0.2 mg/l or less in small water treatment plants (WHO, 2004).

G The sensitivity of an environment to acidification varies with the calcium concentration:
Sensitivity concentration (mg/L)
high…… < 4
medium…… 4-8
low……..> 8

H Some metal criteria vary with hardness. These criteria were determined with a hardness of 10 mg of CaCO3/l.

I This criterion was defined for an esthetic skin problem called argyria. This value is defined for drinking water.

J These US EPA criteria, whether they apply to brackish, marine or freshwater environments, were defined for arsenic III but apply here to total arsenic (as the toxicity of arsenic III and V are considered equal and additive).

K This is a maximum allowable concentration (MAC) defined for drinking water. It is the arsenic concentration for which the risk is considered as "not significant". Health Canada defines the term "not significant" as values for which one new cancer case above background per 100,000 people to one new cancer case above background per 1 million people (i.e., 10-5 to 10-6 ). This criterion is used in the context of surface water contamination prevention and that is why it is different from the drinking water standard. Some surface waters may contain natural concentrations higher than the quality criterion.

L This quality criterion is equivalent to the risk level of one new cancer case for a population of 1 million exposed individuals. This quality criterion applies to the inorganic form only. Interim quality criterion.

M This is a maximum allowable concentration (MAC) defined for drinking water.

N Copper toxicity reduces when the dissolved organic carbon concentration increases (U.S.EPA, 1998).

O Above this concentration, drinking water's organoleptic or esthetic properties could be altered.

P This is an interim quality criterion. It does not protect mayflies (Ephemerella subvaria) if this species is as sensitive as some data indicate. Before comparing with the chronic effect criterion, surface water quality data must be corrected to reduce the fraction of the non-bioavailable metal associated with the particles. A correction factor of 0.5 is used on data for surface water with an TSS concentration <l 10 mg/l. A correction factor of 0.33 is used on data for surface water with an TSS concentration ≥ 10 mg/l. Some good quality surface waters can contain natural levels that are higher than the water quality criterion. In these situations, the natural levels, not the quality criterion, must be considered as the reference value. A site-specific quality criterion can also be determined on a case-by-case basis.

Q Above this concentration, drinking water's organoleptic or esthetic properties could be altered. Some good quality surface waters naturally have higher concentrations.

R This value was determined for drinking water.

**Notes on surface water quality protection criteria and guidelines**

S This quality criterion is based on a daily consumption of 15 g of fish, mollusk or crustacean. This quality criterion includes methylmercury.

T Based on U.S.EPA data (1976b), the MDDELCC has opted for an operational quality criterion of 10 µg/l for petroleum hydrocarbons. Other criteria are presented for other types of hydrocarbons.

U This quality criterion is used to prevent any change in fish taste and colour.

V This quality criterion is applicable to raw water for drinking water when the water is treated by filtration. This avoids the introduction of additional treatment processes . This criterion of 200 CFU/100 ml (or 150 E. coli/100 ml ) applies to the arithmetic mean of samples that must match the highest results achieved for the 12 consecutive month moving average, drawn from a period of at least 36 months.

W Any artificial temperature increase or decrease must not:
- modify the water temperature of an entire river section or portion of a lake causing the foreseeable move or modification of existing or potential aquatic populations
- alter localized sensitive zones (i.e., spawning grounds)
- kill living organisms near a discharge.

Furthermore, the environment must not undergo sudden temperature changes due, for example, to suddenly stopping thermal discharge in the cold season.

X Dissolved oxygen concentrations should not be lower than the following:

| Temperature | Dissolved oxygen concentration | | | |
|---|---|---|---|---|
| | Freshwater biota | | Warm water biota | |
| °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 |

In waters with sensitive biological communities, the presence of additional physical or chemical stressors may require the use of more restrictive limits. In the hypolimnion waters, the natural concentration in dissolved oxygen is sometimes lower than the concentrations noted above. This state must not be aggravated by the addition of biodegradable matter leading to a decrease in oxygen in the environment.

Y This is an interim quality criterion. This criterion applies to waters with a hardness between 20 and 100 mg of CaCO3/l.

aa Since this substance requires a large quantity of $0_2$ to degrade, it is important to ensure that the dissolved oxygen quality criterion is also respected in order to protect aquatic life.

# Appendix 3.2
Review of 2017 monitoring report

June 1, 2018

Mr. Martin Boucher, Vice-President, Sustainable Development
Stornoway Diamonds (Canada) Inc.
1111 St-Charles West, West Tower, Suite 400
Longueuil, Quebec J4K 5G4

Ref. No.: 061470005

**Subject: Review of 2017 monitoring report**

Sir:

As Norda Stelo's project manager overseeing the environmental studies for the Renard Diamond Mine Project, Stornoway Diamonds (Canada) Inc. provided me the opportunity to conduct a complete review of the 2017 monitoring report. On the basis of this review as well as my knowledge of the activities that were carried out and in which I was involved, I can confirm that the activities documented in this report were indeed undertaken and that the monitoring results faithfully reflect what is documented in the report. I can also attest to the fact that the prevention, risk management, mitigation and compensation measures, which were set out in the Environmental and Social Impact Assessment and discussed with the Cree and government authorities, have been implemented.

The Norda Stelo team can confirm this on the basis of various activities in which we were directly involved with our partner EnviroCree, who also participated in the monitoring program. Once the Renard project was under way, Norda Stelo has been able confirm the application of the specified measures through:

- the design, fish habitat development and monitoring activities undertaken by our team in collaboration with EnviroCree under the Renard project fish habitat compensation program;
- our air quality specialist's report to the National Air Pollution Surveillance (NAPS) Network on the Renard mine's 2017 emissions;
- our participation in collaboration with EnviroCree in big game monitoring in the Renard mine sector as well as along Route 167. As part of these monitoring activities, our big game specialist consulted with tallymen to ascertain their perceptions of the impacts of the presence and operation of the mine on big game as well as their hunting activities;
- our participation in the analysis and interpretation of surface water and groundwater quality data and the preparation of related monitoring reports;
- the loan of some of our environment personnel to assist the Renard mine environment team;
- the preparation of authorization requests in connection with the modified processed kimberlite containment facility, the ore sorting plant, the installation of a system of pump wells and other requests in which we validated information submitted to the MDDELCC;

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- our participation in a follow-up meeting held by the Renard project Environment Committee on the monitoring program. This meeting enabled me to become aware of the questions and issues raised by committee members in relation to environmental monitoring activities;
- the implementation of environmental monitoring activities;
- the development and application of compensation measures.

Our direct participation in these activities enabled us to confirm that the work to optimize the Renard project's environmental activities initiated as part of the environmental and social assessment process continued in 2017, in compliance with the concerns raised in public consultations and the conditions set out in the Global Certificate of Authorization (CA), the sector-based CAs and conditions related to federal authorizations.

The hiring and procurement strategy deployed by Stornoway is compliant with the commitments the company made to these communities in the Mecheshoo Agreement and Partnership Declaration.

This monitoring report will be released to the public, in keeping with Stornoway's focus on ensuring transparency since the start of the development project. I encourage the Stornoway team to continue their excellent work showing respect for the environment and communities and ensuring transparency, as demonstrated to date.

Yours sincerely,

Vital Boulé, M. Sc. Biologist
Project Manager
Environment Manager, Norda Stelo

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