Appendix II

Photo report

Coniferous forest

Q108

Q109

H139

H131

Tundra

Q31

Q94

Q104

Q99

Barren

Q13

Q20

Wetlands

HM67

QM59

QM80

QM52

Bank Swallow near Joan Lake

Nests in waste pile

Nest in active pit

Appendix VI. Rehabilitation and Closure Plan

A. Rehabilitation Strategic Plan

TATA STEEL MINERALS CANADA

Strategic Planning for the Progressive Restoration of Mine Sites Operated by TSMC in the Schefferville Area

August 8, 2017

NOTE TO THE READER

This strategic plan is a guiding document for planning ecological restoration activities at the various mine sites operated by TSMC in the Schefferville area. This document is intended as a useful consultation tool for communities and governments.

This document is not TSMC's closure plan.

Local communities will need to be consulted prior to the production of the closure plan. TSMC is committed to restoring its sites in close collaboration with local communities.

TSMC will not ask to be released from its responsibilities until the restoration work is carried out to the full satisfaction of local communities.

TABLE OF CONTENTS

Pictures : T² Environnement

CONTEXT AND ISSUES

The year 2017 will mark the commissioning of several new deposits for TSMC. This acceleration of production comes with many challenges for the environment team, including the progressive restoration of its various sites. The progressive restoration program must be implemented to reduce the exposure of bare soil, reduce the production of dust, restore ecosystem functions and preserve the quality of water from waste dumps and pits.

This strategic plan defines the necessary foundations for the progressive restoration of the various mine sites currently operated or that will be operated by TSMC throughout the duration of its mining activities as well as at the closure of the project. This strategic plan supports TSMC's Environment and Permitting team in evaluating restoration priorities, forming the necessary teams, defining the best restoration approaches and methods to use and defining a realistic progressive restoration schedule.

This strategic plan also describes the actions already undertaken by TSMC (Section 6) in collaboration with the universities of Laval and McGill, T^2 Environnement and Viridis Terra Innovations as well as with Earth Alive Clean Technologies Inc.

It is essential not to underestimate the complexity involved in planning and managing a restoration project of this size. The mining complex is vast, it includes several installations and the restoration requires that various environmental issues be considered simultaneously. Furthermore, restoration work must be done in a progressive manner, which adds a further level of complexity to the planning of work. Nothing can be left to chance. The following principles must therefore be respected in priority:

- The priorities and restoration targets must be defined from the start, in collaboration with the various TSMC teams that will be involved in the planning and execution of restoration work (environment teams, engineering, community relations, management, etc.).

- The team of engineers in charge of designing and operating waste dumps and pits must be consulted at the start of the restoration project in order to integrate the approaches and constraints associated with the progressive restoration of mine waste. Using this approach will minimize production costs over the long term, facilitate restoration work and reduce the total cost of restoration between now and the closure of the mining complex. The expectations and requirements of the various levels of government for the restoration of sites must be known and respected.

- The expectations of local communities must be known and considered when choosing the sites to be restored and the methods to be used. Local communities must also be involved in the implementation of restoration work.

- Several restoration options must be studied. These must integrate, among other things, the potential and constraints of the sites, the governmental requirements and the costs associated with each option that is studied.

- The selected restoration option or options must meet TSMC's goal and objectives for the restoration of its sites (see Section 2 for more details).

- The implementation of the various restoration projects must be carried out in stages, with the establishment of medium-scale pilot projects serving to test the effectiveness of the different restoration methods advocated before undertaking the larger-scale work.

- A strong spirit of collaboration must be established at the outset between the various teams responsible for restoring the sites. For example, in order to develop adapted restoration methods, researchers involved must know and integrate into their research the realities associated with the restoration objectives as well as the logistical, technical and budgetary constraints of TSMC. Similarly, the team responsible for carrying out the restoration must know the scope and purpose of the research carried out by the different teams of researchers.

The technologies and restoration approaches that will be advocated by TSMC will have to meet the restoration objectives presented in Section 2. The selection of restoration approaches and their medium- and large-scale implementation will be carried out by the various teams presented in Section 3, in collaboration with strategic partners. The sites that will be restored, the planned scope of work and the preliminary restoration schedule are presented in Section 4. The constraints, most promising restoration approaches and recommended tools are presented in Section 5 in a non-exhaustive and preliminary manner. The actions already undertaken to restore TSMC mine sites or those that will be undertaken as of 2017-2018 are for their part presented in Section 6. And finally, Section 7 presents the major steps that will be followed to implement the restoration program.

2

RESTORATION OBJECTIVES

A restoration program cannot be put in place without clearly defining the objectives. These must be defined at the outset and must be known and adopted by the management team as well as all TSMC personnel, consultants and researchers involved in the site's restoration in addition to local communities. These objectives must be considered when selecting and implementing the restoration approaches. They must be continually revisited throughout the implementation of the restoration program and modified as required if they no longer meet the expectations of TSMC or other relevant stakeholders.

The following restoration objectives must be considered for the development and implementation of the restoration program:

- The use of organic and mineral inputs that are costly to transport must be minimized and, if possible, avoided.
- The restoration must be progressive and upstream planning must be done to reduce the total cost of restoring the sites between now and closure.
- The restoration must aim for an accelerated reconstruction of natural ecosystems that is done in a functional and sustainable way.
- Restored sites must be sustainable and require minimal maintenance over time.
- The advocated restoration approaches must allow for a good control of the quality of surface and subterranean water from waste dumps and pits that have reached the end of operation.
- The advocated restoration approaches must allow for a good control of water and wind erosion from waste dumps and pits that have reached the end of operation, especially for ferrous sediments in suspension that cause a reddish colouration in the water (colloids), as well as for dust.
- The selected restoration methods must be compatible with and complementary to wildlife protection programs already in place (Bank Swallow) or programs that may be put in place in the future.
- The restoration of waste dumps and pits must be done at affordable cost compared to other restoration methods used in northern regions.
- A pilot project must be developed as of 2017 to test and compare the most promising restoration methods in a combination of climates, soils and sites.
- The restoration must be implemented in stages in order to benefit from the results generated by the pilot project.
- Restored sites must meet the needs and expectations of provincial (Quebec and Newfoundland) and federal governments.
- Restored sites must meet the needs and expectations of local communities.

3

ADMINISTRATIVE, SCIENTIFIC AND TECHNICAL RESPONSIBILITIES

This section presents the various teams responsible for implementing the restoration project for the various sites operated by TSMC.

3.1 TSMC

A restoration program of this magnitude cannot be implemented without the close involvement of key resources within TSMC. TSMC is taking the initiative of allocating all of the human and material resources necessary for the advancement of this flagship project. The TSMC environment team provides the management effort required for the administration, financing and budgetary follow-up of the restoration project. In parallel, TSMC technicians provide monitoring and conduct field audits necessary to assess the quality of restoration work and the progress of the project according to pre-established timelines. TSMC engineers responsible for the design of pits and waste dumps have been involved right from the beginning of the project to ensure that restoration methods are in line with geotechnical constraints. And finally, the environment team ensures that the results of the restoration program are communicated to other TSMC units, various levels of government, the Tata Group, local communities as well as the general population.

TSMC will also supply the equipment it has at its disposal (heavy equipment, transport equipment, pumps and other associated equipment) to prepare the sites and assist in planting and irrigation efforts.

TSMC's community relations team has the key role of consulting with local communities on local issues associated with the restoration of the sites. In doing so, it gathers local knowledge related to natural ecosystem restoration processes, develops partnerships with local resources and companies interested in working in the field of ecological restoration and ensures a transfer of knowledge at the local level.

3.2 T² ENVIRONNEMENT AND VIRIDIS TERRA INNOVATIONS

T² Environnement was selected by TSMC to coordinate the implementation of the restoration project. T² Environnement experts have worked on the various mine sites for more than 10 years now. They have carried out a multitude of biophysical inventories and have mapped the flora and ecosystems of the region. Experts from T² Environnement also coordinated the production of several impact studies for the various projects and have produced this strategic plan. Viridis Terra Innovations, for its part, specializes in the development of low-input mine phytoremediation technologies tailored to sites and to the needs of its clients. It has participated in producing the strategic plan.

Working in close collaboration with TSMC, T² Environnement and Viridis Terra Innovations are responsible for developing and implementing state-of-the-art, low-input technologies to restore sites operated by TSMC in order to bring back ecological functions and ensure their traditional use by local communities. A short description of promising ecological restoration methods for TSMC sites is presented in Section 5.

T² Environnement and Viridis Terra Innovations are responsible for preparing the sites to be restored, obtaining the inputs required for restoration at a competitive cost, coordinating work with the other teams present on the site, carrying out phytorestoration work and implementing monitoring and follow-up on the success of vegetation recovery.

3.3 LAVAL AND MCGILL UNIVERSITIES

Under the responsibility of professors Damase P. Khasa (Laval University) and Charles Greer (McGill University), a research team was formed to isolate, identify and test the symbiotic microorganisms that will have the most beneficial impacts on the growth and survival of shrubs that are typical of the northern ecosystems found in the Schefferville area. The research project developed by this team of researchers is described in Section 6. The research team's discoveries will then be tested on a medium scale during pilot projects put in place by TSMC, T² Environnement and Viridis Terra Innovations.

3.4 EARTH ALIVE CLEAN TECHNOLOGIES

Earth Alive Clean Technologies develops and distributes environmentally friendly microbial products. Its soil activator will be tested at the DS03 site, along with the isolates developed by Laval University.

SCOPE OF RESTORATION WORK AND SITES TO BE RESTORED

The restoration work contained in the strategic plan covers the following elements:

- Restoration of waste dumps
- Restoration of overburden piles
- Restoration of pits that have reached the end of operations
- Control of the quality of water from waste dumps and old pits
- Stabilization, restoration and drainage control of active roadsides, ditches and old access roads

Mine tailings (old Timmins 2 pit) are not included in this restoration strategy. At the end of the life of the DSO projects, a specific closure plan will be developed that will include tailings management. The methods developed for the ecological restoration of the waste dumps and other pits will no doubt be adapted and used for the restoration of the Timmins 2 pit once it has been filled with tailings.

The commissioning and closure sequence of the various TSMC sites is presented in the following table. Progressive restoration work must be carried out accordingly. This sequence may be modified by TSMC, depending on the realities observed in the field and in the mining plan.

Table 1

TSMC OPERATIONS SCHEDULE AND DEADLINE FOR DELIVERING A DETAILED RESTORATION PLAN FOR EACH SITE

ASSOCIATED WASTE DUMPS AND PITS	START OF OPERATIONS	DEADLINE FOR DELIVERING THE DETAILED RESTORATION PLAN	CLOSURE DATE
DSO3 SECTOR			
TIMMINS 3 N	FY* 2020	FY 2021	FY 2022
TIMMINS 4	FY 2015	FY 2018	FY 2019
TIMMINS 7	FY 2016	FY 2018	FY 2019
FLEMING 7 N	FY 2016	FY 2022	FY 2023
DSO 4 SECTOR — NEWFOUNDLAND / LABRADOR			
KIVIVIC 1	FY 2016	FY 2028	FY 2029
KIVIVIC 2	FY 2016	FY 2025	FY 2026
KIVIVIC 3	FY 2018	FY 2022	FY 2023
KIVIVIC 4	FY 2018	FY 2028	FY 2029
KIVIVIC 5	FY 2018	FY 2028	FY 2029
DSO 4 SECTOR — QUEBEC			
GOOWOOD	FY 2018	FY 2027	FY 2028
SUNNY 1	FY 2030	FY 2030	FY 2030
SECTOR HOWSE			
HOWSE	FY 2017	FY 2032	FY 2033

* FY : TSMC fiscal year (April 1 to March 31)

5 ISSUES AND RESTORATION METHODS

5.1 ISSUES

Several key issues must be considered prior to selecting the most promising methods to restore the waste dumps and pits operated by TSMC. By considering the following issues, TSMC will be in a position to develop its restoration approaches:

Remoteness

Schefferville is located 530 kilometres from Sept-Iles as the crow flies. There is no road access to the TSMC mine site. Only a railway, primarily reserved for mining convoys, provides access to the Gulf of St-Lawrence and the adjacent road network. Inputs (in particular organic matter) are not readily available unless hefty transportation costs are paid. It is therefore essential that restoration methods considered to be low input (those that require minimal amounts of organic matter, fertilizer or irrigation) are used.

Costs incurred

The selected methods must be economically affordable since they will be implemented over large areas. While economically sustainable, the selected methods must meet the needs of local communities regarding the restoration of sites.

Site ecology

Several different ecological zones and microclimates are present in the Schefferville area. Subarctic forest, or taiga, is generally present below an elevation of 650 m. As with all Arctic ecosystems, the wind plays an important role in the distribution and composition of terrestrial ecosystems. Slope orientation also influences the distribution of ecosystems. For example, it is not uncommon to observe forest ecosystems above 650 m on southwest slopes with little wind exposure.

In comparison, ecosystems located above 650 m are dominated by alpine tundra. No trees are present, apart from spruce shrubs (Krummholz) strongly deformed by the wind. Even shrubs and herbaceous plants have difficulty growing on tundra sites that are the most exposed to wind. In such conditions, their presence is limited to small depressions.

The thickness and drainage of surface deposits also play a central role in the distribution of ecosystems. Thin soils or rocky outcrops are very dry and poorly fertile, while thick soils of medium texture retain more water and are more fertile. Finally, wetlands with rich soil are found in depressions or along streams or lakes.

The choice of restoration methods must factor in the climate, the thickness of deposits and drainage. The ecological conditions that prevail in nearby natural ecosystems must be replicated as accurately as possible on the degraded sites and the plant species must be chosen carefully for the restoration project to be a success.

The short growing season of plants must also be considered in the implementation of the restoration methods that will be selected. This reduced time window makes it necessary to establish detailed and efficient logistics for the implementation of restoration techniques during the favourable season.

Toxicity and possible sources of contaminants

TSMC regularly conducts physicochemical analyses of the quality of mine waste and water on all of its sites. Waste rock and overburden from the various mine sites operated by TSMC are not acid-causing and therefore not susceptible to

acid mine drainage. No toxic substances are used in large quantities for the operation of pits and waste dumps. Only explosives residue (nitrates and diesel from the byproducts of emulsion) are likely to be present in small concentrations in the waste dump material and in the pits. These, however, are not likely to compromise the regrowth of plants that will be used for the phytorestoration. Since TSMC mine waste does not contain a significant source of acid and heavy metal contamination, restoration work will focus primarily on the ecological restoration and revegetation of sites.

The strong content of certain elements naturally present in waste rock could, however, have a negative impact on phytorestoration work, particularly for iron, magnesium and aluminum. It is also important to select restoration methods that will effectively control emissions from sediments and dust, two major environmental issues in mining projects.

And finally, point sources of contamination from hydrocarbons could be present in old mine sites operated by IOCC until 1980. This complementary concern must be considered when performing restoration work if the problem arises and represents a risk that could increase restoration costs.

Agreements with the various First Nations

TSMC has developed strong partnerships with the various First Nations that are present on the implementation territory. The agreements with First Nations regarding restoration will be respected, notably the requirements related to the closure plans. The First Nations must also be involved in the implementation of restoration activities.

5.2 METHODS

The following 3 tables present certain promising methods that are compatible with the above-mentioned issues. The restoration strategy is evolutionary and must be adapted to the realities in the field. The use of these methods must therefore be validated by field tests that are to take place from 2017 to 2019 (see Sections 6 and 7 for more details).

The tables are separated into logical sections, namely the preparation of the site to be restored (Table 2), the potential ecological restoration techniques (Table 3) and finally, the material and equipment to consider (Table 4). The following section (Section 6) details how some of these methods have been tested at TSMC's sites or will be in the coming years.

TECHNIQUE	SHORT DESCRIPTION	ADVANTAGES	DISADVANTAGES	USEFULNESS ON TSMC SITES
ROUGH AND LOOSE	An excavator using a digging bucket digs small holes on mine waste, dumping the material that is generated from the holes to create mounds between the holes.	• Greatly reduces erosion problems • Creates microsites and microhabitats that are excellent for biodiversity • Fixes the problem of mine waste compaction • Brings some fine particles back to the surface (develops a better structure favourable to plants) • Creates protection against winter and wind desiccation • Excellent for renaturalizing sites (mimics the natural processes of ecosystems) • No amendment used • Low cost	• Requires machinery • Environment remains harsh for plants	Needs to be considered for all TSMC sites (waste dumps, overburden piles and pits)
FURROWS	Alternative to the rough and loose technique. Straight furrows are burrowed using an excavator with a special triangle head.	• Easy to implement • May be completed more quickly than the rough and loose technique • No amendment used • Lower cost than the rough and loose technique	• Requires the intensive use of heavy machinery • Not as effective in creating plant habitats as the rough and loose technique • Does not mimic natural processes • Environment remains harsh for plants	Only as an alternative to the rough and loose technique
OVERBURDEN (only in places where overburden is available in sufficient quantities and can be separated from waste rock)	Overburden is the inert mineral soil found between the living topsoil and the bedrock. During mining, overburden is kept in a separate pile and may be reused after closure for restoration purposes. In the process, a layer of overburden is added over mine waste.	• Easier to establish healthy ecosystems on overburden than on waste rock and fine tailings (closer conditions to real soil) • From experience, overburden use increases productivity and success of ecological restoration activities at least 3- to 4-fold • Lower costs than importing soil and organic amendments	• Not always available on sites to restore • There is a cost to transporting it from overburden piles to the waste dumps and pits. However, through progressive restoration, it is possible to coordinate these activities with mining operations. Overburden that is removed from a new site is transported directly to an old site that is ready to be restored.	Needs to be considered for all TSMC sites where overburden is available (waste dumps and pits)

TECHNIQUE	SHORT DESCRIPTION	ADVANTAGES	DISADVANTAGES	USEFULNESS ON TSMC SITES
WOOD BIOMASS	Wood biomass is chipped as ramial wood chips (RWC) and applied on mine waste. If higher pH is necessary on mine waste, some wood biomass may also be burned and transformed into ash.	• Excellent organic amendment to restore forest and shrub ecosystems • Can be produced on-site using surrounding natural ecosystems as donor sites (for example, cut an alder stand and chip it, then the alders will sprout and grow again). It is also possible to put in place fast growing plantations • Lowest cost amendment in general (not much transport needed) • Can also be transformed into wood fibre as mulch for hydroseeding purposes • Good potential for collecting alders locally (several stands are a short distance from the sites to be restored). • Still considered a low-input option	• High carbon/nitrogen ratio, which causes a nitrogen shortage during the first year due to enhanced microbial activity that needs to be compensated	Needs to be considered for all TSMC sites (waste dumps, pits and overburden piles)
HERBACEOUS BIOMASS	On basins of fine tailings, grass can be seeded in the spring and mixed with the tailings in the fall to improve tailing conditions. Straw and hay can also be bought from farmers and applied on both waste rock and fine tailings.	• Nutrients are available more rapidly compared to wood biomass • Excellent organic amendment for the ecological restoration of mine waste • Remains a low-input option	• Poor growth rate of herbaceous species in Schefferville • Not easily economically viable to import straw and hay from the south (an option to be explored all the same)	Wood biomass should be a better option than herbaceous biomass, but local harvesting potential and the feasibility of importing the biomass should be evaluated all the same.
NO SITE PREPARATION	It is possible to plant seedlings with special substrates directly on mine waste without site preparation.	• No machinery needed • Very lost cost	• Low success rate on compacted waste • Only works with seedling plantation with special subs-trates (see Table 2 for more information) • Very slow ecosystem development	Needs to be considered for all TSMC sites (waste dumps, pits and overburden piles)

TECHNIQUE	SHORT DESCRIPTION	ADVANTAGES	DISADVANTAGES	USEFULNESS ON TSMC SITES
SEEDLING PLANTATION	Trees and shrubs are planted in biodegradable bags containing special substrates for enhanced establishment.	• Easy to implement • Low inputs needed • No machinery needed • Low cost	• Does not control erosion on the short term • Low cover density	Needs to be considered for all TSMC sites (waste dumps, pits and overburden piles)
WOODY PLANT HYDROSEEDING	Hydroseeding of indigenous tree and shrub seeds or microcuttings using a special formulation for enhanced establishment.	• High cover density effectively controls erosion • Low inputs needed • Quick development of the shrubby ecosystems of forest tundra and alpine tundra • Low cost	• Requires a pre-treatment of surfaces on waste rock and fine tailings (not normally needed on overburden) but still considered low input	Needs to be considered for all TSMC sites (waste dumps, pits and overburden piles)
HERBACEOUS HYDROSEEDING	Hydroseeding of indigenous herbaceous plant seeds or rhizomes. Some herbaceous species may be planted using seedlings collected from donor sites.	• Ideal for the restoration of ecosystems dominated by herbaceous plants • High cover density allows for effective erosion control	• Not suitable for waste rock and other rocky deposits • Requires large quantities of amendments (soil or organic) to be sustainable	Only for restoring and reconstructing wetlands
HYDRAULIC PHYTOCONTROL OF LEACHATE	This is an ecological engineering technique in which phreatophyte plants (with a deep root system) such as alders and willows within an optimal treatment design system filter leachate to avoid their transport into natural riparian ecosystems.	• Low cost compared to traditional treatment systems • Once it is in place, little maintenance is needed	• Lots of space is needed to establish the system • Inappropriate for leachate with very high concentrations of certain contaminants that may become toxic to plants	May be used to naturally filter and treat leachate at the peripheries of mine waste

Table 4 MATERIALS AND EQUIPMENT TO CONSIDER TO USE LOW INPUTS

MATERIAL AND EQUIPMENT	SHORT DESCRIPTION	ADVANTAGES	DISADVANTAGES	USEFULNESS ON TSMC SITES
HYDROGEL	Hydrogel is a biodegradable polymer which absorbs up to 1000 times more water than its initial volume. It is often used to improve water uptake by plants during periods of drought or on sites with excessive drainage.	• Maintains water in the ecosystem that can be used by plants when it does not rain for many days • Improves survival rate on sites with excessive drainage • Only one application needed	• Not all types of hydrogel have the capacity to make water available to plants during droughts • Availability of low-cost hydrogel is limited	Promising solution for waste dumps, pits, and overburden piles where the water table is very deep
TEMPORARY IRRIGATION	A temporary irrigation system is installed temporarily on the site during the first growing season to enhance plant establishment and survival and to protect them from drought.	• May help reduce the use of inputs for successful establishment of plant communities on mine waste • Equipment can be reused every year for the restoration of new areas	• Equipment must be rented or purchased • Access to water sources close to mine waste may be problematic	Promising solution for waste dumps, pits, and overburden plies where water table is very deep and where water sources (lakes, watercourses, ponds) are available
SOIL ACTIVATOR™ PRODUCT	Soil Activator™ is a bioactivator developed by Earth Alive Clean Technologies. The product is made of beneficial PGPR.	• These bacteria are known to often improve the growth and nutrition of plants	• Developed for the agricultural sector. There is therefore a high probability that the product may not be adapted to mine waste conditions and Schefferville climatic conditions • Pseudomonas is a bacteria that is highly effective in bio-weathering of rocks, which may increase toxicity to plants by heavy metals (needs to be tested)	Needs to be tested with both seedling plantation and hydroseeding
BIOSTIMULANTS — SAPROPHYTE	Saprophytic fungi are used to increase the decomposition of organic inputs so nutrients will become available more quickly to plants and to accelerate the formation of soil.	• They can improve plant productivity by more than 15% • Help stabilize organic inputs on-site by acting as a natural adhesive, thereby reducing erosion • Help reduce the quantity of organic inputs needed for successful restoration activities • Considered the most effective microorganisms in bioremediation, particularly when it comes to decontaminating sites that have been contaminated by hydrocarbons	• It takes several weeks before being effective for stabilization. As a result, the use of vegetative gum is required to resolve the problem on the short term when hydroseeding	Only use when wood or herbaceous biomass is applied

MATERIAL AND EQUIPMENT	SHORT DESCRIPTION	ADVANTAGES	DISADVANTAGES	USEFULNESS ON TSMC SITES
BIOSTIMULANTS — ROOT SYMBIONT	Symbionts are symbiotic microorganisms associated with plant roots that are known for greatly increasing plant survival, establishment, growth, and nutrition on degraded lands such as mined sites. Laval University is currently working on developing biostimulants adapted to TSMC sites which thrive in forest tundra and alpine tundra ecosystems.	• They may improve seedling survival by up to 75%, health by up to 130% and growth by up to 115% on mine waste • Helps reduce the quantity of amendment needed for successful restoration activities • Low-cost technology for the restoration of large areas • Low-input technology • Long-term effect	• Often site-specific and species-specific. As a result, when several plant species are used and work is done on sites with very different soil conditions there is often a need to develop several biostimulants.	Ensure the compatibility between our restoration methods and the biostimulants developed by Laval University. Needs to be tested on different TSMC sites with both seedling plantation and hydroseeding
MINERAL SUPPLEMENT	Based on the study of the ecological and climato-edaphic conditions of TSMC sites, factors limiting plant growth will be identified. Mineral supplements will be added as needed to offset the limiting factors.	• Reduces toxicity to plants by heavy metals • Increases the availability of limiting elements • May be used to change the pH, which has an effect on nutritional and trace element availability to plants • Improves plant nutrition and productivity on degraded sites when applied correctly	• Plants generally assimilate only around 50% to 60% of the supplement • Short-term effect	If needed, various mineral supplements will be tested to find the optimal formulation for the successful, low-cost ecological restoration of TSMC mine waste
SPECIAL SUBSTRATES FOR SEEDLING PLANTATION	Based on the study of the ecological and climato-edaphic conditions of TSMC sites, vital substrate conditions for seedling establishment will be determined.	• Based on experience, the selection of the right type of bags and plugs with special substrates in which seedlings will grow is fundamental for the establishment, survival and growth of seedlings outplanted on mine waste	• May need to import materials from Sept-Iles to make the special substrates	Different types of bags and plugs with special substrates will be tested to find the optimal plantation technique for TSMC sites

Added to these restoration methods are the tools to manage restoration work. Several management software programs exist to plan restoration work and ensure long-term monitoring of restored sites. TSMC is evaluating the need to acquire one of these tools and the possibility of developing its own database.

6

RESTORATION STEPS THAT HAVE ALREADY BEEN UNDERTAKEN

The previous section was dedicated to the issues and restoration methods that have a high potential of sustainably restoring the degraded ecosystems in the Schefferville area. This current section is the logical continuation as it presents restoration actions that have already taken place or that will be undertaken in the coming years to restore sites degraded by TSMC operations. These approaches can also be used to restore other sites degraded by mining activities in the Schefferville area.

6.1 PREVIOUS ECOLOGICAL STUDIES OF ECOSYSTEMS ON THE TSMC SITE

Comprehensive ecological surveys and detailed mapping of terrestrial ecosystems (TEM) were performed for all TSMC sites, including DSO2 (Ferriman and Star deposits), DSO3 (Timmins and Howse deposits) and DSO4 (Kivivik, Sunny and Goodwood) prior to operations. This information will be used as a basis for preparing the restoration plans. The TEM data will be complemented by a site visit to the already disturbed sites of Timmins 1 and Timmins 4 in 2017 and the Kivivik sites in 2018. TEM ecological data as well as data from future

field visits will be carefully analyzed using GIS and modelling tools to extract all of the key elements for restoration purposes.

In addition, physicochemical and mineral composition analyses as well as the leach tests that were previously done for mine waste that will be generated for several TSMC sites will be carefully analyzed to create a complete picture of the deficiencies and toxicity problems that may be encountered on the various sites to be restored.

6.2 APPLIED RESEARCH PROJECT WITH LAVAL AND MCGILL UNIVERSITIES

Efforts by T² Environnement and Viridis Terra Innovations resulted in securing a research grant of $100,000 per year for three years with the teams of Dr. Damase Khasa of Laval University and Dr. Charles Greer of McGill University. Associated research work, spanning from 2016 to 2019, will develop new green technologies related to the ecological restoration of TSMC mine sites in Schefferville. T² Environnement and Viridis Terra Innovations, as well as TSMC, have invested several tens of thousands of dollars in research and development time, laboratory analyses and logistical support costs to complement the $300,000 over three years that will be paid by the Fonds de recherche du Québec — Nature et technologies (FRQNT). Dozens of potential symbiotic microorganism strains have been isolated in the laboratory since the beginning of the project using root and soil samples collected at the TSMC site. These microorganisms will be tested in the lab (in vitro) and in a greenhouse (in vivo) in the fall of 2017 to test their ability to grow in mine waste and improve the survival rate and growth of five key plant species (Picea mariana, Betula glandulosa, Vaccinium uliginosum, Alnus crispa and Salix sp.), species which are particularly abundant in forest tundra and alpine tundra ecosystems and on mine waste from TSMC sites. The most promising strains will be tested directly on TSMC sites (in situ) as of 2018 to determine their effectiveness as biofertilizers. T² Environnement, Viridis Terra Innovations and TSMC will closely monitor the progress and results of this research project. Biofertilizers developed as part of this project will be integrated into pilot tests and mid-scale restoration activities at the Timmins 1, Timmins 4 and Kivivik sites.

6.3 TRIALS OF PRODUCTS DEVELOPED BY EARTH ALIVE CLEAN TECHNOLOGIES

In 2017, TSMC is testing another product made by Earth Alive Clean Technologies called Soil Activator™ for the restoration of roadsides. T² Environnement and Viridis Terra Innovations will include Soil Activator™ in tests at Timmins 1 in 2018.

7

NEXT STEPS

The implementation of a restoration plan for all TSMC operations in the Schefferville area involves a variety of considerable technical and logistical challenges, notably relating to the harsh climate, the short growing season, the low amount of organic matter that is available and the factoring of the concerns of local communities.

7.1 2017-2019 PLANNING

As described in the previous sections, small- and medium-scale pilot tests (over an area of about 10,000 m^2) will first be carried out in order to develop sustainable restoration approaches. These tests will take place at the DS03 sector in 2017 and 2018 (forest taiga) and later at the DS04 sector (alpine tundra). Once the effectiveness of the pilot tests has been demonstrated, restoration approaches will be replicated over larger areas. These will be adapted to factor in the climate and soil specificities of each site in order to develop the restoration plan for all TSMC operations in the Schefferville area.

7.2 RESTORATION PLAN EXTENDED TO OTHER TSMC SITES

The major steps to be taken to produce the restoration plan for all TSMC operations in the Schefferville area are presented here.

The scale of the restoration to be carried out (number of sites, types of sites and area per site to be restored) must first be identified in order to develop a realistic implementation schedule. For the restoration of the sites to be a success, it is essential to take into account the concerns of stakeholders not only at the start of the project but also throughout its implementation.

Each site to be restored is different. Its ecology, hydrology, hydrogeology, geochemistry and geotechnics must therefore be carefully studied in order to develop a restoration method that is adapted to the biophysical realities of the site.

It is also necessary to optimize the restoration objectives presented in Section 2 based on the results obtained during the pilot tests and the concerns of local communities for the entire duration of the restoration project.

Starting in the summer of 2017 and in close collaboration with TSMC, the First Nations and other stakeholders will be consulted during an exploratory meeting to integrate their knowledge and their concerns into the 2018 and 2019 pilot tests. A transfer of knowledge at the local level will be implemented at such a time as deemed appropriate by the parties and various partnership possibilities will be evaluated.

The large-scale restoration of the sites will require rigorous management, the involvement of several participants and restoration spanning several years on sites with varied climatic and ecological conditions. The pilot tests currently in progress will help develop a functional restoration approach adapted to the realities of the site that can be used to solve other environmental problems present in the Schefferville area.


TATA

B. 2018 Progress Report

Environnement

Viridis Terra
INNOVATIONS

Ecological Restoration of TSMC Mine Sites

2018 Ecological Restoration Trial Establishement: Progress Report at Timmins 4

December 18th, 2018

Table of contents

T^2 Environnement Working Team

Hugo Thibaudeau Robitaille, biologist, M Sc.	Project management, inventory, data analysis, report and protocol writing
Daniel Tarte, biologist	Inventory, data analysis, quality control
Camille Auger, biologist	Data analysis, protocol writing
Robert Lebrun, Technician	Geomatics, mapping

Viridis Terra Innovations Working Team

Martin Beaudoin Nadeau, RPF, M Sc.	Inventory, data analysis, report and protocol writing
Evgeniya Smirnova, S.E., PhD	Inventory, data analysis, report and protocol writing

Tata Steel Minerals Canada Limited (TSMC) Working Team

Mariana Trindade, PhD, Corporate Environmental Manager	Project coordination, quality control
Tara Oak, Senior Environmental Coordinator	Onsite logistics support, quality control
Jean-François Dion, Environment technician	Inventory (seed collection), onsite logistics support

This report is formatted for both sides printing.

The appropriate citation for this document is:

T2 Environnement and Viridis Terra Innovations. 2018 Ecological Restoration Trial Establishment: Progress Report. Technical report submitted to Tata Steel Mineral Canada. 27 pages + appendix.

1 INTRODUCTION

The year 2018 marked the implementation of the first restoration trial at the Timmins 4 site. Several actions have taken place since 2016 to set the basis of this ambitious research and development project. However, the restoration trial implementation is a cornerstone in the Tata Steel Minerals Canada Limited (TSMC) strategy and, if successful, will allow a systematic, efficient and cost-effective ecological restoration of the sites disturbed by mining activities.

T^2 Environnement (T2) and Viridis Terra Innovations (VTI) recognize TSMC's needs to sustainably-restore their decommissioned mined sites to meet regulatory requirements and satisfy local community needs for an effectively-reclaimed natural environment. In addition, our team has done everything in its control to obtain further research funding, including from the Québec Fonds du Plan Nord, Natural Resources Canada (NRCAN) among others, and developed all required links with university researchers to increase the project's quality, reduce costs, and develop other necessary research programs for the benefit of TSMC. T2 and VTI will also invest time and resources in the coming year to create a research and development project (Phase 2) to implement at a larger scale the best restoration solutions.

Past, present and future milestones of the restoration project are presented in Section 2, while the details of the activities performed in 2018 are presented in Section 3. Section 1.1 presents the project objectives jointly set in 2017 by TSMC, T2 and VTI. Finally, all detailed protocols developed to implement the 2018 restoration trial at Timmins 4 are included in the Appendix.

1.1 PROJECT OBJECTIVES

As a reminder, the following restoration objectives were identified in the Strategic Restoration Plan (TSMC, 2017) for the development and implementation of the TSMC restoration program:

- The use of organic and mineral inputs that are costly to transport must be minimized and, if possible, avoided.
- The restoration must be progressive and upstream planning must be done to reduce the total cost of restoring the sites between now and closure.
- The restoration must aim for an accelerated reconstruction of natural ecosystems that is done in a functional and sustainable way.
- Restored sites must be sustainable and require minimal maintenance over time.
- The advocated restoration approaches must allow for a good control of the quality of the surface and subterranean water from waste dumps and pits that have reached the end of operation.
- The advocated restoration approaches must allow for a good control of water and wind erosion from waste dumps and pits that have reached the end of operation, especially for ferrous sediments in suspension that cause a reddish colouration in the water (colloids), as well as for dust.

- The selected restoration methods must be compatible with and complementary to wildlife protection programs already in place (ex. Riparia riparia or Bank Swallow) or programs that may be put in place in the future, such as the exclusive use of indigenous species in all restoration programs.
- The restoration of waste dumps and pits must be done at affordable costs compared to other restoration methods used in northern regions.
- A pilot project must be developed starting in the fall of 2017 to test and compare the most promising restoration methods in a combination of climates, soils, and sites.
- The restoration must be implemented in stages in order to benefit from the results generated by the pilot projects.
- Restored sites must meet the needs and expectations of provincial (Quebec and Newfoundland & Labrador) and federal governments.
- Restored sites must meet the needs and expectations of local communities.

The 2018 restoration trial implemented by T2 and VTI respects each of the above objectives.

2 PROJECT HIGHLIGHTS AND MILESTONES SINCE ITS BEGINNING IN 2016

Two years have passed since the beginning of the restoration project. It is consequently time to recall past project milestones and have a look at what is coming. The following table presents, milestone by milestone, the historical highlights of the restoration project and forecasts where it should be one year from now.

Table 1 Past, Present and Future Project Milestones

Project Milestone	Description	Date
Research grant submission (FRQNT)	Laval and McGill Universities, T2, VTI and TSMC submitted a $300,000 grant application at the Fonds de recherche du Québec – Nature et technologies (FRQNT). Our team was in competition with many other highly competitive teams of researchers and practitioners.	February 2016
FRQNT awarded the grant	Our team won the competitive process and started the project named: Isolation, identification and selection of root vegetable symbionts to improve the rehabilitation of the habitats of the Arctic tundra of Québec affected by mining activities.	May 2016
Roots, soil and mining waste collection	Our team went to the TSMC site to collect roots of four targeted plant species, associated soil and mining waste. Roots, soil and waste symbionts were rapidly extracted and conserved for isolation and extraction.	July and August 2016
TSMC awarded a contract to T2 and VTI	Our team supported TSMC in developing its mine restoration objectives and program as well as its research and development vision.	December 2016
Mycorrhizae and bacteria insolation and identification	Mycorrhizae were isolated and identified at the University Laval laboratory. Bacterial diversity using environmental DNA techniques was analyzed at the Natural Research Council of Canada (NRCC) laboratory.	February 2017
2017 joint workshop	The FRQNT research team met to present their preliminary results and plan the coming two years research objectives. An action plan was produced and used since then to follow up with the project. TSMC received four times a year a progress report based on the action plan.	March 2017
Restoration strategic plan	The document “Strategic planning for the progressive restoration of mine sites operated by TSMC in the Schefferville area” was jointly developed by T2/VTI and TSMC. The document supports TSMC’s Environment and Permitting team in evaluating restoration priorities, forming the necessary teams, defining the best restoration approaches and methods to use and defining a realistic progressive restoration schedule.	June 2017
2017 summer fieldwork	Two field teams sampled old IOC waste dumps (waste samples and ecological description), selected potential sites to restore, sampled the surrounding natural environment (soil samples and ecological description) and collected seeds of the targeted shrub species.	July 2017

Project Milestone	Description	Date
2017 seed harvest	Glandular birch (Betula glandulosa), green alder (Alnus viridis), and bog blueberry (Vaccinium uliginosum) seeds were collected for the 2018 restoration trial. Seeds were processed and stored at MFFP facilities in Berthier, Québec.	September and October 2017
2017 fall restoration trial	T2/VTI team went in the field to implement a small-scale preliminary restoration trial at the Timmins 4 site to see if late fall restoration activities may possibly be realized and successful. Both seedling and hydroseeding techniques were used. Planeleaf willow cuttings were also collected at the same time for the 2018 restoration trial.	October 2017
TSMC Restoration and logistics plans	T2 and VTI submitted to TSMC the "2017-2018 Ecological Restoration Trial Plan for the Timmins 4 Site". This document presents the following core data: waste dumps/natural ecosystems edaphic and ecological description, phenology of the targeted plant species, restoration methods to be used, and comparison with other mining restoration projects. The logistics plan was submitted at the same time to provide TSMC with a detailed restoration trial implementation schedule, action items and dedicated teams.	February 2018
In vitro lab and In vivo greenhouse test of the developed inoculum	Laval University researchers are testing the most promising strains of mycorrhizal fungi and endophytes in vitro (in Erlenmeyer's) and in vivo (in greenhouses) to develop an inoculum that can be tested in the field at the TSMC site.	February 2018 to March 2019
Restoration trial implementation at Timmins 4 site	As described in Section 3 and in the protocols presented in the Appendix, a medium-scale restoration trial was established at the Timmins 4 site. The trial was designed to statistically test several restoration techniques, site preparation techniques, plant species and irrigation in order to start adapting and optimizing the restoration technologies for TSMC sites and developing the most successful ecological restoration strategy at low costs.	June 2018
2018 restoration trial first monitoring	Plant growth and survival rate data were collected at the Timmins 4 site. Several locations were also evaluated at the DSO4 site to implement the 2019 trial.	September 2018
2018 seed harvest	Glandular birch, green alder and black spruce seeds were collected for the 2019 restoration trial.	September and October 2018
2018 Progress report	The 2018 Ecological Restoration Trial Establishment – Follow-up Report was submitted to TSMC. The document included all protocols used for the 2018 restoration trial establishment as well as several photographs.	Start of November 2018
Willow cuttings harvest and storage	Planeleaf willow (Salix planifolia) cutting harvest along the Schefferville TSMC site road and storage near the TSMC camp.	October-November 2018
Planning Phase 2 of the research and development Restoration project	Phase 2 will be dedicated to adapt and implement restoration techniques at a larger scale to restore entire waste dumps and pits. Among potential research topics are: northern greenhouse production; shrub and cutting orchards development; use of some adapted indigenous grass species; large scale production of an inoculant; etc.	October 2018 to March 2019

Project Milestone	Description	Date
	The development of phase 2 will lead to a grant submission to one or several of the major funding sources.	
Statistical analysis of the 2018 plantation data	Perform required statistical analysis to evaluate survival and germination rates for different species, site treatments and used amendments. The 2018-2019 Ecological Restoration Trial statistical analysis is to be submitted before the end of the year to TSMC.	November and December 2018
Proposal submission (2019-2020)	T2 and VTI will submit a proposal to implement the restoration activities in 2019 and plan restoration activities of 2020.	January 2019
2019 restoration trial implementation	T2 and VTI will implement the 2019 restoration trial. Among planned activities are to test the inoculum developed by Laval University, multiply the number of sites tested (DSO4, Timmins 1), test site adapted indigenous grass species and start testing bio-engineering techniques for Timmins 1 slope stabilization.	June and July 2019

3 2018 RESTORATION TRIAL ESTABLISHMENT AT THE TIMMINS 4 SITE

2017-2018 was the first period of our ecological restoration trial implementation. As with any research and development project, the first year is of paramount importance to calibrate the project protocols and find new solutions to overcome challenges or unexpected events. This section is dedicated to presenting the findings of our 2017-2018 restoration trial establishment and to highlighting the potential solutions to improve the project deliverables and fieldwork activities. Each subsection is associated with a restoration activity implemented in 2018.

3.1 SEEDLINGS PRODUCTION, TRANSPORT AND PLANTATION

Native shrubs and tree seedlings are very useful to rapidly colonize and restore a mining site. The targeted species were selected for their capacity to colonize TSMC waste dumps and resist harsh climatic and edaphic conditions, as demonstrated in detail in the T2/VTI Restoration Plan (T^2 Environnement and Viridis Terra Innovations, 2018). All seedlings were grown from seeds collected at the TSMC site, close to the site selected for the restoration trial, except for black spruce (Picea mariana) (seeds came from the MFFP). Shrub and tree seedlings were produced in greenhouses in southern Quebec, at the Pépinière Boucher site in the Lac Saint-Jean region. They were sent to Sept-Îles by truck and then to Schefferville by train in a refrigerated railcar. A flatbed truck was used to bring the seedling to the TSMC mining site for further preparation and plantation. The seedling protocol is available in the Appendix, with additional details on the methodology used for the 2018 restoration trial implementation.

Table 2 Seedling Production, Transport and Plantation: Findings and Potential Solutions

Findings	Potential solutions
Seedlings produced by Pépinière Boucher from seeds collected in the Schefferville region in fall 2017 were abnormally small, which is not ideal for the plantation.	Perform a site visit at various seedling producers; analyze the infrastructure and product quality; select and work with a new seedling producer. Seedling producers to visit are the following: Girardville, St-Modeste and Pépinière Aiglon.
Seedlings were out of dormancy. Temperatures in Saguenay were above 20°C during the shipping period, and close to 0° C (less than 0° C at night) at the DSO3 camp site.	Produce the seedlings on a two-year cycle outdoors or for 8 months non-stop in a heated greenhouse, put them into dormancy in a cold chamber in November for 7 months, and ship these dormant seedlings to the TSMC mine at the end of May or early June in a refrigerator at a maximum temperature of 4°C. Working this way should fix the problem of transport and acclimation.
Transportation logistics between the Pépinière Boucher site in the Lac Saint-Jean region and Schefferville were very challenging and demanding for the T2, VTI and TSMC transport logistics team. Seedlings nearly missed being shipped by train from Sept-Iles to Schefferville due to a logistical mistake from the delivery company (Purolator).	Seedling production down south could be tested again in 2019, but only under the conditions to meet good growth and transportation standards.
Vaccinium uliginosum (bog blueberry) did not tolerate well the transport from Saguenay to Schefferville by truck and train and acclimation was very difficult (most seedlings turned brown after one week at the DSO3 camp) due to significant temperature differences. The seedlings were very small and not dormant.	• Prepare the seedlings in Schefferville (at lower elevation compared to the TSMC site) where temperature is warmer and less windy for better acclimation. • Use low-tunnel with P-19 membrane (used in vegetable growing) for better acclimation to protect the seedlings from cold wind and frost.
Betula glandulosa (glandular birch) better tolerated the transport, but acclimation was also very difficult and had a negative impact on seedling quality and viability. The seedlings were not dormant.	
Alnus viridis (green alder) seedlings were tall enough and in good shape when they were unpacked at the TSMC camp, but they began to show signs of hard acclimation after more than 7 days on site. Cold temperatures at the TSMC site adversely affected alder acclimation.	
Picea mariana (black spruce) seedlings produced by Pépinière Boucher were too small and weak to be planted.	Perform a site visit at various seedling producers; analyze the infrastructure and product quality; select and work with a new seedling producer. Seedling producers to visit are the following: Girardville, St-Modeste and Pépinière Aiglon.

Findings	Potential solutions
Humidification of the plantation substrates at site was inadequate due to lack of access to water with a watering hose.	• Humidify the plantation substrate (peat moss) with warm water before seedling transplantation into the bag in order to provide the seedling with the optimal level of humidity. • Connect a garden hose to the TSMC water system or to a 1000-L container close to where the seedlings are processed before outplanting and water the seedlings when necessary.
Fall plantation is not possible due to the very harsh environment of the mined sites and lack of time for the seedlings to establish a well-developed root system before winter.	Outplant dormant seedlings in late spring or early summer.
Prior to planting, the seedling storage location was not protected from cold wind, which weakened the seedlings.	
To overcome the restoration challenges associated with unfit seedlings, the team transplant seedlings (glandular birch and bog blueberry) naturally growing on old IOC mining waste dumps (Flemming 7 sector) into the plantation substrate (burlap bags and Jiffy pots with plantation substrate). These locally-grown seedlings were then outplanted at the Timmins 4 site.	Transitionally (in 2019 and potentially in 2020, until dormant seedlings from south and local orchards are ready) use shrub seedlings growing naturally in disturbed sites located close to the sites to restore. The seedling harvesting must be done sustainably in order to not compromise restoration of other waste dumps.
The main plantation substrate (peat moss) was dry and very difficult to moisten.	Add biochar/charcoal to the planting substrate or on the top of planting bags and pots in order to optimize its physical and chemical properties.
Locally grown glandular birch and bog blueberry seedlings showed positive signs of establishment and regrowth in September when the restoration trial was monitored.	• Collect seedlings on the area surrounding the site, treat them (rooting fertilization) and replant them. • Consider establishing small local orchards for targeted species (willow with cuttings, birch, alder, bog blueberry with seeds or locally-collected seedlings) and analyze seedling growth time to reach maturity before outplanting. Find potential places to establish these orchards (protected from dominant wind, with a high snow accumulation, sunny, with proper soil properties).

Selected photos

Back spruce seedlings

Bog blueberry seedlings

Glandular birch seedlings

All the above seedling photos were taken at Pépinière Boucher in Lac Saint-Jean, prior to their transfer at the TSMC site. Notice the small size of the black spruce and bog blueberry seedlings. Larger size black spruce seedlings from a southern provenance were also sent to compensate for the small size of the seedlings grown specifically for TSMC.

Seedlings transplantation at TSMC camp

Seedlings protection from night frost

Seedlings are transplanted from small size plug plant trays into Jiffy and burlap bags. Seedlings were also protected from night frost for the first 10 days using plastic tarps and bedsheets.

Seedling plantation at Timmins 4

Overall view of the restoration block 1

Green alder and glandular birch seedlings grown from locally-collected seeds and black spruce seedlings from southern provenance seeds. All above seedlings where grown at the Pépinière Boucher in Lac Saint-Jean.

Glandular birch and blueberry seedlings harvested in old IOC waste dumps and transplanted on Timmins 4 site.

Dead seedling

Excess of hydrogel in Jiffy pot

Green alder growth after one growing season. All green alder seedlings came from Pépinière Boucher.

Seedlings plantation at the reference site, in a natural terrestrial ecosystem

Seedlings planted at the reference site, in a natural terrestrial ecosystem

Seedling survival measurements were taken during the fall 2018 monitoring visit. Seedlings survival rates after one growing season will be statistically assessed before the end of 2018.

3.2 CUTTINGS HARVEST, STORAGE AND PLANTATION

Willow cuttings are available locally and therefore represent an efficient and cost-effective way to colonize TSMC waste dumps. Planeleaf willow branches were harvested in late October and early November 2017 and stored between two decommissioned trailers, close to the camp, where snow accumulates during the winter. The cuttings had been previously covered with insulating foam and plastic tarps. Stems were cut, soaked in water for several days and then used for restoration purposes. The cuttings protocol is available in the Appendix as well as further details on the methodology used for the 2018 restoration trial implementation.

Table 3 Cutting Harvest, Storage and Plantation: Findings and Potential Solutions

Findings	Potential solutions
In general, the willow cuttings were in good shape when dug out from the snow in June 2018.	
The stored willow stems that were the most humid (at the bottom of the pile) had a small amount of mould on them.	Do not overwater the willow stems before storage to avoid mold development on the bark during winter.
The first row of willow stems was submerged in water in the spring causing further mould problems.	Raise the bundles of willow stems from 1 foot to 2 feet above the soil surface for storage to avoid the problem of flooding in the spring or place them on a platform that drains excess water (perforated).
It was inefficient and not safe to manually dig out the bundles of willow stems between the two camp dorms where they were stored for the winter.	Store the bundles of willow stems on the north-east side of the old camp dorms close to the wall, where snow accumulates and melts very slowly. If they are stored in this location, select an area where it is possible to dig the bundles out with a small excavator (i.e., in an easier and safer way).
Willow cuttings used on the site did not have “conventional” age and size: less than 5 years old, 1 to 2 cm in diameter (i.e., they were much older), therefore it was not possible to predict the same results reported in the literature. Furthermore, to our knowledge, it is the first time that cuttings have been produced from Planeleaf willow.	Aside from larger willow stems, as a potential alternative of the raw material if not abundant enough, there is a possibility to collect small one-year willow stems that are usually not used with larger willow cuttings, root them in seedling containers and replant on site.
Willow cuttings showed great signs of regrowth in September when the restoration trial was monitored.	
A positive correlation was noted between cutting lengths and diameter and cuttings establishment and survival.	

Selected photos

2017 cutting harvest: cutters received by train cargo (3 days later than expected) and pile of cuttings just before transportation up to site

Cuttings storage

Planeleaf willow large cuttings after one growing season

Overall view of a planeleaf willow large cuttings plot

Planeleaf willow large cuttings (60 cm) planted horizontally and vertically for the slope stabilization small scale trial

Overview of the slope stabilization small scale trial

Root system of a horizontally-planted planeleaf willow cutting

3.3 HYDROSEEDING

Hydroseeding is a good way to quickly establish a high density cover of shrub and tree communities at low cost without requiring substantial inputs. Shrubs and tree seeds are collected in the fall. Hydroseeding activities with the well-mixed formulation including mulch, water, fertilizers, seeds, biofertilizers, plant glue and hydrogel may be done in the fall before snowfall or in early spring when the snow has melted. The micro-cuttings are applied before the hydroseeding. The hydroseeding protocol is available in the Appendix to find further details on the methodology used for the 2018 restoration trial implementation.

Table 4 Hydroseeding: Findings and Potential Solutions

Findings	Potential solutions
The hydroseeding activities went very well and only took one day of preparation and one day of application.	
Hydroseeding cannot be conducted in temperatures below 0°C due to ice formation in the hose.	Only carry out the hydroseeding activities when temperature is above 0°C.
Transporting the hydroseeder between the water source and the restoration site takes more time than the hydroseeding activities at the Timmins 4 restoration site.	Create artificial waterproof watering basins close to the restoration site in order to reduce transport during hydroseeding activities. These basins could also be used for irrigation purposes.
Black spruce and glandular birch emergence was successful, with up to 50 small seedlings per 50 cm*50 cm plot. These seedlings were well established, but very small due to the short growing season. Not many alder seedlings were found growing in the hydroseeding plots. Alder may therefore not be a good species to use with hydroseeding. However, longer term monitoring will confirm this hypothesis, as alder and birch seedlings look very similar when young. No blueberry emergence was observed during the fall 2018 monitoring. It appears that seed viability of blueberry is not high enough to be used with hydroseeding activities.	Based on 2018 results, adapt seed quantity in the hydroseeding formulation in order to obtain sought density.
Micro-cuttings were performing better at the bottom of the rough and loose holes where more water accumulated, as these dry and die if they lack water during early establishment. Overall, micro-cuttings establishment and survival was low compared to 30-cm cuttings or 60-cm cuttings planted vertically or horizontally.	Based on results from other restoration projects in Quebec, micro-cuttings need to be applied during site preparation and buried under few centimeters of soil in order to obtain more recovery.
It was very expensive and time consuming to mobilize the hydroseeder to the TSMC site. Shipping logistics to return the hydroseeder back to the south was also difficult, requiring VTI to pay for the lease of another hydroseeder for the summer period.	TSMC should purchase a hydroseeder and keep it on site to avoid high shipping costs and unnecessary delays. The hydroseeder may also be used for other tasks such as roadside restoration.

Selected photos

Hydroseeding mix preparation

Hydroseeding an experimental block plot

Hydroseeded experimental plot

50 cm X 50 cm quadrant used for hydroseeded plot monitoring and small black spruce seedlings

Small glandular birch seedling

Small glandular birch seedling

Root system of small hydroseeded seedlings

3.4 SITE PREPARATION

Site preparation is essential to protect seedlings, cuttings and hydroseeded plots from excessive wind and frost. It is also required to provide the seedlings and cuttings with an adequate substrate for plant growth (deep uncompacted rooting, nutrient availability). Slope was reshaped to reduce steepness from 35-40º down to 25º. The rough and loose technique was then implemented in parts of the experimental blocks to increase surface roughness and decrease mining waste bulk density. Overburden was then spread at the surface over some restoration plots. The site preparation protocol is available in the Appendix, with further details on the methodology used for the 2018 restoration trial implementation.

Table 5 Site Preparation: Findings and Potential Solutions

Findings	Potential solutions
2017 fall site preparation led to an unstable slope and landslide of the bottom half of the slope in the spring during the melting of snow.	• Reshaping the slope should be done one year in advance (at minimum the fall prior to the plantation) to allow the slope to stabilize before outplanting and seeding. • The optimal depth of digging for the rough and loose technique implementation should be investigated in order to avoid unnecessarily destabilizing the waste dump slopes. In order to do so, the following measurements of the waste dump surfaces must be taken: signs of erosion, slope failures, rough and loose mound height and shape.
Heavy machinery was not available on time in June 2018 and put the project in jeopardy.	• The heavy machinery must be reserved 4-5 months in advance and T2/VTI should have definite confirmation from the TSMC mining team that the needed heavy machinery will be available for targeted dates or; • T2/VTI should get an approved purchase order for field activities in January of the year and subcontract the heavy machinery needed for site preparation.
With a 5-day delay and after long discussions and logistical organization with the TSMC mining team, the required heavy machinery was acquired and site preparation completed.	
As soon as the heavy machinery was available, the site preparation went smoothly and took 3 days in total.	

Selected photos

Timmins 4 waste dump slope reshaping

Overburden added over rough and loose plot

General overview of the Timmins 4 restoration block 2 (with and without rough and loose)

3.5 IRRIGATION

Irrigation is essential to ensure an adequate survival rate of the seedling/cutting plantations and hydroseeding. It could be critical for the hydroseeding and cuttings, in particular during the first three weeks when seeds germinate and the cuttings root system is established. A network of 20 wobblers was installed on half of the experimental blocks. No water truck was available, despite having been included in the purchase order with the local community. Therefore, five 1000-L containers were installed to provide minimal irrigation to the planted and hydroseeded plots. The irrigation protocol is available in the Appendix, with further details on the methodology used for the 2018 restoration trial implementation.

Table 6 Irrigation: Findings and Potential Solutions

Findings	Potential solutions
TSMC did not have the resources and time to conduct the irrigation treatment as presented in the protocol delivered at the end of June 2018.	• Have a T2/VTI supervisor on site who coordinates summer and fall watering activities. • Secure the access to a nearby water source. • Have access to a water truck, either from TSMC or from local communities. • Collect snow and rain water in a nearby waterproof basin or other type of installation.
No community members were available to water the planted and hydroseeded plots.	

Selected photos

1-inch pipe secondary level irrigation network with wobbler and close-up of 1-inch pipe

2-inch pipe (blue) primary level and restoration block 1 irrigation system overview

3.6 MANPOWER

Local manpower is essential to ensure the success of TSMC's restoration activities, in particular for seedling and cutting plantations, plantation maintenance and monitoring, seeds/cuttings collection as well as relations and knowledge transfer with local communities. The local manpower integration in the 2018 restoration trial was carefully planned in the T2/VTI logistics plan submitted to TSMC in January. However, the purchase order to involve local communities was only awarded in late June 2018, when the restoration trial was implemented.

Table 7 Manpower: Findings and Potential Solutions

Findings	Potential solutions
The local community members that were supposed to support seedling preparation did not show up. Three people came to help only for half a day during planting of the seedlings but were inefficient. These situations subsequently put the restoration trial in jeopardy. Several contacts were made by TSMC with a representative of the local community to correct the situation, without any success.	• T2/VTI to negotiate with TSMC and local communities to ensure the percentage of planned manpower from the Schefferville region is sufficiently small such that it does not compromise the project if they do not show up. • T2/VTI get an approved purchase order for field activities in January 2019 and take care of the subcontracting of manpower for field and monitoring activities of the coming spring and summer, including with local communities. • One local staff is hired by T2/VTI (part-time or full time, to be determined according to TSMC needs) to take care of the restoration logistics (seeds/cuttings collection and storage; seedling orchards; site preparation; plantation; watering, restored sites monitoring, data collection, etc.).
The T2/VTI team spent substantially more time on site than planned to attempt to solve of the manpower problem.	
The T2/VTI team worked long hours (16 to 18 hours per day) and stayed 3 days longer on site to overcome the lack of manpower. The restoration trial design was also adapted, lowering the number of experimental blocks from 5 to 3.	

4 CONCLUSIONS

T2 and VTI overcame many technical and logistical challenges to establish the Timmins 4 site restoration trial. The results of the restoration project are still more than satisfactory and it is clear that the deployment of the project in 2019 will benefit from the lessons learned in 2018. Several recommendations are made in Section 3 to improve the project implementation, which should be followed in 2019 in order to increase the quality of the deliverables and optimize the contribution of all working teams involved in the T2/VTI restoration project.

T2 and VTI are committed to support TSMC in developing the second phase of the research and development project. Technically and economically viable solutions must be developed to bring the ecological restoration to an industrial scale in order to restore larger waste dumps and pits.

5 LIMITATIONS

This document describes the ecological restoration activities performed at the TSMC Timmins 4 site, and more widely summarizes the restoration project activities conducted to support the ecological restoration of the TMSC mining site. This document is intended as a useful consultation tool for TSMC and its partners.

It is important to note that the local communities will need to be consulted prior to the production of the closure plan. TSMC is committed to restoring its sites in close collaboration with local communities. TSMC will not ask to be released from its responsibilities until the restoration work is carried out to the full satisfaction of local communities.

This document is meant to be consulted as a whole. A section of the document cannot be cited out of its context. This document was made for the exclusive usage of Tata Steel Mineral Canada Limited (TSMC) and contains confidential information developed through T2 and VTI respective research and development programs. Any use or appropriation of the content of the document other than for TSMC exclusive usages is strictly forbidden without the mutual contentment of TSMC, T^2 Environnement and Viridis Terra Innovations, and unauthorized use will be prosecuted.

6 REFERENCES

Tata Steel Minerals Canada Limited, 2017. Strategic planning for the progressive restoration of mine sites operated by TSMC in the Schefferville area. Reference document developed by T^2 Environnement and Viridis Terra Innovations for public release. 23 pages.

T^2 Environnement and Viridis Terra Innovations, 2018a. 2017-2018 Ecological Restoration Trial Plan for the Timmins 4 Site. Technical report submitted to Tata Steel Mineral Canada. 69 pages + appendices

T^2 Environnement and Viridis Terra Innovations, 2018b. 2017-2018 Ecological Restoration Trial Logistic Plan. Technical document submitted to Tata Steel Mineral Canada. 4 Excel spreadsheets

Appendix

2018 Ecological Restoration Trial Establishment Protocols

1. Objective of the Protocol

The objective of this protocol is to establish guidelines for the harvesting, the transportation, the storage, the preparation and the plantation of willow cuttings in order to maximize the survival and grow rates. The experimental block display and the plantation design are presented in the Plantation and Hydroseeding Protocol (P&H) and in its related appendices.

2. Necessary Material

2.1. Harvesting

For the harvest stage, only a sharp cutting tool and a large blanket or burlap and some rope to carry the stems are needed. Lopping shears, hand pruning shears, a small wood saw, brush cutters, or a chain saw are appropriate tools that can be used to harvest the stems.

2.2. Transportation and Storage

Here is a list of the equipment needed to transport and store the willow stems:

- Twine and/or rope
- Burlap or a reflective moisture barrier
- Large Styrofoam pieces to insulate the stems
- Large tarp or plastic to cover the stems
- Heavy materials (wood or metal) that can spend the winter outside

2.3. Preparation of Cuttings

The transformation of the stems into cuttings and the preparation of the cuttings to be outplanted will require the following material:

- Buckets with flowing water or a stream or a lake were the stems can be soaked ideally for 5 to 10 days
- Painting primer
- Roots system hormones powder
- Sharp cutters
- Larges burlaps
- A small chain saw for the biggest cuttings

3. Harvesting

3.1. Selecting the Plant Material

For this project, stems from plane leaf willow (Salix planifolia) are used as cuttings. This species has been selected because of its abundance in the region and because of its ability to colonize disturbed ecosystems and promote ecosystem reconstruction after mining. Other willow species can also be used according to their availability and project requirements.

Live wood of at least 1 year old or older, preferably woody stems of 2 to 5 years old, should be used. The current year's growth lacks the stored energy reserves necessary to consistently sprout when planted. Do not use very old or dry wood. The best wood has a smooth bark which is not deeply furrowed. Older stems with thick bark produce fewer adventitious buds and are less vigorous than younger stems.

Cuttings that are made from willows growing in site conditions similar to the restoration site have a more successful survival and establishment rate. Plant materials originating from a site that is 300 m in elevation above or below the restoration site will not be well adapted to the restoration site conditions and have a lower rate of establishment. Damaged stems also have a lower survival rate than healthy ones.

Ideal willow individuals collected for producing the cuttings should be from 2 to 8-cm in base diameter, at least 1.27 cm. Those willows will have a better chance of surviving following the harvest.

Procedure:

- Locate a site with a lot of plane leaf willows that has similar conditions to the restoration site.
- Select some willows that are 2 to 8 cm base in diameter.
- Choose stems that have a smooth bark.
- Select plant materials that are free of physical disease, fungal or insect damages.

3.2. Cutting Stems

Success of establishment is significantly increased if stems are harvested+ during the dormant season. This is the period between the fall leaf drop and the plant leaf budding in the spring.

The stems should be long enough to be able to do 2 or 3 cuttings from each. They will be cut into cuttings right before the outplanting stage. It is crucial to have fresh cuts on both sides of the cuttings when outplanting them.

It is also important to make sure the willows from which the stems are harvested are going to recover from the harvesting. Do not remove more than 30% of the overall canopy cover from any willow stand and do not harvest all branches from any single willow.

Procedure:

- Cut the stems during the dormant season (one month after the shrub lost its leaves).
- Stems should measure between 1 and 2 metres.
- Approximately 1 000 willow stems of 1.5 m will be needed for the 2019 spring tests. An extra 500 stems will be needed to proceed with a medium scale slope stabilization trial.
- Cut the stems with a sharp tool to make a clean cut.
- Be careful not to damage the bark.
- Keep the stems in a cool and shady place while waiting to store them. You can also water them a little to keep them wet.

4. Transportation and Storage

Some techniques can be used to facilitate transportation of the cuttings. Also, it is really important to properly store the cuttings until they are outplanted. At all times, cuttings need to be protected from desiccation, sunlight and wind.

Procedure:

- During transportation and storage, willow bundles should be covered or wrapped with burlap or a reflective moisture barrier.
- Stems should be tied into bundles of 25 or 50 stems each, the important thing is that each bundle contains the same number of stems.
- Stems should not be placed directly on the ground, they can be placed on wooden pallets or metal structures.
- Make sure the storage area is dark, moist, and cool at all times. If they are kept outside, choose a site where snow can accumulate. The snow will offer a good insulation and moisture content.
- Stem bundles may be covered with a black tarp or plastic to be kept dark.
- The bundles of stems should be protected from the extreme cold by Styrofoam pieces or fibreglass insulation and large blankets if available.
- Put heavy materials, like wood or metal pieces on top of the protective layers to prevent them from blowing away.
- Stems should be periodically checked for signs of frost damage and to insure mould is not forming.
- Optimal storage is usually done at the temperature of -3 to 4°C in a cold chamber under dark and moist conditions.

5. Preparation of Cuttings

Cuttings of larger diameter have more energy and stored reserves than smaller diameter cuttings but are often more difficult to place into the ground. Cuttings should be large enough that they will not bend or break while driven into the ground during installation. Cuttings from 6 to 15 mm in diameter typically have the highest survival rates, but cuttings up to 40 mm in diameter are used for some specific slope stabilization projects.

One of the most important steps is the identification of the top of cuttings. If cuttings are planted upside down, mortality will occur. Cutting the two extremities of the cuttings with two different angles will allow quick recognition of the cuttings top. Cut the tip to be planted in a 45° angle, this will also favour the insertion of the cutting in the ground. The top end of the cutting is cut at a 90° angle.

Soaking plant material before outplanting significantly increases the survival rate. Research shows that soaking the cuttings in running or periodically refresh water for ideally 7 to 10 days, at least 3 to 5 days, can double the survival rate. Cuttings should be removed from water before roots and adventitious bud emergence from the bark (it normally takes 7 to 10 days). Before soaking in a stream or in large buckets, put the cuttings in permeable bags and secure them so that the cuttings cannot come out. If necessary, add weight to the bag so that the cuttings stay submerged. If large buckets are used, water needs to be changed at least every 48 h to avoid mould occurrence.

Procedure:

- Cuttings diameter shall be 1.27-cm (½-inch) to 9 cm (3.54 inches).
- Cut the top of the cuttings with a horizontal cut and bottom with a 45-degree angle.
- Two different lengths of cuttings need to be done for the Spring 2018 test. A minimum of 540 long ones with a length from 70 to 100 cm and a minimum of 540 short ones with a length from 25 to 30 cm. Remember that 3–5-cm (1-2 inches) of the cuttings will be removed prior to planting. So, for the first cut you should make sure you leave an extra length.
- Be careful not to damage the bark.
- Make bundles of 25 or 50 cuttings of the same length. Wrap them into a burlap and tie them with strings.
- Soak the bundles of cuttings in a stream or in a large container (1000 L) for 7 to 10 days.
- Remove the cuttings from water before roots emerge from the bark and before the buds start to open. After 5 days of soaking, check if the buds and the roots start to develop.
- Then, soak 1/3 of the bottoms of the cuttings for at least 24-36 hours in a solution of water and root growth hormone powder in large buckets or sprinkle the powder on the bottom end of the cuttings if large buckets are not available. The first option is to be favoured. It is also possible to make a homemade solution of hormones with 50 % crushed small young willow cuttings (1-year-old) and 50 % water.
- Remove the bottom 3–5-cm (1-2 inches) of the cuttings with a clean diagonal cut to freshen up the conductive xylem cells prior the outplanting.
- To prevent excessive desiccation, dip for a few seconds the top 1/3 part of the cutting bundles in a solution made of 1 part of primer for 1 part of water. If it rains during this activity, cover the end of the cuttings that was dipped into the solution with a tarp to let it dry a little.
- Outplant the cuttings in the field (see H&P protocol for details on how and where the cuttings were planted)

1. Objective of the Protocol

The objective of this protocol is to establish detailed guidelines to prepare the seedlings and small cuttings and to outplant them in order to maximize their survival and establishment rates. The experimental block display and the plantation design are presented in the Plantation and Hydroseeding Protocol (P&H) and in its related appendices.

2. Necessary Material

2.1. All

- Mini tunnels used for vegetable growing (http://www.duboisag.com/fr/arceaux-pour-mini-tunnel.html)

2.2. Control

When outplanting the cuttings and the seedlings in the control and cuttings plantation substrate (no substrate), one should ensure the following material is available:

- 720 seedlings 45/110 plugs (180 of each species), 180 small cuttings and 540 long cuttings.
- Hammer or mace for the cutting (if the soil is compacted)
- Rebar (if the soil is compacted)
- Planter shovel
- Trowel

2.3. Large Jiffy plugs Containing an Already Made Growing Substrate

2.3.1. Preparation

Material needed for the preparation of large Jiffy plugs:

- 720 seedling Jiffy plugs (180 of each species) and 180 small cuttings added in empty Jiffy plugs on site
- 900 large Jiffy plugs in total

2.3.2. Outplanting

The following items are the only ones needed to outplant the Jiffy:

- Planter shovel
- Trowel

2.4. 2 L bag

2.4.1. Preparation

The preparation of 1940 2 L bags will require the following items:

- 1760 seedling 45/110 plugs (180 of each species for blocks and 260 additional of each species for tests outside the blocks) and 180 small cuttings
- 3880 L of soil
- 19.4 kg of fertilizer 8-31-8
- 19.4 kg of hydrogel
- Accurate weighing scale (gram or less)
- Pots of 2 L to measure the soil
- Small pots to measure the fertilizer and the hydrogel
- 1940 burlap 2L bags
- 1940 elastic bands
- Boxes (anything that can contain the filled bags)

2.4.2. Outplanting

Only a few things are needed to outplant the 2 L bags:

- Planter shovel
- Trowel

3. Control

Seedlings were produced from locally collected seeds (see Seeds Harvesting Protocol or SHP) at the Pépinière Boucher in Lac Saint-Jean and the cuttings were produced according to the Willow Cuttings Preparation and Plantation Technique (WCP).

The control seedlings and cuttings are going to be planted directly in the mine waste or overburden spread at the surface of mine waste. Avoid planting in the summer because of heat stress and a shortened growing period. Early spring (start to mid-June at the TSMC site), just after snow melt and when the soil is loose enough, is ideal.

Procedure:

- If the seedlings have spent more than 7 days in the refrigerated trailer, they should be exposed to the sun gradually. After watering them, put them outside, in a shady place for 2 days, not exposed to the wind. Then, gradually expose them to the sun during a three-day period (1/4 day, ½ day, and full day). Choose a location sheltered from the wind and night frost. Check the root moisture and water when needed.
- Plant the cuttings and the seedlings in early spring, after snow melts and when night frost is not a problem (temperature not going below -2°C) and when the soil is loose enough.
- Water the seedlings just before outplanting.
- Start by planting the seedling at the end of the experimental blocks and progressively fill the empty plots backward to avoid walking near the planted seedlings.
- Use a planter shovel to dig a hole for the seedlings.
- Push the cuttings directly into the soil for outplanting and use a hammer and a rebar if the soil is too compacted to create a hole that has a smaller diameter than the cutting.
- The larger and longer the cuttings, the deeper the cuttings need to go into the soil.
- For the seedlings, all the shoots should be above the ground and all the roots should be underground.
- Each cutting should have a minimum of 2–4 leaf nodes or bud scars above the ground.
- 2/3 to 3/4 of the cutting length should be placed below the soil surface.
- There must be a distance of 1 m between each plant.
- Avoid damaging buds when inserting the cutting into the hole.

4. Jiffy

4.1. Preparation

Seedlings were produced from locally collected seeds (see Seeds Harvesting Protocol or SHP) at the Pépinière Boucher in Lac Saint-Jean and the cuttings were produced according to the Willow Cuttings Preparation and Plantation Technique (WCP).

Procedure:

- Water the seedlings just before outplanting.
- If the seedlings have spent more than 7 days in the refrigerated trailer, they should be exposed to the sun gradually. After watering them, put them outside, in a shady place for 2 days, not exposed to the wind. Then, gradually expose them to the sun during a three-day period (1/4 day, ½ day, and full day). Choose a location sheltered from the wind and night frost.
- 440 Jiffy containers contain Picea mariana seedlings, 440 Betula glandulosa, 440 Vaccinium uliginosum and 440 Alnus crispa.
- Dig a hole in the soil of the Jiffy plug a little bit wider and deeper than the plug.
- Place the plug in the hole and start filling the rest of the hole with loose soil.
- The plug should no longer be visible when the hole is filled.
- For the seedlings, all the stems should be above the ground and all the roots should be under the ground (at the seedling roots collar).
- For small cuttings (25-30 cm), gently insert the small cuttings in the Jiffy plug.

4.2 Outplanting

The outplanting of the Jiffy should be done in the loose soil of the waste dumps. Summer and winter are both too harsh seasons for planting. Furthermore, in the Schefferville region, the conditions may be too harsh for the fall plantation to allow seedling establishment and winter survival. It is more appropriate to plant in the spring, when the weather is cool, but not cold and the air is not too dry. Seedlings in large Jiffy plugs must be watered just before outplanting. The ground surrounding the Jiffy should not be compacted to allow the water and the oxygen to circulate freely.

Procedure:

- Start by planting the Jiffy at the end of the experimental blocks and progressively fill the empty plots backward to avoid walking near the planted seedlings.
- Dig a hole that is only a little wider and deeper than the Jiffy.
- Place the Jiffy in the hole and start filling the rest of the hole with loose soil.
- The Jiffy should no longer be visible when the hole is filled.
- For the seedling, all the branches should be above the ground and all the roots should be under the ground (at the seedling roots collar).
- Do not compact the soil around the Jiffy.
- There must be a distance of 1 m between each plant.

5. 2 L bag

5.1. Preparation

Seedlings were produced from locally collected seeds (see Seeds Harvesting Protocol or SHP) at the Pépinière Boucher in Lac Saint-Jean and the cuttings were produced according to the Willow Cuttings Preparation and Plantation Technique (WCP).

To avoid the hydrogel from coming into contact with water or that the mixture to blow away, the preparation of the 2 L bags should be made inside under all circumstances. The substrate mixture inside the burlap bag will ensure that the seedling or the cutting has the necessary nutrients and water input to promote its establishment and survival. Hydrogel will play a significant role in protecting plants against water shortage by diminishing soil water transpiration, thereby retaining more water in the bag.

Procedure:

- The preparation of the 2 L bags must imperatively be done inside.
- Moisten the peat moss using a small concrete mixer.
- 1940 2 L bags need to be prepared.
- 180 2 L bags will contain small willow cuttings.
- 440 2 L bags will contain Picea mariana seedlings, 440 Betula glandulosa seedlings, 440 Vaccinium uliginosum seedlings and 440 Alnus crispa seedlings.
- Start by weighing 10 g of hydrogel and 10 g of fertilizer (8-31-8) in the cups and mark them to get the right amount each time without using the scale.

- Fill each burlap bag with 2 L of moist peat moss, 10 g of fertilizer and 10 g of hydrogel and manually mix the substrate.
- Put one seedling plug or one cutting per burlap bag.
- There should be a layer of substrate mixture between the seedling plug or the cutting and the sides of the burlap bag (more or less in the centre of the bag).
- For the seedling, all the stems should be above the ground and all the roots should be under the ground (at the seedling roots collar).
- For the cuttings make sure 2/3 to ¾ of the cutting length is below the soil surface.
- Tie the opening of the bag on the cutting or root collar with an elastic band.
- Put all the burlap bags with the cuttings in a box of some sort to keep them from falling and to facilitate the transport to the site.

5.2. Outplanting

The outplanting of the 2 L bags were done on each type of mine waste substrate (see the P&H protocol for more details). Summer and winter are both too harsh seasons for planting. Furthermore, in the Schefferville region, fall conditions may be too harsh for fall plantation to allow seedling establishment and winter survival. It is more appropriate to plant in the spring, when the weather is cool, but not cold and the air is not too dry. Seedlings must be watered just before outplanting. The ground surrounding the bags should not be compacted to allow the water and the oxygen to circulate freely. The burlap bags should not be visible from above ground. The burlap bags will eventually break down and decompose to let the roots of the plant expand in the mine waste.

Procedure:

- If the seedlings have spent more than 7 days in the refrigerated trailer, they should be exposed to the sun gradually. After watering them, put them outside, in a shady place for 2 days, not exposed to the wind. Then, gradually expose them to the sun during a three-day period (1/4 day, ½ day, and full day). Choose a location sheltered from the wind and night frost. Check the root moisture and water when needed to make sure the roots stay moist.
- Start by planting the seedlings with burlap bags at the end of the blocks and progressively fill the empty plots backward to avoid walking near the planted seedlings.
- Dig a hole with the planter shovel that is only a little wider and deeper than the bag.
- Place the bag in the hole and start filling the rest of the hole with loose soil.
- The bag should no longer be visible when the hole is filled.
- For the seedling, all the stems should be above the ground and all the roots should be under the ground (at the seedling roots collar).
- Do not compact the soil around the bag.
- There must be a distance of 1 m between each plant.

1. Objective of the Protocol

The objective of this protocol is to establish detailed guidelines to allow for good site preparation before restoration activities in order to maximize the survival and establishment rates of the cuttings, the seedlings and the hydroseeded parcels.

2. Necessary Material

2.1. Site selection
- Maps
- GPS

2.2. Slope Reshaping
- Large bulldozer

2.3. Experimental Block Design
- Computer
- Site map

2.4. Experimental block Delineation
- Stake flags – Marking flags
- Flagging tape
- Blue spray paint
- 30 reflective markers (6 for each block)
- 50 m measuring tape
- 100 m rope
- Permanent black markers

2.5. Block Preparation

2.5.1. Pre-treatment of Surfaces

2.5.1.1. Rough-and-Loose
- Excavator

2.5.1.2. OverburdenMmix
- Excavator
- Dump truck

2.5.2. Watering Treatment (irrigation)

2.5.3. Nutritional Inputs

2.5.3.1. Granular Fertilizer
- 200 kg/ha Eco+ 14-14-14

2.5.3.2. Dolomitic Limestone
- 3 000 kg/ha

3. Site Selection

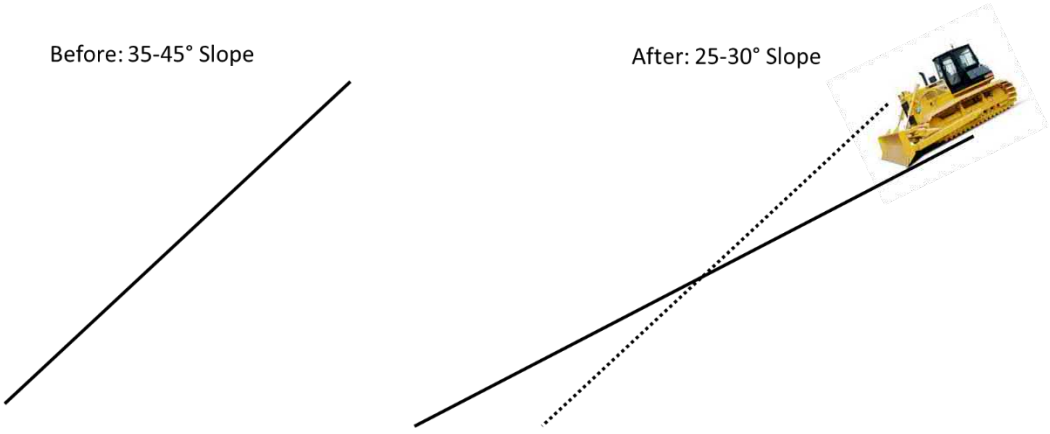
Several criteria are required to select a site suitable for an ecological restoration trial. First of all, it should not be used for current or foreseeable mining activities. Also, the site needs to be large enough to contain all the experimental blocks. The site must feature uniform soil characteristics all over to ease the statistical analysis (to reduce undesirable variance). It should also present characteristic similar to the site to be restored at large scale. Finally, the site must be securely accessible. The block should be placed accordingly to follow climatic gradients.

4. Slope Reshaping

   Some slopes of the Timmins 4 waste dump show significant instability problems, with slopes sometimes as steep as 45°, showing slow and fast slope movement (creeping and slumping). Slopes of waste rock piles should not exceed 30° and preferably 25° in order to protect soil against landslides and erosion. The slopes must be reshaped to 30° or less in order to increase the stability of the Timmins 4 dump and prepare the site for restoration. However, the bottom of the slopes reshaped in the fall of 2017 on the Timmins 4 dump presented signs of instability in the spring of 2018. A year (or even 2) period may therefore be necessary to let the reshaped slope material stabilize and the slope find stability. The 2019 plan may therefore have to be modified according to this new information.

   Procedure:

   - Push the material of the waste dump from the top to the bottom of the waste dump with a bulldozer.
   - Continue until the slope angle is less than 30° (an excavator needs to be able to drive on the slope after the reshaping is done).
   - Monitoring of slope stability will be necessary to know how long it takes to reach stability. This information in unknown at this stage of the project.



5. Flat Area

   For the flat area such as the top waste dump pile or the lower bench of Timmins 4, no reshaping is required but some protection can be made with rough & loose and overburden at the top of the Timmins 4 waste dump. See section 8.1 of the current for details.

6. Experimental Block Design

   The experimental block design is used to divide the site to test all possible treatment combinations of watering treatment, site preparation, nutrition treatment, plantation substrate and hydroseeding for each plant species.
   The design of the experimental block should be done by qualified land reclamation specialists. See the Hydroseeding and Plantation Protocol (P&H) and its appendices for more details.

7. Experimental Block Delineation

All the experimental blocks were delineated and marked with stake flags, flagging tape, and spray paint. The delineation allows to separate the different blocks in plots in order to properly apply the different treatments in each.

Procedure:

- Follow the plan that has been made at step 6 (Experimental block design is shown in the appendix).
- Plant a reflective marker at each corner of each block (15 m X 50 m) as well as for half of the two longest sides (at 25 m).
- Connect each stick by painting on the ground with the blue spray paint.
- Split the block into 36 plots, 18 for seedling plantation and 18 for hydroseeding (4 m X 5 m plots) using surveyor flags and blue paint.

8. Block Preparation

8.1. Pre-treatment of Surfaces

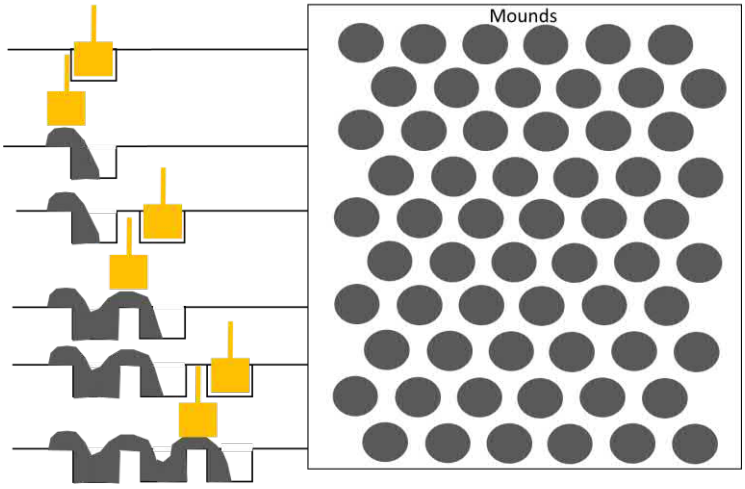
8.1.1. Rough and loose Technique

The rough and loose technique will be used to recreate microsites that will reduce the negative impact of wind, favour snow accumulation, and provide shelter to vegetation. The technique encourages the development of irregular topography comparable to that of natural ecosystems which decreases erosion potential and water speed on slopes. Also, the rough and loose technique loosens waste rocks, bringing smaller particles back to the surface and improving the water infiltration capability of soil, thus reducing runoff and enabling soil to maintain water availability to plants during periods of drought.

Procedure:

- Use an excavator with a digging bucket (1-m+ wide).
- Open holes on soil or mine waste, dumping the material that is generated from the holes in mounds between the holes (see the bellow figure for an example).
- The excavator takes a large bucket full of soil and places it to the left of the hole that was just open, half a bucket away from the hole so it is half in and out of the hole.
- Soil representing half a bucket width to the right of the first hole is left untouched leaving half a bucket between excavated holes.
- A second hole is then excavated to the right of the untouched soil. The material is then placed between the first and second holes, so it is a quarter in the first hole, half on the untouched soil, and a quarter bucket on the second hole.

- Finally, the last two activities are repeated until the excavator reaches the end of the row.
- Other rows are made following the same steps. However, the holes are dug and aligned with the untouched soil of the previous row.
- Care should be taken when excavating the holes to scatter the material between holes as the hole is dug.



8.1.2. Topsoil/Overburden Mix

Compared to the waste rock material, topsoil and overburden has geochemical and physico-chemical properties more similar to natural ecosystems soil (topsoil) and surficial deposit (overburden). However, for the 2018 restoration trial, only overburden was used due to a lack of time and resources. An overburden/topsoil mix will be tested in the 2019 restoration trial.

Procedure:

- Take some of the nearby Timmins 4 overburden with an excavator and use a dump truck to carry it up to the restoration site. Do the same thing with the topsoil.
- Mix the overburden and the topsoil (3 to 1 ratio) with the excavator.
- Use the excavator to carry the overburden/topsoil mix up to each targeted plot.
- Add a layer of around 10 cm of the topsoil/overburden mix where necessary with an excavator.
- Make sure not to compact the soil.

8.2. Watering Treatment

Weather forecasts in Schefferville are unpredictable. Some summers (i.e. no rain in July 2016) showed a significant period of drought. The effect of a periodical irrigation on plants establishment and survival therefore needs to be measured. Consult the Irrigation Protocol (IrP) for more details on how and when to irrigate.

Procedure:

- Only deal with a professional irrigation retailer to design and buy the irrigation equipment.
- As shown in the experimental block design in the appendix, half of the surface of the block is irrigated. The other half is not.
- Water source should come from a water tanker truck.
- 4 wobblers per experimental block received the irrigation) covering (18 m X 18 m, see irrigation design per block in the appendix), for a total of 24 wobblers.
- Each wobbler is connected to an IPEX 1 inch diameter pipe.
- Each wobbler line (two per block) is connected to a water 25 PSI pressure regulator.
- Each wobbler line is connected to the main irrigation line (2 inches flex blue pipe).
- The main irrigation line is connected to a 6.5 HP gasoline pump.
- The pump has a filter to avoid muddy materials plugging the wobblers
- The gasoline pump is connected to the water tanker truck with a flex high pressure 2-inch pipe.

8.3. Nutritional Inputs

Granular fertilizer and dolomitic limestone will be added manually were necessary in order to measure their effects on plant grown and survival.

8.3.1. Granular Fertilizer

Waste rocks, but also overburden at a lesser extent, contain very low concentration of N, P, and K. Slow release granular fertilizer will make these three important nutritional elements available to the trees and shrubs, thereby, possibly improving seedling early establishment on TSMC waste dumps.

Procedure:

- Apply the granular fertilizer (Eco+ 14-14-14, 200 kg/ha = 0.4 kg/plot (4m X 5m)) manually in the appropriate area according to the experimental block design (Appendix), using a small bucket and a measuring cup.

8.3.2. Dolomitic Limestone

In order to reduce Fe and Mn availability to plants in waste material to avoid toxicity, pH has to be increased. Dolomitic limestone, which is a sedimentary rock mainly composed of different forms of $CaMg(CO_3)_2$, is known for its ability as an amendment to enhance soil pH while increasing Ca and Mg content in soil. By enhancing pH, limestone also improves plant N, P, K, Mg, and Ca availability in soil, one of our main limiting factors in TSMC waste rocks.

Procedure:

- Apply the dolomitic limestone (3000 kg/ha = 6 kg/plot (4m X 5m)) manually in the appropriate area according to the experimental block design (Appendix), using the limestone bag directly to spread the limestone.

1. Objective of the Protocol

   The objective of this protocol is to establish detailed guidelines for the application of the new innovative SYLVEN™ technology. Hydroseeding of SYLVEN™ formulation allows the establishment of high-density shrub and tree communities on site. The SYLVEN™ formulation provides necessary water, nutrients, mulch, and other amendments for enhancing seed germination and thereafter seedling establishment on mine waste.

2. Necessary Material
   - Finn T30 Hydroseeder
   - 100 m rigid pipe
   - Extra 50 m rigid pipe
   - Water pump to fill the tank with river or lake water or water truck
   - Spraying guns
   - Greasing gun and grease
   - Hydroseeder key
   - Knife
   - Precision scale
   - 1 L measuring cups
   - 50 ml tubes
   - Mask (optional)
   - Gasoline in a 5- to 10-gallon tank
   - Formulation components
     - Water (27 778 kg/ha)
     - Wood fibre (at least 3 000 kg/ha)
     - Hydrogel (150 kg/ha)
     - Adhesive (4-7 kg/ha)
     - Granular fertilizer (384 kg/ha)
     - Pleurotus inoculant (12 L/ha)
     - Seeds

Quantity X	Quantity 4X
VU = 242 507 seeds/ha	VU = 970 029 seeds/ha
AC = 1 854 103 seeds/ha	AC = 7 416 414 seeds/ha
BG = 1 018 211 seeds/ha	BG = 4 072 845 seeds/ha
PM = 87 654 seeds/ha	PM = 350 617 seeds/ha
Total = 3 202 476 seeds/ha	Total = 12 809 905 seeds/ha

Environnement

Viridis Terra
INNOVATIONS

3. Preparation

When filling the hydroseeding tank, always add the lightest materials first. Hydrogel is added at the restoration site, just before starting hydroseeding the SYLVEN™ formulation.

Procedure:

- Start the water pump.
- Fill the tank until water reaches the upper side of the shaft.
- Stop the pump.
- Start the hydroseeder.
- Begin reverse agitation at low to medium speed.
- Add the seeds.
- Add the inoculant.
- Add the adhesive.
- Add the fertilizer.
- Start the water pump again.
- Fill the tank with water until it reaches 200 gallons while adding the mulch (wood fiber in this case).
- If water reaches 200 gallons before finishing to add the mulch, stop the water pump and finish adding mulch.
- Speed should be increased to almost full speed to increase mixing when adding mulch.
- Start the pump again and fill the tank until it reaches 300 gallons.
- Increase speed to full speed during 1 min.
- Reduce speed to low.
- Transport the hydroseeder close to the plots where the mix is applied (the hydroseeder has to be no more than 150 feet from the plots).
- When arriving on site, add the hydrogel and put forward agitation at full speed during at least 1 min.

4. Hydroseeding

Proceed to hydroseed the chosen plot.

Procedure:

- Add the appropriate spraying gun.
- Carry the pipe to the plots.
- Reduce speed to medium.
- Make sure the recirculation valve is open.
- Open the pump discharge valve.
- Engage the clutch.
- Open the remote valve and start to hydroseed uniformly the plots.
- Someone has to verify the level of formulation in the hydroseeder while counting the time of spraying to ensure each plot receives the same amount of formulation.
- When the tank is empty, the valves are closed, the engine is stopped, and the pipe is rolled back to the hydroseeder.

5. Maintenance
   The hydroseeder must be well maintained each day to ensure proper operation.
   Procedure:
   - The pipes must be emptied of water every day.
   - The hydroseeder needs to be cleaned, rinsed and greased after each use.

1. Objective of the Protocol

The objective of this protocol is to establish guidelines for the harvesting of native shrub and tree seeds. In nature, millions of seeds are dispersed into the disturbed sites every year, yet only a few successfully grow and thrive. To succeed, individuals need to come from the right species, one capable of thriving on these disturbed ecosystems.

They must also have the right genetics to help them survive the harsh environmental conditions of mine wastes. As a result, seeds shall be collected from individuals and stands with varieties that have genetically developed these adaptations and thrive in conditions as similar as possible to a disturbed mining site.

2. Necessary Material

2.1. Harvesting

Here is a list of equipment needed for harvesting seeds from native shrubs and trees:

- One pail for each collector (if more than one species is collected, use one pail for each species)
- One small 1L bucket to measure the quantity of catkins or cones collected (count the number of fruits needed to fill the bucket the first time and then count the number of buckets collected in the pail)
- GPS to indicate location of the collection
- Camera to take pictures of places where seeds are collected
- Permanent marker to write on bags
- Field form, to document collection information: date, GPS coordinates, quantity of collected material per location (amount of paper bags and number of buckets in each bag)

**** Avoid collecting when it is raining

2.2. Transportation

Here is a list of the equipment needed to transport and store the seeds:

- Dozens of paper bags for catkins and cones in order to keep them dry
- Paper cards to identify the species, lot number, GPS coordinate, location of collection, picture number (this card follows the seed collected until the seed processing facilities)
- Cold chamber or cooler with ice packs (Only for berries)
- Closed hard containers when necessary (Only with berries)

2.3. Short Term Storage and Shipping from TSMC Site to Seed Processing Facilities

Materials needed for short-term storage before shipping to seed processing facilities:

- Cool and dry space protected from bad weather
- Tables to spread out the catkins and cones for drying
- Dehumidifier
- Refrigerator when necessary (only for berries)

Materials needed for shipping to seed processing facilities:

- Cart boxes for catkins and cones
- Cooler with ice for berries

3. Harvesting Procedure

3.1. For all Species:

- Take pictures of all seed collection sites
- Complete the seed collection form (date, GPS coordinates, quantity of collected material per location (number of lunch paper bags and number of buckets in each bag))
- Collect seeds in several different sites to increase genetic diversity.
- Select collection sites with ecological conditions similar to the site to restore.
- When collecting, fill up the first paper bag or a small bucket by counting the number of catkins and cones that you put in, then calculate the amount of paper bags or buckets you will need to fill up in order to harvest the necessary fruit quantity for each species.

3.2. Glandular birch

- Check every day or second day the status of seed ripening starting in early September. See photos in Appendix D to identify proper seed appearance.
- Collect the catkins when ripening begins in the fall from early September to late October.
- Select mature catkins that have turned greenish brown instead of green and that the seeds inside are brown.
- Avoid collecting catkins with insect bites or collecting branches or other impurities.
- 45 000 catkins need to be collected in 2018.

3.3. Bog blueberry

- Check every day or second day the status of fruit maturity starting in early August. See photos in Appendix D to identify proper seed appearance.
- Collect the berries from early August to late August.
- Select the berries that are ripe and have turned dark blue.
- Bog blueberry will not be collected in 2018. Seed viability is not good enough for economically efficient harvesting.

3.4. Plane leaf willow

- Check every day or second day the status of seed ripening starting in late-June.
- Collect the seeds in July (maybe late June for an early spring), just after the capsules began to open.
- Select mature catkins that have turned yellowish brown instead of green and that the seed-coats are firm and the seeds have a dark charcoal and black colour.
- 30 000 catkins will ideally be collected in summer 2019.

3.5. Green alder

- Check every day or second day the status of seed ripening starting in early September
- Collect the seeds from early September to late October. See photos in Appendix D to identify proper seed appearance.
- Be careful not to confuse green alder with its sister species, the speckled alder (Alnus incana ssp. Rugosa).
- Select mature catkins that have turned to a greenish-brown colour.
- Avoid collecting catkins with insect bites or collecting branches or other impurities.
- 15 000 catkins will be collected in fall 2018.

3.6. Black Spruce

- Check every week the status of cone maturity starting in early September. See photos in Appendix D to identify proper cone appearance.
- Collect the cones from early September to late November. The best seed collection sites are located in the bottom of valleys where black spruce trees are found in higher abundance under better growth conditions. On exposed sites, the spruce trees produce very little viable seeds and reproduce mainly by layering. This is the reason why we favour collecting in the bottom of valleys.
- Select only fresh current year cones. Cones reach maturity in September.
- Select mature cones that have turned to a dark purplish-brown colour instead of a deep red to purple colour.
- Avoid collecting cones with insect bites or collecting branches or other impurities.
- 10 000 cones will be collected in fall 2018.

4. Drying and short time storage

Procedure :

4.1. Keep the catkins (alder, birch, willow) and cones (black spruce) in an aerated, cool (10-15 ºC) and dry place in paper bags.
4.2. Discard all branches, leaves and other foreign bodies from the piles of catkins.
4.3. Spread catkins and cones on a table in a dry room if they are wet.
4.4. Keep the berries in a refrigerator at 4ºC.
4.5. Ship the seeds as quickly as possible.

5. Transportation Procedure

Catkins are transported by plane as soon as possible to the T2/VTI office for quality control. Following quality control, the seeds will be sent to the ministère de la Forêt, de la Faune et des Parcs (MFFP) seed processing facilities.

5.1. Glandular birch, green alder and black spruce

- Keep the catkins and cones in an aerated, cool and dry place in paper bags during transportation and until seed processing.

5.2. Bog Blueberry

- Keep the berries at a temperature of between 2°C and 10°C in a cooler with ice packs during transportation and in the MFFP refrigerator before processing.
- Transport the berries in closed hard containers to avoid crushing them.

5.3. Plane leaf Willow

- Catkins are placed in paper bags when collected, allowing moisture to escape and preventing overheating (< 20°C).
- Discard all branches, leaves and other foreign bodies from the piles of catkins.
- The drying and extraction process needs to be started within 24 hours of collection.

6. Processing and Storage

6.1. Glandular birch

- Dry the catkins in an incubator with less than 23% relative humidity.
- Store the seeds at -18°C to -20°C or at -1°C to 3°C at a moisture content of between 5%-7% until use.

6.2. Bog blueberry

- Soak the berries in cold running water inside muslin bags in a pelt for 3 to 6 days in order to soften the peels and the pulp.
- Process the berries in a blender with adhesive tape placed on the blades to prevent seed damage so that the peels and pulp are well separated from the seeds.
- Add water to the blender content and continue mixing while peels and pulp are discarded and seeds decant at the bottom.
- Repeat these steps until water is transparent and almost all residue of the berries is gone.
- Remove the leftover residues at the top.
- Dry the seeds in an incubator with less than 23% relative humidity.
- Store the seeds at -1°C to -3°C at a moisture content of between 5%-8% until use.

6.3. Plane leaf willow

- Place the seeds on screen trays for drying. 24 hours of drying is usually sufficient, but it depends on place relative humidity that may delay the process if high. To maximize the drying process, a room where relative humidity is controlled to 20-23% should be used. The opening of capsules is the indicator of seed ripening. This should be surveyed regularly in order to obtain good quality seeds.
- Dislodge the seeds from the cotton tuft by using air movement.
- Store the seeds at -18°C to -20°C at a moisture content of between 5%-8% until use.

6.4. Green alder

- Dry the catkins in an incubator with less than 23% relative humidity.
- Store the seeds at -18°C to -20°C or at -1°C to 3°C at a moisture content of between 5%-8% until use.

6.5. Black spruce

- Dry the cones in an incubator with less than 23% relative humidity.
- Store the seeds at -18°C to -20°C or at -1°C to 3°C at a moisture content of between 5%-8% until use.

1. Objective of the Protocol

To succeed mining site reclamation, it is essential to understand the natural environmental conditions of the area. Therefore, ecosystem characterization with particular emphasis on edaphic conditions need to be realized. An ecological characterization of the disturbed sites (waste dumps and other related mining sites) should also be done to better understand the ecology of the site to restore. The objective of this protocol is to establish guidelines for ecosystem characterization and soil sampling.

2. Necessary Material

2.1. Ecosystem Characterization

- Ecosystem Field Form from the "Field Manual for Describing Terrestrial Ecosystems 2nd Edition" of the British Columbia Ministry of Forests and Range and the British Columbia Ministry of Environment.
- Plant Identification guides
- GPS
- Compass
- Plant press (herbarium)
- Clinometer

2.2. Soil Characterization

- Auger or shovel
- Pail
- Knife
- Plastic bags
- GPS
- Tape measure or ruler
- Field form
- Permanent markers
- Cooler
- Mobile pH meter

3. Ecosystem Characterization

Natural ecosystem characterization must be done on each slope aspect close to where the deposits are located, on the upper slope or ridge and at the bottom of the slope. Additional ecosystem characterization can be done on mid slope position if the ecosystem characteristics are really different from the two others. The ecosystem characterization will be done by filling the Ecosystem Field Form as per the Field Manual for Describing Terrestrial Ecosystems 2nd Edition" of the British Columbia Ministry of Forests and Range and the British Columbia Ministry of Environment. Complete the "Site description" and the "Vegetation" sections. In order to better understand the natural ecosystem variability occurring close to the site to restore, a total of 8 to 10 field forms must be completed. One to two field forms must also be completed on each mine waste dump or other mining site to restore. Quadrant are 400 m^2 each (11.5 m radius).

4. Soil Characterization

For each ecosystem survey sample, one soil pedon will be dug out with a shovel or an auger until it is not possible to dig anymore, or water table is reached. Soil profile description will be done according to the Ecosystem Field Form as per the Field Manual for Describing Terrestrial Ecosystems 2nd Edition" of the British Columbia Ministry of Forests and Range and the British Columbia Ministry of Environment. Complete the "Soil description" section. The following parameters will be documented in the field sheet:

- Parent material texture
- Surficial material description
- Soil classification
- Rooting depth
- Root restricting layer
- Drainage
- Flood regime
- Profile diagram
- Horizons deepness (for both organic and mineral horizons)
- Horizon soil texture
- Horizon soil structure
- % of coarse fragment in each horizon
- Presence of intrusions
- Presence of bolds

5. Soil Sample Collection

In each natural ecosystem sampled, two soil samples of at least 200 g are collected in the first 10 cm and a second one on the following 20 cm. One in the pedon dug for the soil characterization and another one within the same plot limit. Soil samples of the same natural ecosystems (same ecotype as determined during the ecological characterization) are mixed together to give a composite sample. Write the sample number in the bag (site code, ecosystem code) using a permanent marker.

Furthermore, one composite sample is taken from each mine waste dump. The composite sample is made of 10 individuals distributed soil samples on site mixed together. These 10 samples are collected equally distanced of each other, on each waste dump side. Each individual sample includes 100 g of soil from the first 10 cm and another 100 g from the following 20 cm. Each composite sample should be given the same sample name and number of their corresponding ecosystem characterization field sheet.

Environnement

Viridis Terra
INNOVATIONS

The composite samples will be analyzed in Maxxam laboratories. The following parameters should be assessed:

- Granulometry (% sand, silt, clay, gravel+)
- Total C and N content
- Soluble cations (P, Ca, K, Mg, Na, S)
- % Saturation
- % Moisture
- pH
- Total Extractable Metals by ICP-MS (Al, Ag, As, Ba, Be, Cd, Ca, Cr, Cu, Co, Fe, Mg, Mn, Mo, Ni, Hg, P, K, Pb, Se, Na, Zn)
- Soil mineral composition by MA 250 4 Acid Digestion Ultratrace ICP-MS Analysis

1. Objectives

The objectives of these activities were to implement the plantation experimental design on the TSMC site.

Several variables have been tested with this experimental design. The implemented layouts are presented in Appendix B and the original layouts in Appendix C (previously to the experimental design changes due to logistical constraints) The following variables were tested: site preparation (Rough & Loose) vs unprepared compacted soil; fertilizer application (dolomitic limestone, rapid and slow release fertilizers) vs original soil (as a control); irrigation vs natural precipitation regime; overburden soil application vs original soil; tree and shrub seedlings plantation vs hydroseeding.

NB: the irrigation system was installed for summer 2018. However it was only used few days during the summer due to lack of manpower on site and unavailability of water truck; thereby, it will have to be tested again in 2019.

Because of logistical constraints, only three blocks were established on the study site contrary to the initially planned five blocks. Two blocks were put on the flat top of the Timmins 4 waste dump while one block was established on the south-west-facing slope. One third of each block was treated with Rough & Loose site preparation technique, another third of each block received Rough & Loose treatment and a 10 cm layer of overburden, while the last third was left without preparation. Soil preparation was done before outplanting and hydroseeding. Furthermore, plant material was preferably established in the microsite depressions, created by R&L site preparation.

2. Necessary Material
    a. Plantation: Seedlings Grown in Pepinière Boucher Greenhouse
        - Green alder (seeds with Schefferville provenance)
        - Bog blueberry (seeds with Schefferville provenance)
        - Glandular birch (seeds with Schefferville provenance)
        - Black spruce (seeds with Quebec provenance): 1-year old seedlings and several month-old seedlings
    b. Plantation: Cuttings and Micro-cuttings
        - Plane leaf Willow: 60 cm, 25 cm, 5 cm
    c. Plantation: Seedlings Excavated near TSMC Mined Sites (close to Flemming 7)
        - Bog blueberry
        - Glandular birch

NB: More than 80% of bog blueberry, black spruce and glandular birch provided by Pépinière Boucher were not viable due to transport, acclimation problems, small age, and lack of dormancy. In order to increase the probability of success of the restoration trial, green alder and bog blueberry excavated seedlings were added in the planting bags or biodegradable pots containing these species.

d. Planting Substrate (Quantity Varies According to Restoration Site Area)

- Planting substrate in the biodegradable pots was prepared by the Pépinière Boucher, slow release fertilizers (approx. one table spoon) has been added to the experimental units with treatment, while in the control units no fertilizers have been applied.
- Planting substrate used for planting bag assembly contains peat moss and hydrogel.

NB: It is important to moisturize peat moss before hydrogel addition. The easiest way to moisturize excessively dry peat moss is to pour hot water on peat moss substrate and mix it together with a small cement mixer until it becomes moist.

e. Plantation Equipment (Quantity Varies According to Restoration Site Area)

- 2 L planting bags with seedlings
- Jiffy pots with seedlings
- Root growing hormones
- Primer-water solution (1:1) (to protect willow cuttings against desiccation)
- Fertilizers: dolomitic lime, fast 8-31-8 (Synagri) and slow 14-14-14 (ECO+) release fertilizers
- Buckets
- Planting shovels
- Pick axe
- Plant transportation containers (modified wooden pallets)
- Two 50 m tapes measures
- Ropes (100 m)
- Flagging tape

3. Experimental Design of Treatment Unit with Plantation

Each treatment unit contains 5 rows of different species outplanted with different techniques and treatment (Appendix). One “longitudinal” row contains 5 willow cuttings of 50 cm long, planted directly into the soil. These long willow cuttings were covered with Primer-water solution to prevent desiccation, while bottom parts of the cuttings have been powdered with root growth hormones. Opposite to each long willow cutting starts the “meridional” row containing different species.

Procedure:

- The first "meridional" row contains 4 willow cuttings of 25 cm planted into jiffy pots (2 replicates), followed by 25-cm willow cuttings in the planting bags (2 replicates).
- The second row contains 1-year spruce seedlings planted in jiffy pots (2 pots), followed by 2 planting bags with spruce seedlings. Some planting bags designated for one-year spruce seedlings contain tiny spruce seedlings (3-4 cm long) produced by Pépinière Boucher.
- The third row contains alders: two jiffy pots and two planting bags.
- Because of the weakness of plant material provided by Pepinière Boucher mainly due to transport and acclimation problems, small age, and lack of a depth dormancy, the fourth row, designated initially for birches, contains several species or plants of different origin. Thus, each jiffy pot with birches grown at Pépinière Boucher, also contains birch seedlings excavated near TSMC mined site (Flemming 7 sector). The planting bags of this row contain birch seedlings provided by the Pepinière Boucher, alder seedling and also a birch seedling excavated near TSMC mined sites.
- In the fifth row, where the Bog blueberry was tested, Jiffy pots contain bog blubbery produced by Pepinière Boucher (2-3 cm tiny seedlings) and blueberry seedlings excavated near TSMC mined sites (Flemming 7 sector); each of the two planting bags contains a blueberry seedling produced by Pepinière Boucher, an alder seedling, and a blueberry seedling excavated near TSMC mined sites.

4. Hydroseeding

   Approximately 120 micro-cuttings (per treatment unit of 5 m per 4 m were dispersed homogeneously on the soil surface of half the block. Then, the micro-cuttings were slightly pressed into the soil by stepping on them. Finally, the hydroseeding mixture was applied above the micro-cuttings and on the soil surface.

   The hydroseeding formulation of the SYLVEN™ technology contains a mixture of water with different materials such as: wood fibre, hydrogel, wood fibre, glue, microorganisms (Pleurotus ostreatus soup) and a mixture of seeds of several local plant species: glandular birch, black spruce, green alder, and bog blueberry (See the Hydroseeding Protocol or HYP, for more details).

1. Objective of the Protocol

The objective of this protocol is to establish guidelines to monitor the hydroseeding and plantations done for the 2017-2018 ecological restoration trial (survival rate, seedling initial height for the plantation).

2. Necessary Material

2.1. Hydroseeding

- Pads
- Field sheets
- 240 survey flags
- 30 cm ruler
- Camera to take pictures
- 50 cm X 50 cm quadrat

2.2. Seedlings and Cuttings

Only field sheets, a measuring tape, and a camera will be needed to monitor the plantations of seedlings and cuttings.

3. Plantation Monitoring

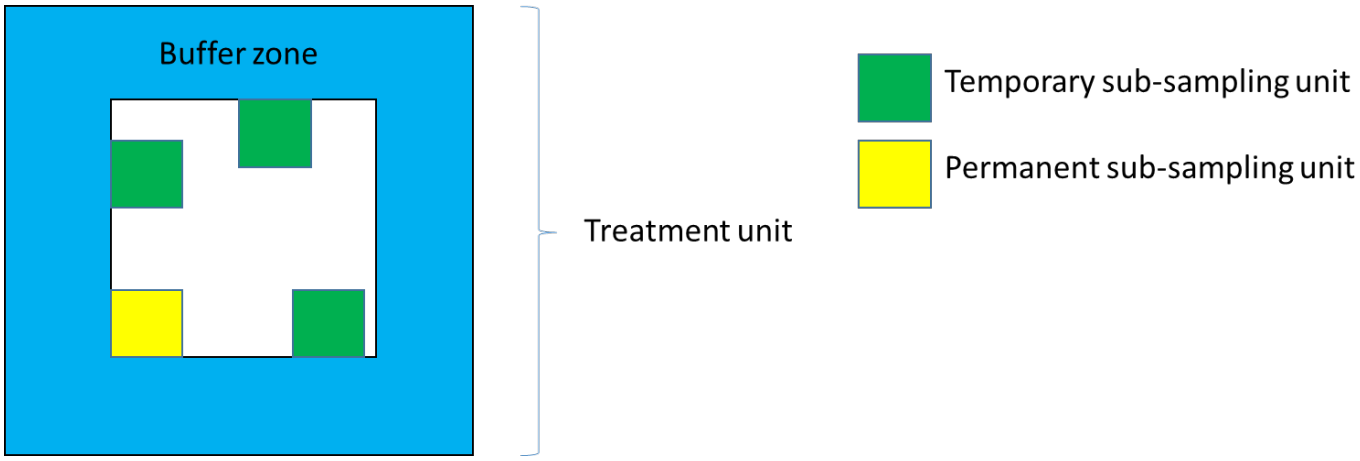
3.1. Hydroseeding

- Determine a buffer zone of 1 m wide all around each treatment unit.
- Walk only in the buffer zone where no data is collected.
- Place random marks in the ground to form four 0.5 m X0.5 m sub-sampling areas (quadrats) (1 permanent and 3 temporary sub-sampling areas) along the buffer zone. Germination rate and species density and frequency will be measured in the 3 temporary sub-sampling areas while growth and species mortality will be assessed in the permanent sub sampling area.
- With eyes 1 foot (30 cm) from the ground surface, count the number of seeds that germinated in each quadrat for each species.
- Place the areas in representative locations of the plot
- Estimate the minimal, the maximal and the mean height of the seedlings in the quadrat for each species.
- Leave the flags of the permanent quadrat in place to be able to recount at the same spot each year.

Content of the hydroseeding monitoring field sheets (See Appendix A for complete field form).

Date	Team	Bloc N: Hydroseeding Unit identification: Nr of replicate:					
Nb of growing seedlings per specie and minimum, maximum and mean height							
Willow cuttings	Spruce	Pine	Willow	Birch	Blueberry		Comments

Example of sub-sampling in the hydroseeding 4 mX 5 m plot



3.2. Seedlings and Cuttings

Fill the field sheets for each seedling and cutting block by block, sub-block by sub-block and treatment unit (plot) by treatment unit.

Content of the seedling/cutting monitoring field sheets (See Appendix).

Date	Team	Bloc N: Treatment Unit identification:					
Treatment (pot/bag/cutting)	Status of treatment: destroyed, good shape	Species	Dead/alive	Status: good, weak	Growth signs	Height	Comments

Environnement

Viridis Terra INNOVATIONS

1. Plantation at the Base of the Slope

In order to test plant adaptation to TSMC climate-edaphic conditions, an additional experimental plot was established at the base the waste dump. The plot is protected against the wind by the wall formed by the dump; also, the wall may promote snow accumulation during the winter. The approximate dimensions of the plot are 15 m X 5 m.

The soil of the plot was treated with dolomitic (20 kg) and Synagri (approx. 15 kg) fertilizers. Most types of planting material were tested.

Willow cuttings: 1 m and 25 cm were outplanted in different ways. Thirty-five willow cutting of 1 m long cuttings were planted vertically; 28 cuttings were planted perpendicularly into the slope. Twenty cuttings of 1 m and 10 cuttings of 25 cm were mixed with 20 kg peat moss (fagot method). Prior to outplanting, all these cuttings were treated with rooting hormones as well. Approximately 20 25 cm willow cuttings were planted vertically in a row.
Spruce: 17 planting bags with spruce seedlings were planted in a row into the soil treated with fertilizers listed above.
Alder: 25 planting bags with alders were planted in another row.

2. Control

As an additional control, an experimental unit of 6 per 6 metres has been established in the control conditions outside the TSMC site in the natural environment. The control plot is localized approximatively10 km south from the main entrance to the TSMC site. The site is surrounded by steep rocks. The soil is covered by native vegetation: lichens and dwarf shrubs.

It was planned to outplant the seedlings in the soil on the control plot. However, because of lack of labour, it has not been done. Therefore, the seedlings have been deposited within the targeted area.
Thus, approximately 50 planting bags with spruce and alder seedlings and willow cuttings were surrounded by jiffy pots with weak bog blueberries (from Pépinière Boucher) and glandular birch seedlings.

3. Plant material conservation trial on the TSMC site

The quantity of plants produced and transported to the TSMC site for the spring 2018 trial corresponded to the amount discussed and approved during the meeting with all project parties. However due to the logistical challenges, the size of experimental design has been reduced from 5 to 3 blocks. The maximal number of seedlings and cuttings were outplanted in the 3 experimental blocks implemented. In order to preserve left over material, it has been decided to organize a small refugium for these plants and to use them in further planting campaigns. Therefore, on the territory of TSMC site, 100 metres apart from the major experimental site, in the flat area covered by native vegetation, 6 per 6 m unit has been delimited. Within this unit the vegetation has been removed, peat moss has been added (approx. 20 kg), planting bags with spruce and alder seedlings have been placed there.

Environnement

Viridis Terra
INNOVATIONS

1. Objective of the Protocol

   The objective of this protocol is to test if a right amount of water during a prolonged period without rain will be beneficial for the seedling plantations and the hydroseeded parcels.

2. Necessary Material

   - Irrigation system installed by T2 Environnement and Viridis Terra Innovations as per designed layout for the 3 restoration experimental blocks. The system includes:
     - 7 HP gas pump;
     - 25 feet water intake from the pump up to the water source;
     - 2-inch pipe network from the pump up to each experimental block section that require irrigation;
     - A total of 6 valves (two per experimental block or one for the seedling plantation, the other for the hydroseeding) to control the water outtake.
     - 24 wobblers (8 per experimental block) to water the seedling plots and the hydroseeded plots.
   - Water source:
     - Originally, a water truck was supposed to be used to water the seedling plantations and hydroseeded plots. This truck was not available when we were onsite. A temporary solution was found to irrigate the experimental blocks.
     - 5 1,000 L containers were installed close to the gas pump. This is not enough to properly water the plantations and hydroseeded parcels, but it is better than nothing. A minimum of 10 1,000 L containers should be installed to irrigate 10 mm to the seedling plantations and hydroseeded parcels, or a water truck should be used.

3. Knowing When to Irrigate

   Rain gauges (pluviometers) were installed within each experimental block. 4 plastic cylinders were partially buried in wastes deposit. They should be emptied before and after irrigating the block. Number of millimetres (before and after) in each rain gauges has to be noted. The rain gauges should be emptied at least once a week.

   The blocks should be irrigated if less than 15 mm of rainfalls occurs in one week or if no significant rainfall (minimum of 10 mm) events occur during 3 consecutive days.

   Also, consider increasing the irrigation frequency if the air temperature is above 22 C for a prolonged period (more than 5 days).

   Exemple:

   - Rain gauges indicate 12 mm; all rain fell in the previous two days = no irrigation required.
   - Rain gauges indicate 25 mm; no rain fell over the last 4 days = irrigation required.
   - Rain gauges indicate 10 mm; last rain event was two days ago = irrigation required.

Environnement

Viridis Terra
INNOVATIONS

4. How to Irrigate

If possible, chose a day not too windy. To prevent excessive evaporation, the experimental blocks should be irrigated early in the morning (before 8 AM) or late in the afternoon (after 5 PM).

Put the water intake into the water source (water truck or 1000 L container). Verify if the gas reservoir is full. Put ignition button to “on”. Turn on the “choke” button. Start the pump at the idle position (minimum or turtle). Turn the “choke” button. Increase the pump regime to maximum (rabbit). To stop the pump, reduce the engine regime to minimum (turtle). Turn off the ignition button.

If 1000 L containers are used, stop the pump each time the container is empty and start it again in a full container. Use a minimum of 5 full containers (equivalent of 5 mm of rain). This should be done 3 times a week if no significant rain event occurred (see section 3).

If the water truck is used, pump 10,000 L for each irrigation event (equivalent of 10 mm of rain). This should be done 2 times a week if no significant rain event occurred (see section 3).

5. Record and Adjust

Record data (number of mm) for each rain gauge after every watering event. Notice if the water was distributed evenly (all rain gauges have a similar amount of water) or unevenly (one rain gauge has more mm that the 3 others). Consider modifying the wobblers positions within each block if the watering is uneven. Dominant wind direction is an important parameter to consider when adjusting the wobblers position.

APPENDIX A

Field data collection sheet for trials

Environnement

Viridis Terra
INNOVATIONS

Seedling Plantation Survey Protocol								
Date		Team		Bloc N: Treatment Unit identification:				
Sampling number	Sub-sampling number	Treatment (pot/bag/cutting)	Status of treatment: destroyed, good shape	Species	Dead/alive	Status: good, weak	Height (cm)	Comments

Hydroseeding survey protocol

Environnement

Viridis Terra
INNOVATIONS

Date		Team		Bloc N: Hydroseeding Unit identification: Nr of replicate:				
Sampling number	Sub-sampl. number	Nb of growing seedlings per species/min height / max height /mean height						
		Willow cuttings	Spruce	Alder	Willow	Birch	Blueberry	Comments

Environnement

Viridis Terra
INNOVATIONS

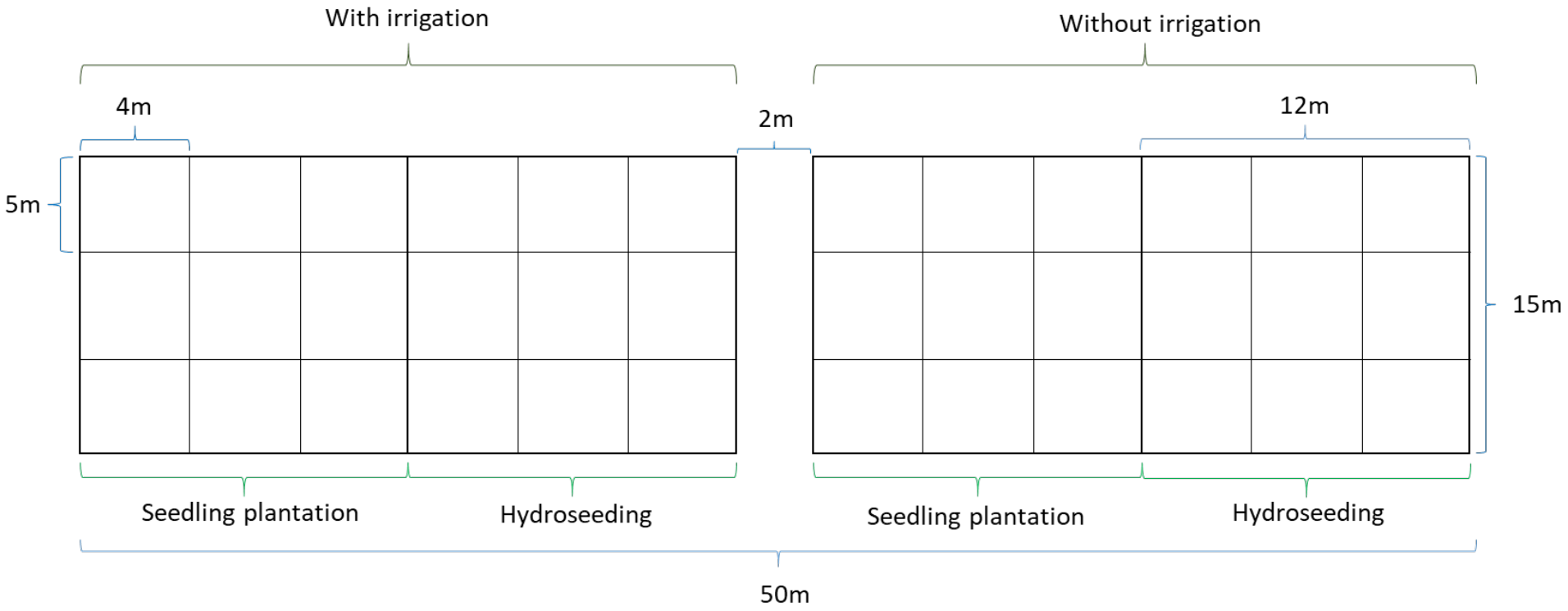
APPENDIX B

Restoration Trial that was established in Spring 2018 following logistic challenges

Environnement

Viridis Terra
INNOVATIONS

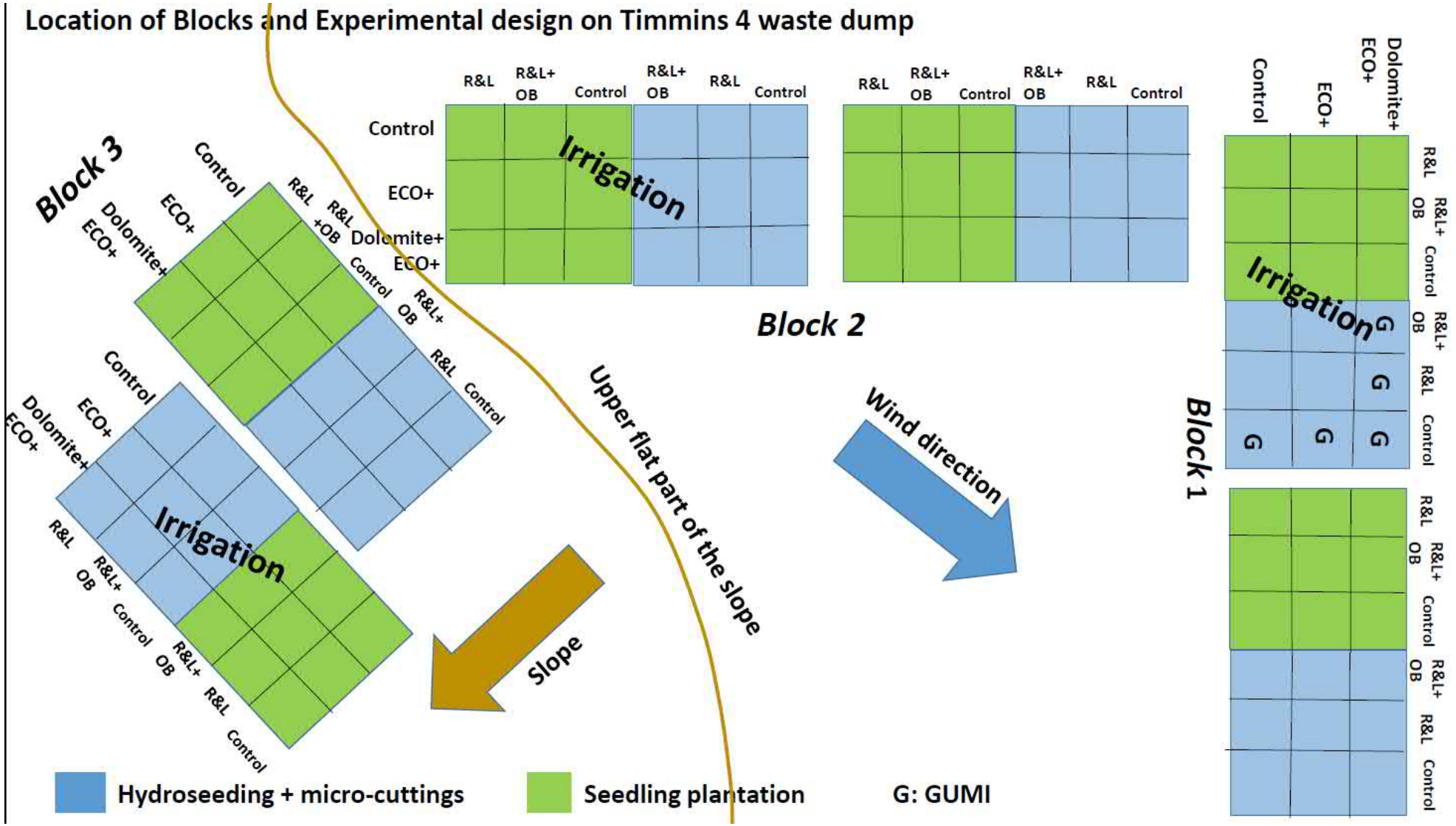
BLOCK LAYOUT



Environnement

Viridis Terra
INNOVATIONS

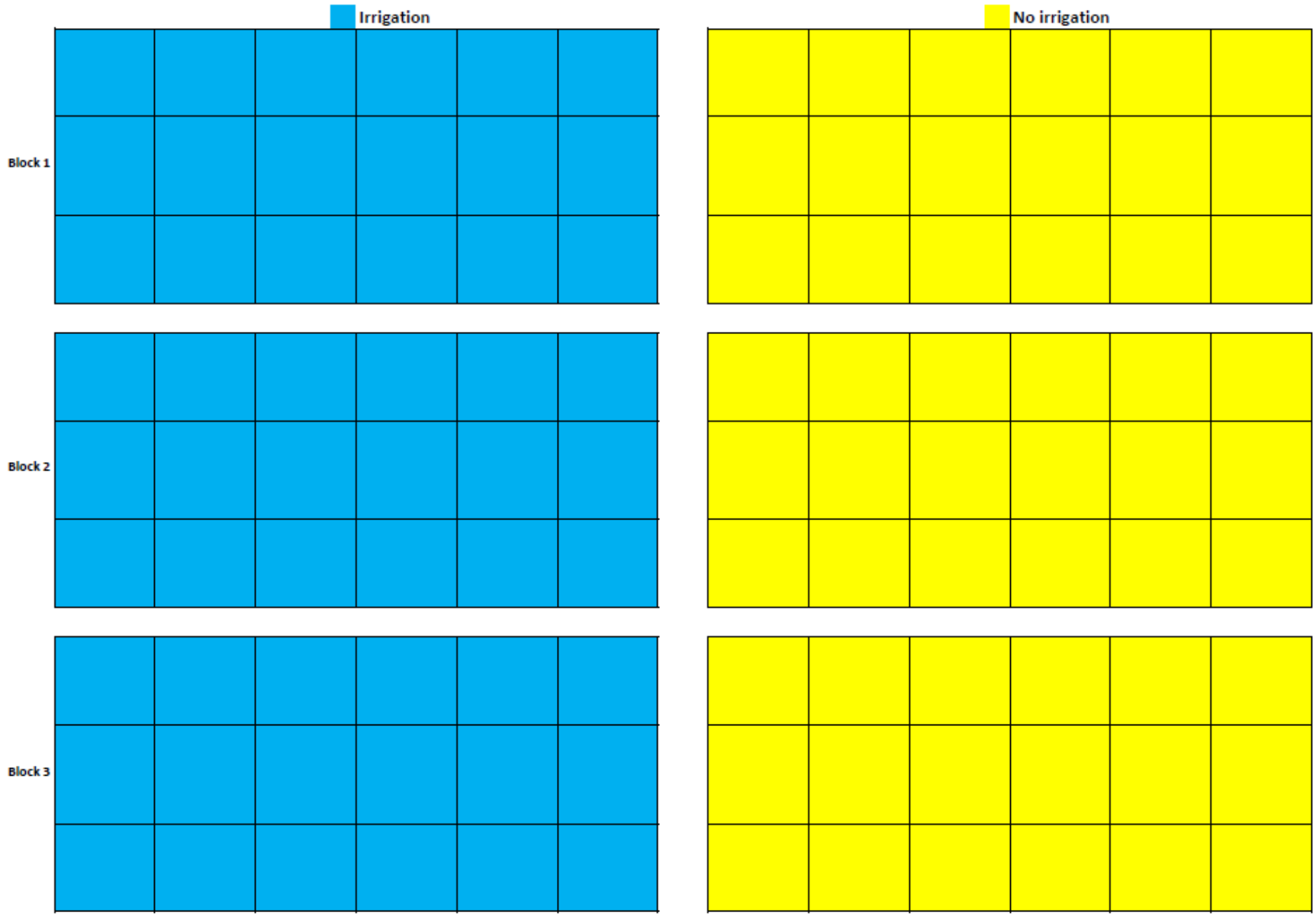
Location of Blocks and Experimental design on Timmins 4 waste dump



Environnement

Viridis Terra
INNOVATIONS

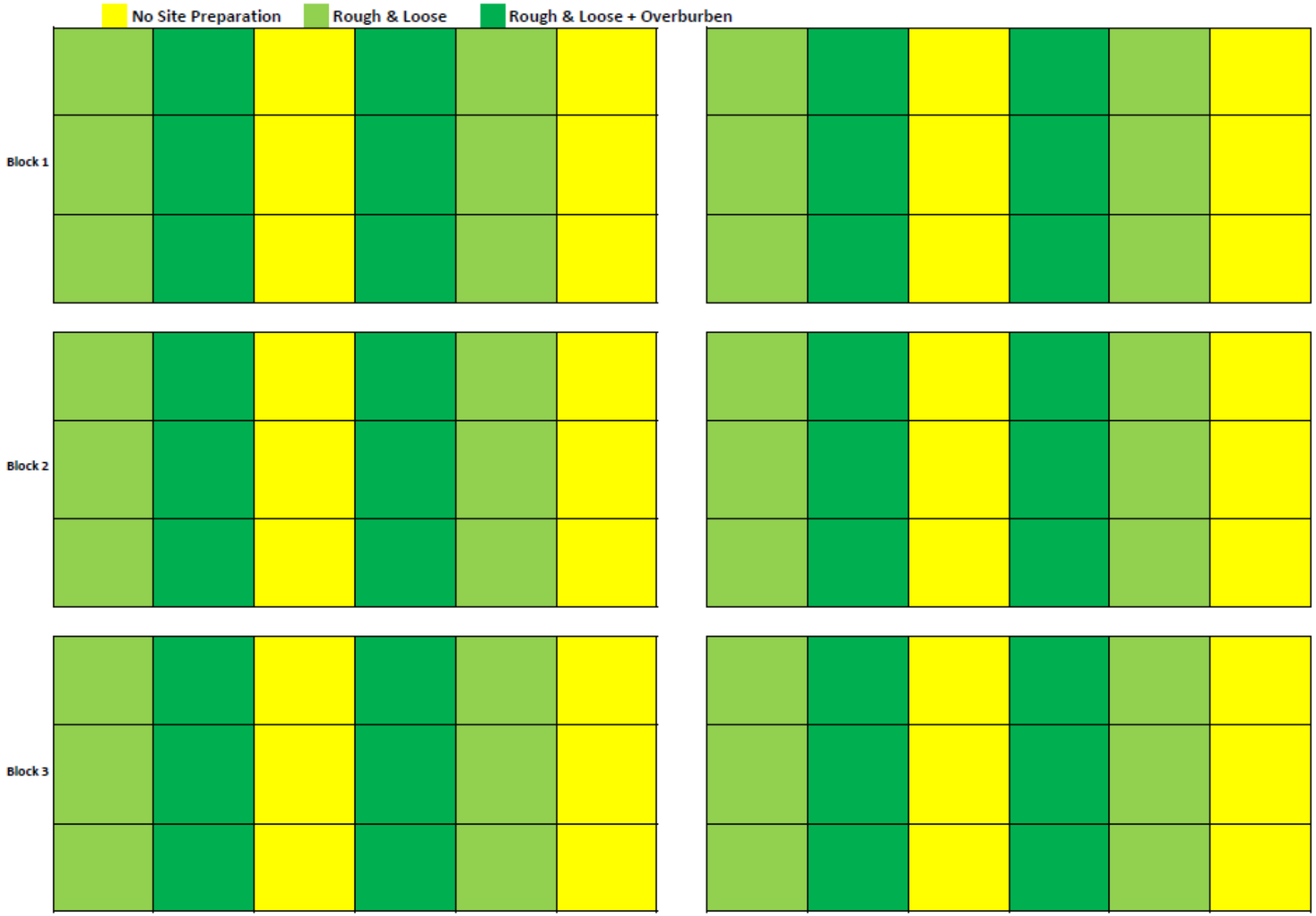
IRRIGATION LAYOUT



Environnement

Viridis Terra
INNOVATIONS

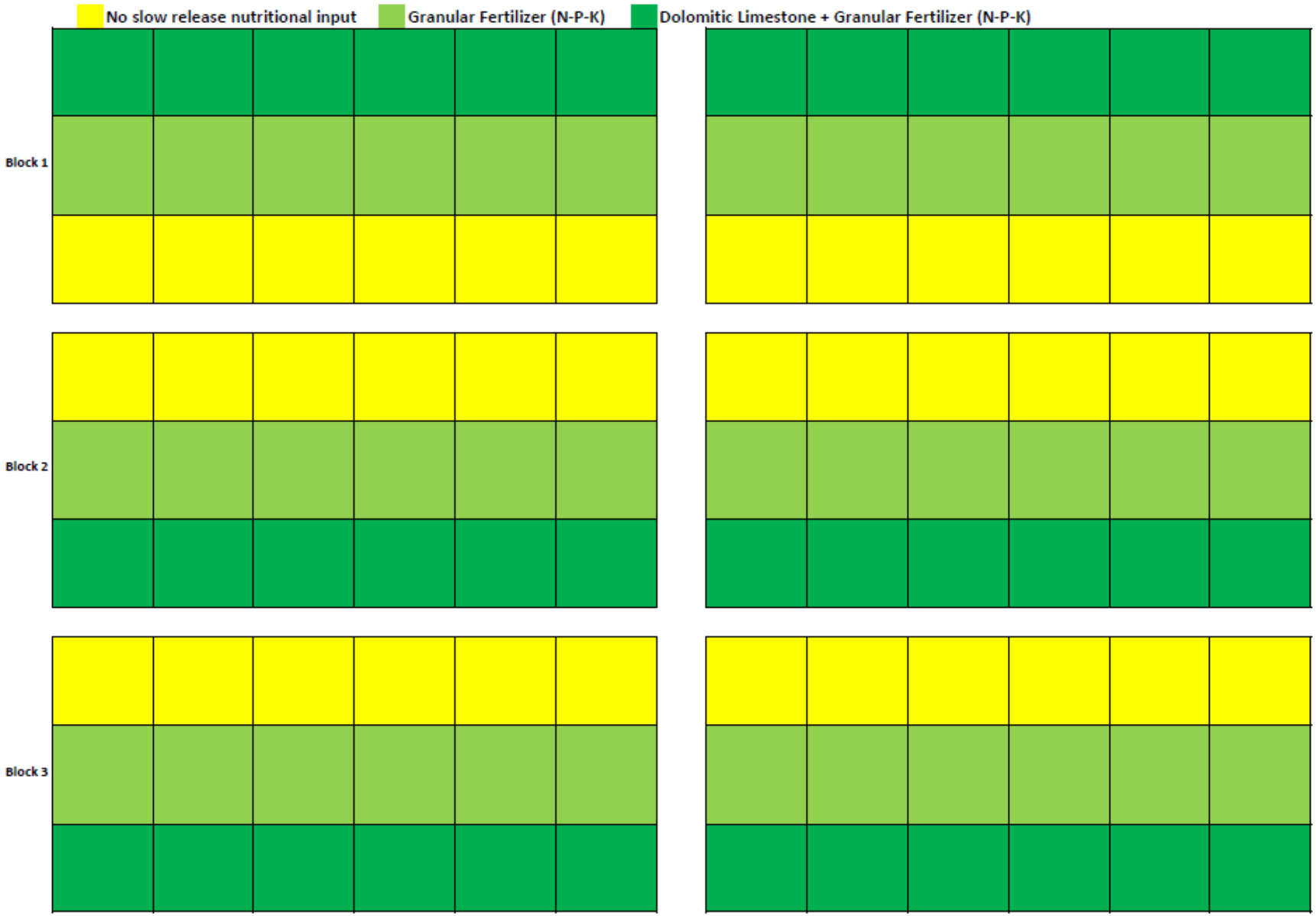
SITE PREPARATION LAYOUT



T² Environnement

Viridis Terra
INNOVATIONS

NUTRITION LAYOUT



Environnement

Viridis Terra
INNOVATIONS

PLANTATION AND HYDROSEEDING LAYOUT

4m

5m

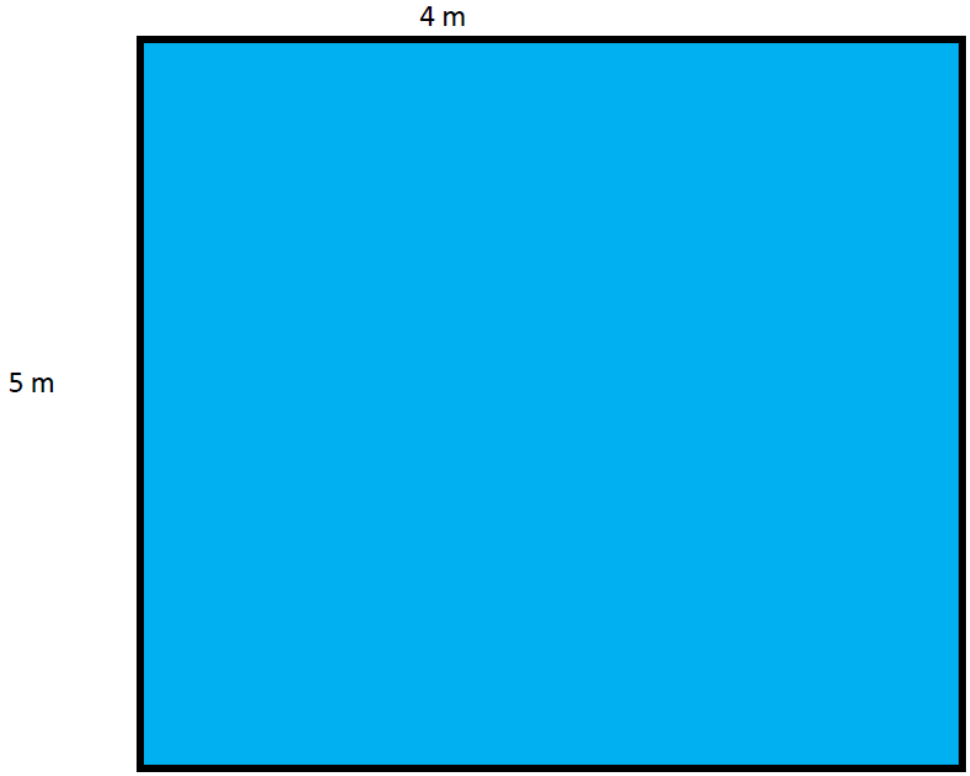
SPC	SPC	SPC	SPC	SPC
SP	PM	AC	BG	VU
SP	PM	AC	BG	VU
SP	PM	AC	BG	VU
SP	PM	AC	BG	VU

Ellepot	Large plug with biodegradable cover
2L bag	Biodegradable jute bag with 2L mix
Cutting	Large 0.7-1.0m long willow cutting

PM	Seedling	*Picea mariana*
SP	Small cutting	*Salix planifolia*
BG	Seedling	*Betula glandulosa*
VU	Seedling	*Vaccinium uliginosum*
AC	Seedling	*Alnus crispa*
SPC	Large cutting	*Salix planifolia*

T2 Environnement

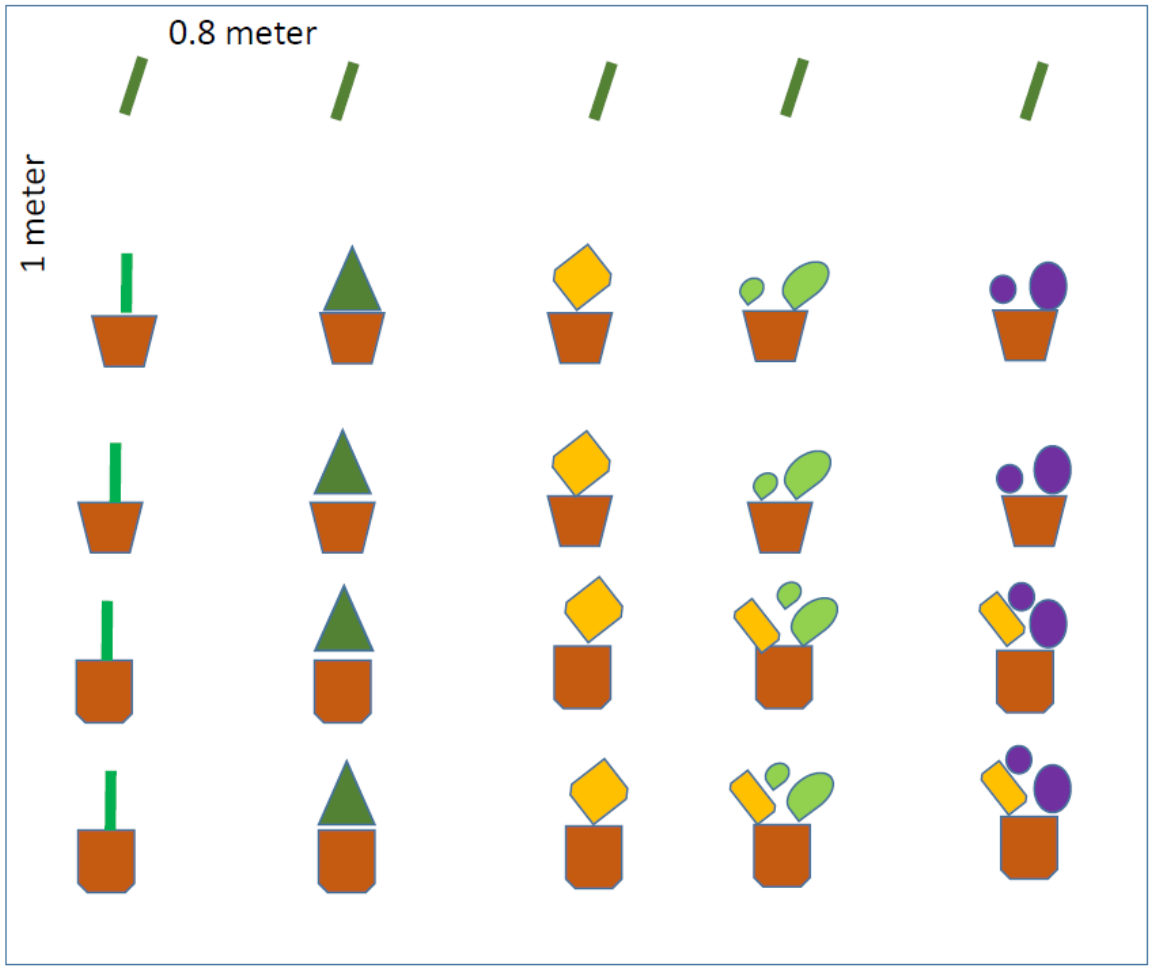
Viridis Terra INNOVATIONS



Picea mariana	**614 000 seeds / ha**
Betula glandulosa	**7 127 000 seeds / ha**
Vaccinium uliginosum	**1 698 000 seeds / ha**
Alnus crispa	**12 979 000 seeds / ha**
Salix planifolia	**60 000 micro-cuttings (5cm) / ha**
TOTAL	**22 417 000 seeds / ha and 60 000 micro-cuttings / ha**

Environnement

Viridis Terra
INNOVATIONS



Biodegradable planting pot

Planting bag

50 cm willow cutting

15 cm willow cutting

Spruce seedling

Green alder seedling

Glandular birch seedling

Glandular birch excavated seedling

Bog blueberry seedling

Bog blueberry excavated seedling

Environnement

Viridis Terra
INNOVATIONS

SPRING 2018 TRIAL SAMPLING NUMBER

Block 1

1	4	7	28	29	30
2	5	8			
3	6	9			
10	13	16	31	32	33
11	14	17			
12	15	18			
19	22	25	34	35	36
20	23	26			
21	24	27			

37	40	43	64	65	66
38	41	44			
39	42	45			
46	49	52	67	68	69
47	50	53			
48	51	54			
55	58	61	70	71	72
56	59	62			
57	60	63			

Block 2

73	76	79	100	101	102
74	77	80			
75	78	81			
82	85	88	103	104	105
83	86	89			
84	87	90			
91	94	97	106	107	108
92	95	98			
93	96	99			

109	112	115	136	137	138
110	113	116			
111	114	117			
118	121	124	139	140	141
119	122	125			
120	123	126			
127	130	133	142	143	144
128	131	134			
129	132	135			

Environnement

Viridis Terra
INNOVATIONS

Block 3	145	148	151	172	173	174
	146	149	152			
	147	150	153			
	154	157	160	175	176	177
	155	158	161			
	156	159	162			
	163	166	169	178	179	180
	164	167	170			
	165	168	171			

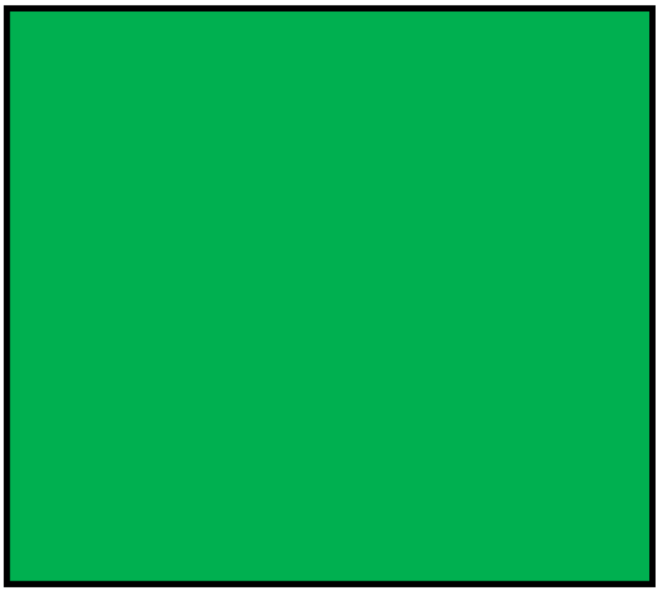
181	182	183	190	193	196
			191	194	197
			192	195	198
184	185	186	199	202	205
			200	203	206
			201	204	207
187	188	189	208	211	214
			209	212	215
			210	213	216

Environnement

Viridis Terra
INNOVATIONS

FALL 2017 SMALL TRIAL

Fall 2017



2L Bag Biodegradable jute bag with 2L mix

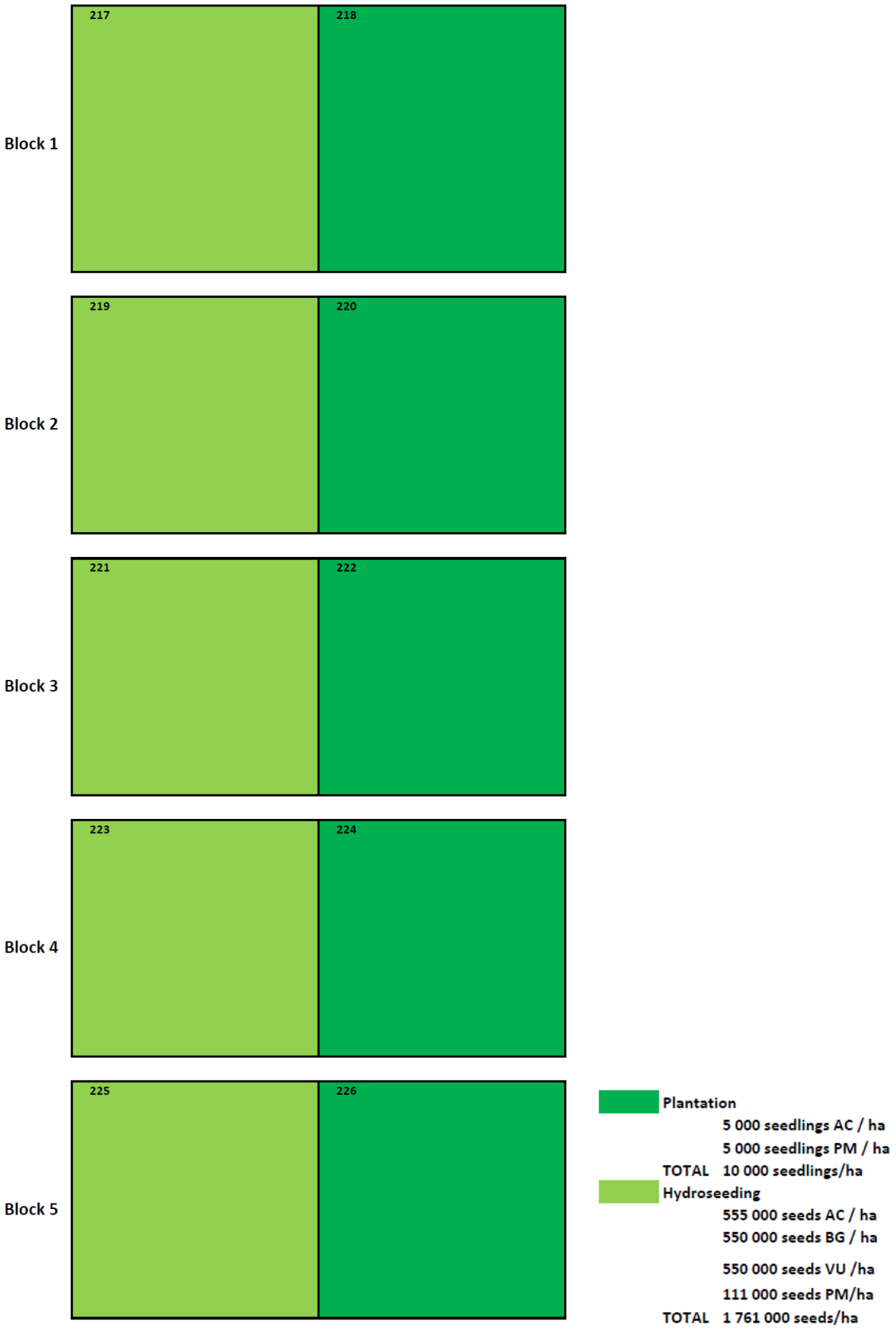
Fall 2017

PM	AC	PM	AC	PM	AC
AC	PM	AC	PM	AC	PM
PM	AC	PM	AC	PM	AC
AC	PM	AC	PM	AC	PM
PM	AC	PM	AC	PM	AC
AC	PM	AC	PM	AC	PM

PM	Seedling	*Picea mariana*
AC	Seedling	*Alnus crispa*

Environnement

Viridis Terra
INNOVATIONS



Environnement

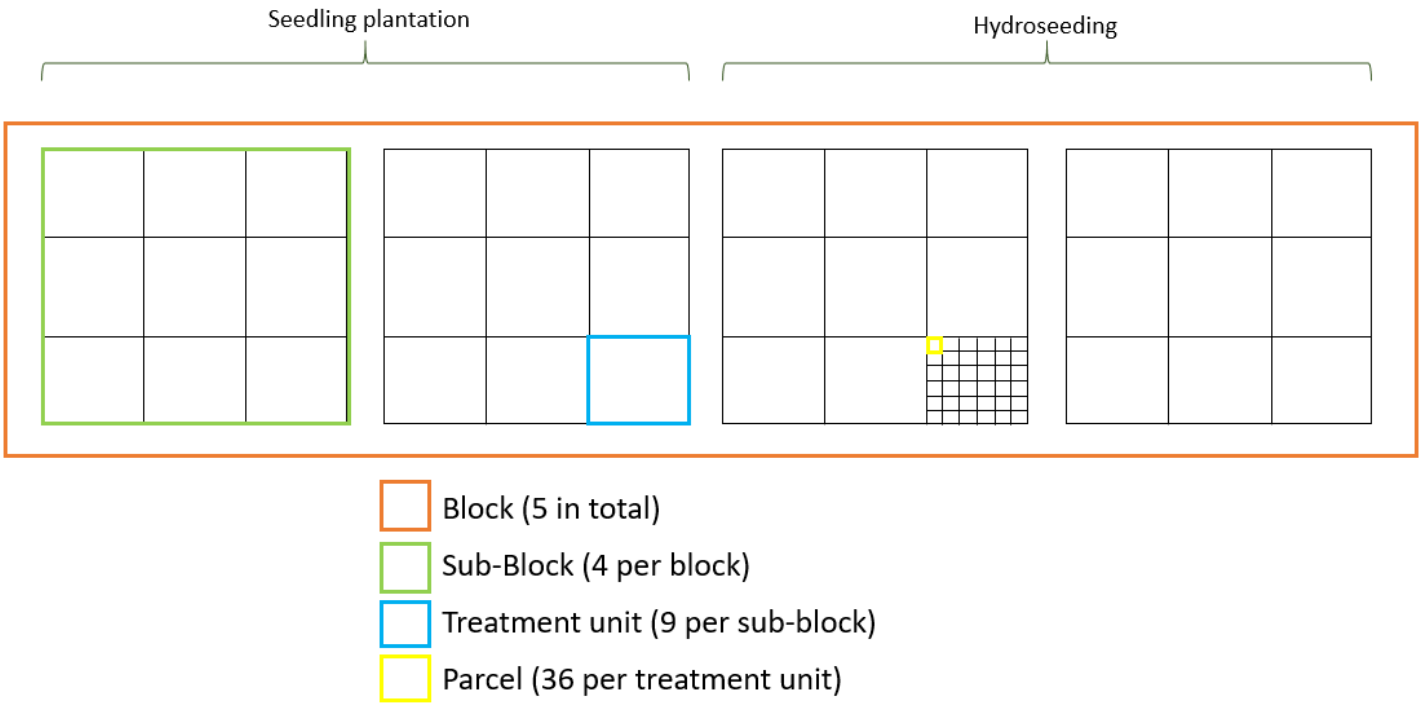
Viridis Terra
INNOVATIONS

APPENDIX C

Restoration Trial that was originally planned for Spring 2018

Environnement

Viridis Terra
INNOVATIONS

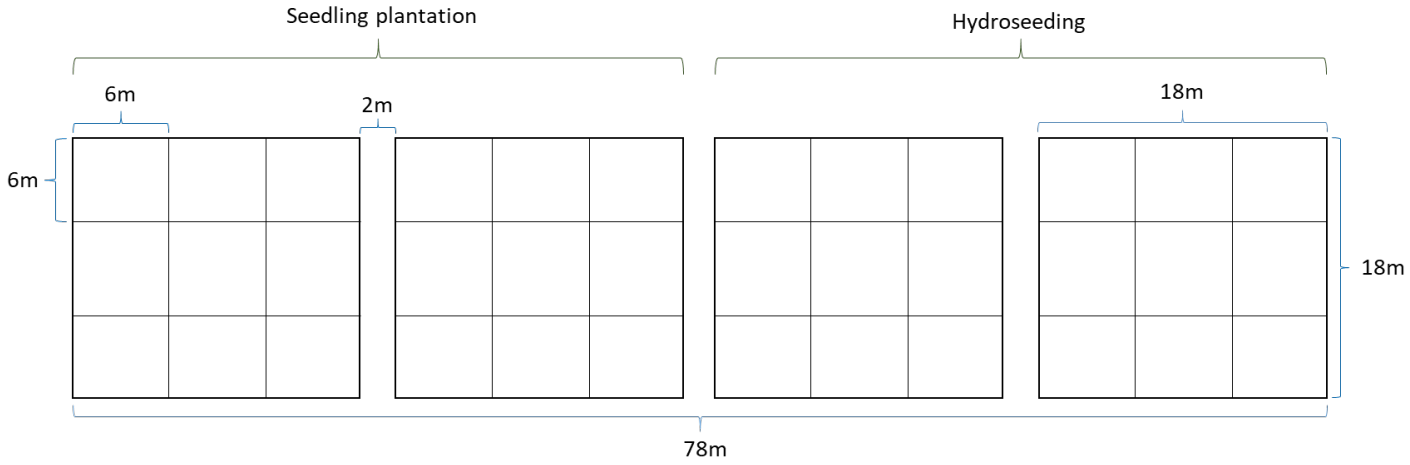


Environnement

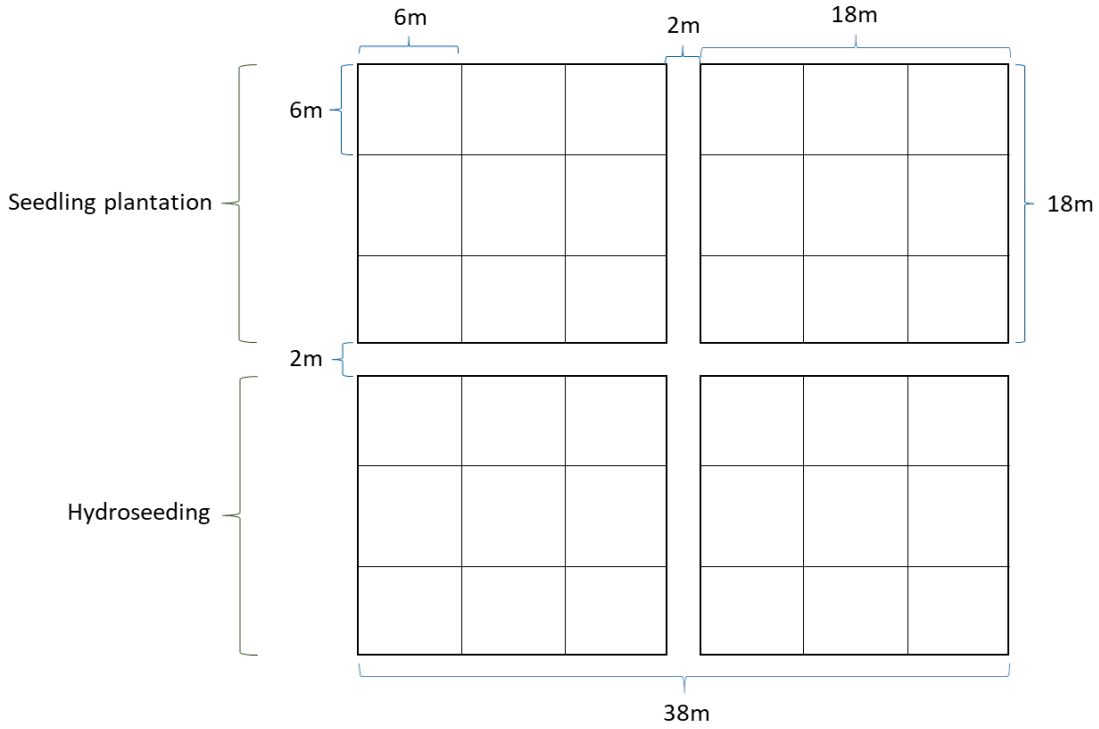
Viridis Terra
INNOVATIONS

EXPERIMENTAL DESIGN ONE BLOCK DIMENSION

Example 1 :



Example 2 :



Environnement

Viridis Terra
INNOVATIONS

GANTT CHART

Ecological Restoration Trial - Spring 2018			DURATION (days)
START DATE	END DATE	DESCRIPTION	
6-10-18	6-12-18	Slope reshaping with Bulldozer	2
6-12-18	6-13-18	Marking site preparation delimitation	1
6-13-18	6-16-18	Rough & Loose application with excavator where necessary	3
6-14-18	6-15-18	Transport of Topsoil (54m3) and overburden (162m3) close to T4	1
6-15-18	6-16-18	Mix and add Topsoil/Overburden to respective treaments	1
6-16-18	6-17-18	Mark the whole experimental design with stake flags, flagging, and reflective poles	1
6-16-18	6-17-18	Apply granular fertilizer Synagri 8-31-8 (1.38kg/plot(6m*6m)) to all hydroseeding treatments	1
6-16-18	6-17-18	Apply slow release granular fertilizer Eco+ 14-14-14 (0.72 kg/plot(6m*6m) to respective treatments	1
6-17-18	6-18-18	Apply dolomitic limestone (10.8 kg/plot(6m*6m)) to respective treatments	1
6-13-18	6-15-18	Prepare willow cuttings with the right size (half 25-30cm, half 70-100cm)	2
6-14-18	6-22-18	Put the prepared willow cuttings in water for 7-10 days	8
6-15-18	6-21-18	Prepare the seedlings with biodegradable bags (be careful not to damage the root system while preparing them) including small willow cuttings	6
6-15-18	6-21-18	Transfer some alder and small willow cuttings in empty jiffy plugs (only the quantity needed and be careful not to damage root system)	6
6-12-18	6-30-18	Follow willow seed production (between Schefferville and DSO3)	18
6-14-18	6-30-18	Collect 15 000 catkins when ready (catkins have started to open, may be ready in late June, early July), spray manually the catkins above the hydroseeding formulation	16
6-16-18	6-17-18	Mark locations where seedlings will be planted with paint	1
6-17-18	6-20-18	Outplant seedlings to respective locations in seedling plantation treatments (Be careful not to damage root system while planting)	3
6-21-18	6-24-18	Outplant the cuttings to respective locations in seedling plantation treatments after dipping the top third in primer solution and bottom third in hormone solution	3
6-20-18	6-23-18	Install irrigation system	3
6-21-18	6-25-18	Apply hydroseeding SYLVENTM formulation	4
6-25-18	6-26-18	Collect GPS coordinates of experimental design	1
6-25-18	6-26-18	Clean up the site	1
6-25-18	6-26-18	Debriefing on 2018 fieldwork with TSMC environmental team	1

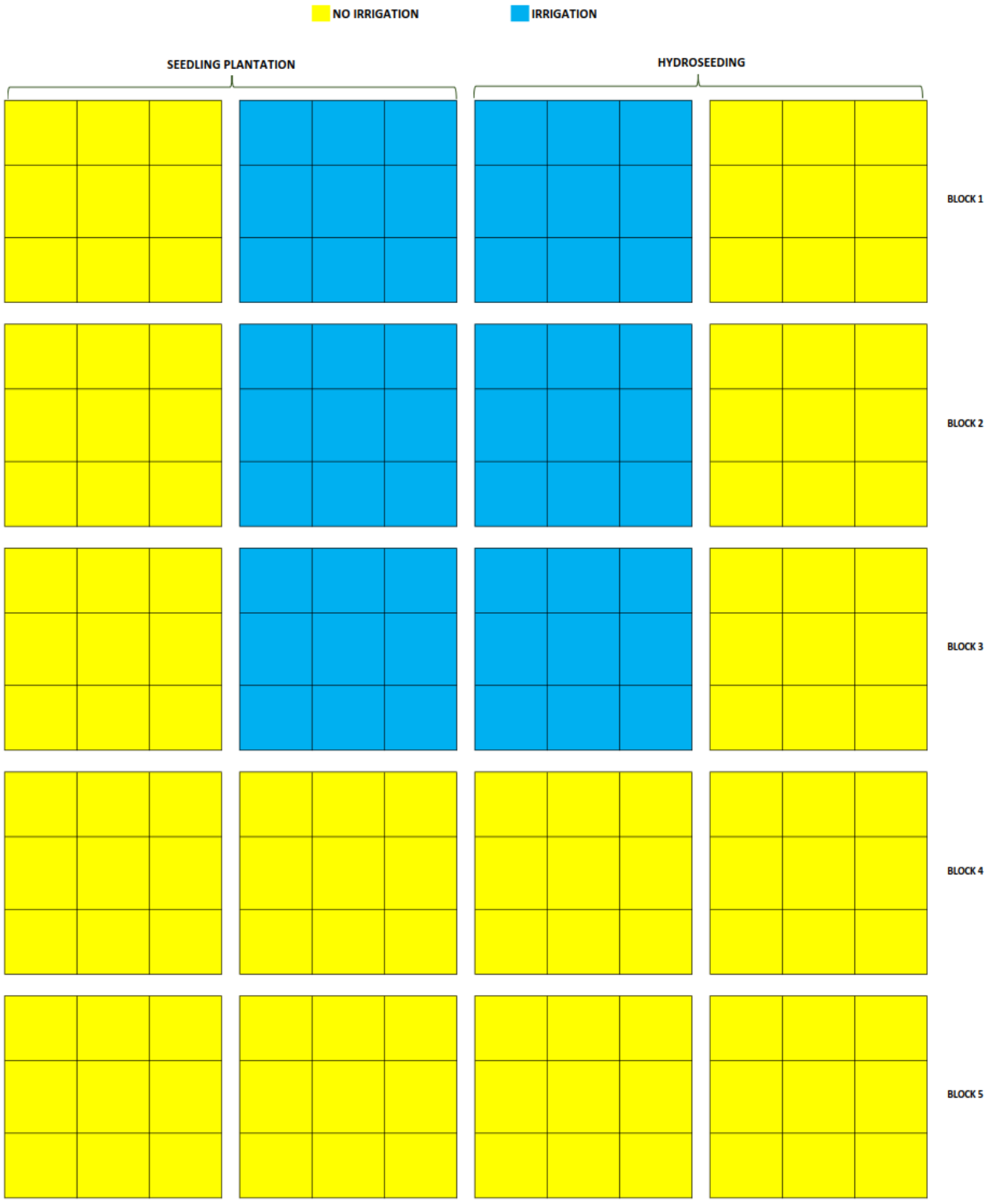
T2 Environnement

Viridis Terra INNOVATIONS

T2 Environnement

Viridis Terra INNOVATIONS

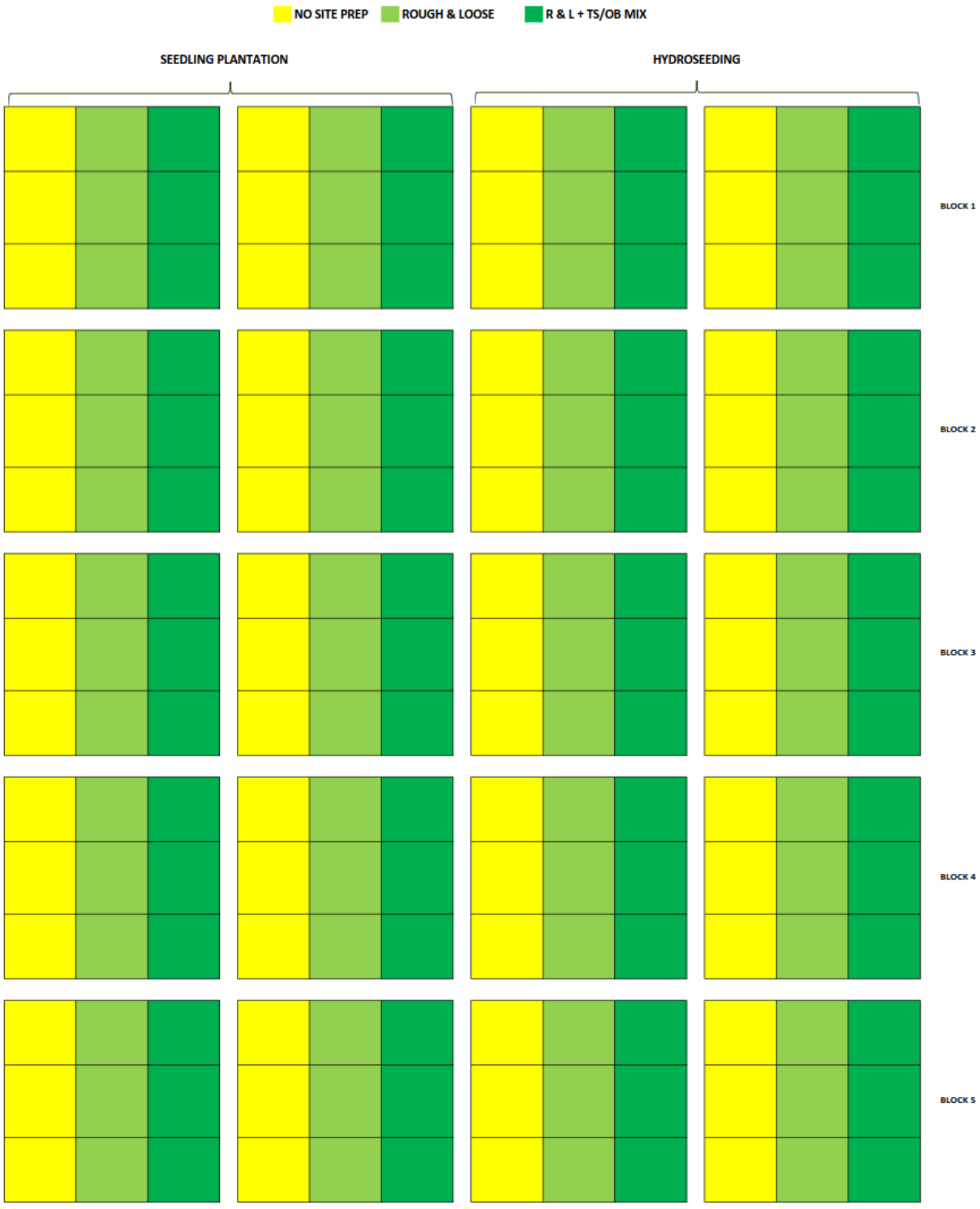
IRRIGATION LAYOUT



T2 Environnement

Viridis Terra INNOVATIONS

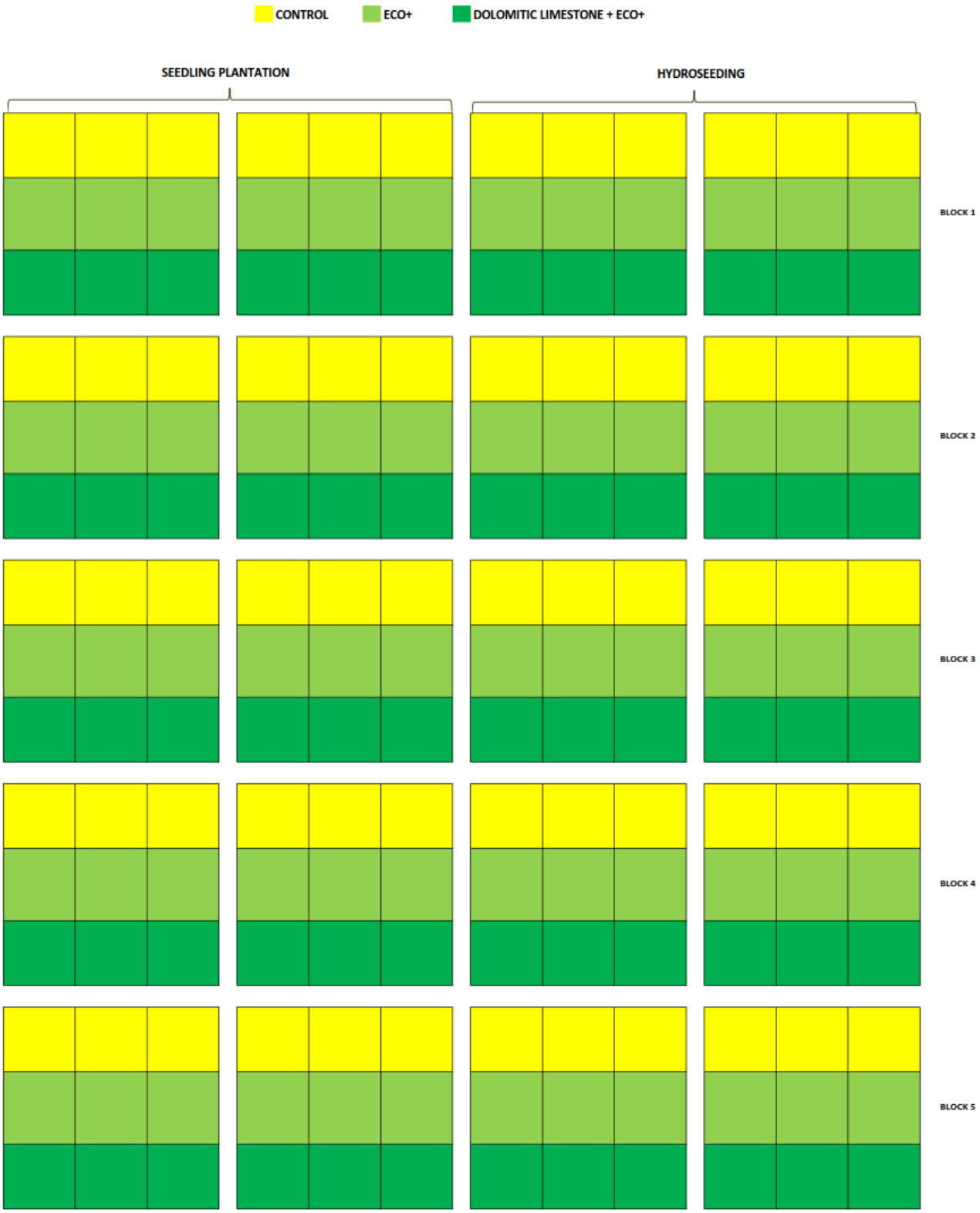
SITE PREPARATION LAYOUT



Environnement

Viridis Terra
INNOVATIONS

NUTRITIONAL INPUT LAYOUT



Environnement

Viridis Terra
INNOVATIONS

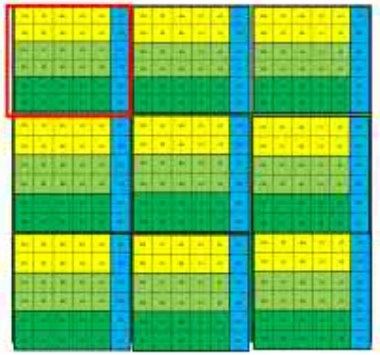
SEEDLING LOCATION LAYOUT

6 m

6 m

PM	SP	BG	VU	AC	SPC
PM	SP	BG	VU	AC	SPC
PM	SP	BG	VU	AC	SPC
PM	SP	BG	VU	AC	SPC
PM	SP	BG	VU	AC	SPC
PM	SP	BG	VU	AC	SPC

Control	45/110 plug	***for small cuttings, only the cutting***
Ellepot	Large plug with biodegradable cover	
2L bag	Biodegradable jute bag with 2L mix	
Cutting	Large 0.7-1.0m long willow cutting	

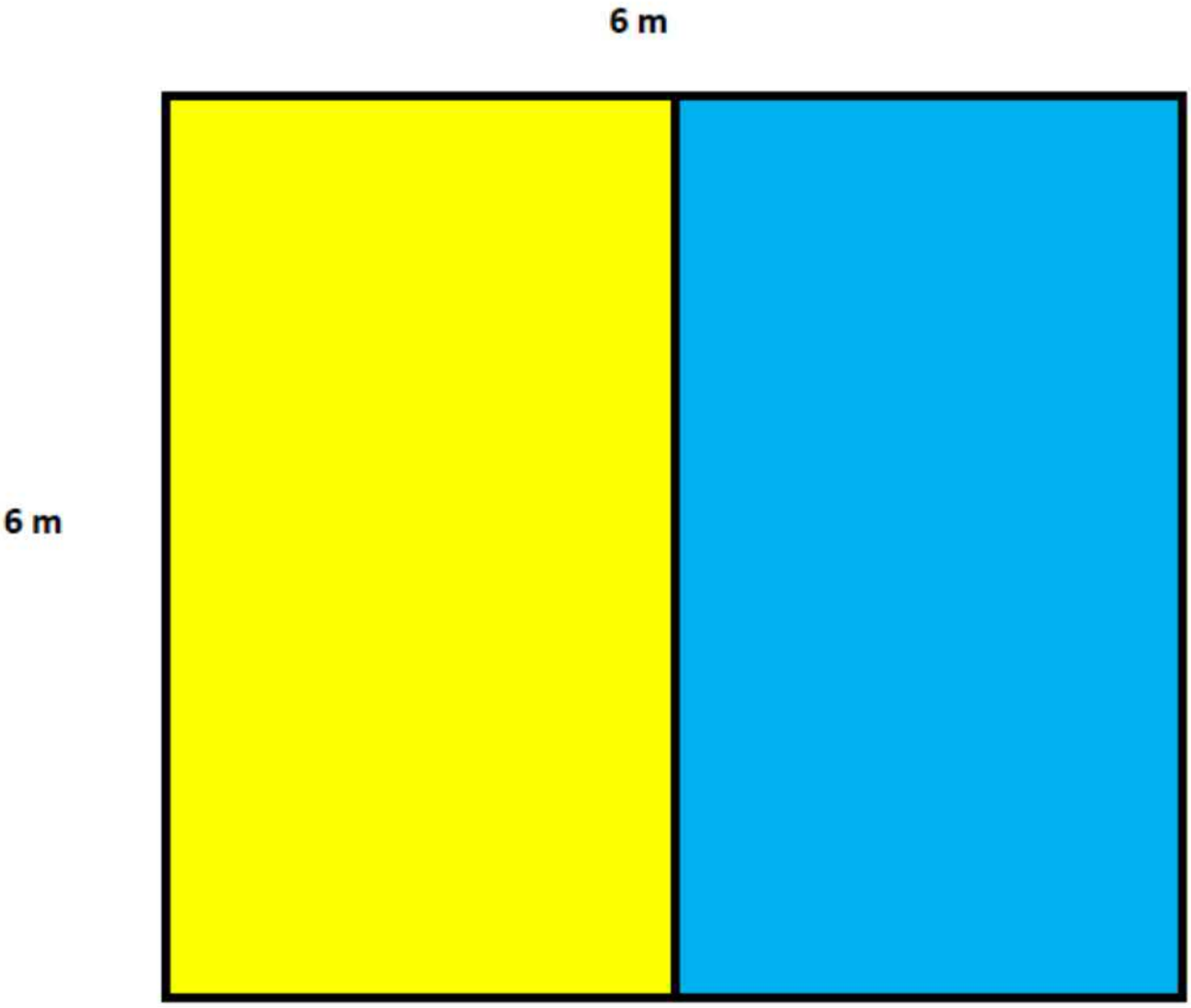


PM	Seedling (n=1)	*Picea mariana*
SP	Small cutting (n=1)	*Salix planifolia*
BG	Seedling (n=1)	*Betula glandulosa*
VU	Seedling (n=1)	*Vaccinium uliginosum*
AC	Seedling (n=1)	*Alnus crispa*
SPC	Large cutting (n=1)	*Salix planifolia*

T2 Environnement

Viridis Terra INNOVATIONS

SEED DENSITY LOCATION LAYOUT



Seed quantity X

VU = 242 507 seeds/ha
AC = 1 854 103 seeds/ha
BG = 1 018 211 seeds/ha
PM = 87 654 seeds/ha

Total = 3 202 476 seeds/ha

Seed quantity 4X

VU = 970 029 seeds/ha
AC = 7 416 414 seeds/ha
BG = 4 072 845 seeds/ha
PM = 350 617 seeds/ha

Total = 12 809 905 seeds/ha

Environnement

Viridis Terra
INNOVATIONS

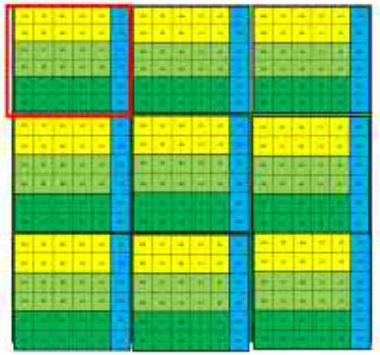
SEEDLING LOCATION LAYOUT

6 m

6 m

PM	SP	BG	VU	AC	SPC
PM	SP	BG	VU	AC	SPC
PM	SP	BG	VU	AC	SPC
PM	SP	BG	VU	AC	SPC
PM	SP	BG	VU	AC	SPC
PM	SP	BG	VU	AC	SPC

Control	45/110 plug	***for small cuttings, only the cutting***
Ellepot	Large plug with biodegradable cover	
2L bag	Biodegradable jute bag with 2L mix	
Cutting	Large 0.7-1.0m long willow cutting	

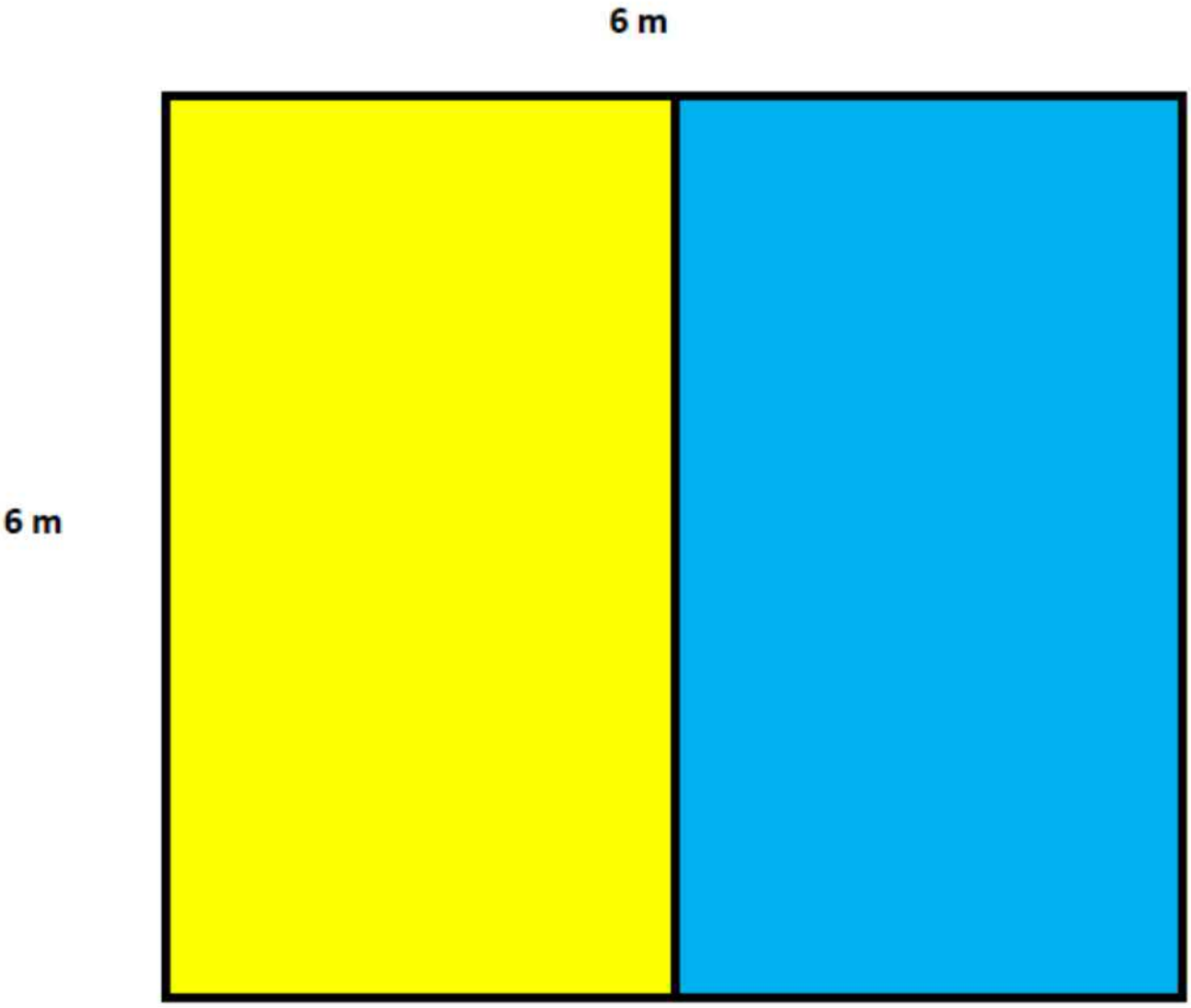


PM	Seedling (n=1)	*Picea mariana*
SP	Small cutting (n=1)	*Salix planifolia*
BG	Seedling (n=1)	*Betula glandulosa*
VU	Seedling (n=1)	*Vaccinium uliginosum*
AC	Seedling (n=1)	*Alnus crispa*
SPC	Large cutting (n=1)	*Salix planifolia*

T2 Environnement

Viridis Terra INNOVATIONS

SEED DENSITY LOCATION LAYOUT



Seed quantity X

VU = 242 507 seeds/ha
AC = 1 854 103 seeds/ha
BG = 1 018 211 seeds/ha
PM = 87 654 seeds/ha

Total = 3 202 476 seeds/ha

Seed quantity 4X

VU = 970 029 seeds/ha
AC = 7 416 414 seeds/ha
BG = 4 072 845 seeds/ha
PM = 350 617 seeds/ha

Total = 12 809 905 seeds/ha

Environnement

Viridis Terra
INNOVATIONS

APPENDIX D

Seed harvesting

Environnement

Viridis Terra
INNOVATIONS

Glandular birch

Glandular birch stand

Glandular birch leaf

Immature catkins are green

Mature catkins are greenish brown

Green Alder

Green alder form

Green alder leaf is simple-dented

Speckled alder leaf is double-dented

Green alder immature cones are green

Green alder mature cones are brown

Environnement

Viridis Terra
INNOVATIONS

http://agroboreal.com/project/aulne-tardif-aulne-crispe

Green alder catkins are erected

http://www.repertoirequebecnature.com/vasculaires/Alnus_rugosa.html

Speckled alder catkins are pendent

Environnement

Viridis Terra
INNOVATIONS

Black Spruce

Black spruce form

Immature cones are red to purple

Mature cones are purplish-brown

Appendix VII. Community 2018 Annual Report

Tata Steel Minerals Canada's Project 2a Certificate of Authorization Conditions 19 to 21

ANNUAL REPORT 2018

Aboriginal Students from Schefferville and Sept-Iles
meet the Quebec Minister of Natural Resources at the Quebec Mine Expo Event

TATA

Mars 2019

Tata Steel Minerals Canada's Project 2a
Certificate of Authorization Conditions 19 to 21

- 2018 ANNUAL REPORT -

Condition 19

Citizens' Information Program

"The Proponent must develop a citizens' information program to be presented to the Administrator, for approval, at least six months prior to the commencement of mining operations. This program must ensure that the most people possible are reached to explain the nature of mining operations, the precautions taken to protect the environment and the corrective measures to take to resolve the problems faced by land users."

TSMC's 2018 information program included the following actions:

Periodic communication of updates on mining activities and measures taken to protect the environment, by way of:

- Communiqués broadcast on local Naskapi and Innu community radio stations providing an update on mining activities, which took place solely at Goodwood, and on concentrator construction finalization efforts. (Annex 1)
- Bi-weekly notices were also distributed in writing to the offices of the Naskapi Nation of Kawawachikamach (NNK), Nation Innu Matimekush-Lac John (NIMLJ), and the Town of Schefferville, and broadcast on local Naskapi and Innu community radio stations, advising the population of mining and blasting activities at Goodwood, along with TSMC contact information. (Annex 2)
- Various interactions and communications were held between Quebec Aboriginal Groups and Tata Steel as detailed by Tata Steel Minerals Canada Consultation Log (Annex 3)
- Quarterly Meetings were held in February 2018, and in June 2018 with extensive and detailed presentation on the State of the Project, including its Environmental Component. (Annex 4)
- IBA Implementation Meeting and Traditional Activities Meetings with Land Users in the Goodwood Area were held with Innu of Sept-Iles and Maliotenam. (Annex 5)
- As per the Consultation Log, IBA Implementation Meetings were held with Matimekush-Lac John Representatives, including their Environmental Consultant, and also including Visits of the Goodwood Area during the Red Water Incident (Annex 6).
- As per the Consultation Log, IBA Implementation Meetings with the Naskapi Nation Representatives were held to discuss various issues including environmental matters. (Annex 7).
- In March 2018, a meeting with Federal Agencies, including Environment Canada was held with the Naskapi Nation, the Matimekush-Lac John Representatives at the Tata

Steel Minerals Canada Mine Site to discuss various environmental matters. (Annex 8)

- As indicated in the TSMC Communication Plan (Annex 9), land users have access to a 24-hour toll free emergency number at the TSMC mine site (1-844-828-2503). This phone number will be included in notices to the population and was already shared to many households through all Aboriginal Workers from Schefferville.
- Innuvelle and Nunatsiaq News: no notices were issued via these newspapers in 2018. For 2019, TSMC will favor direct interaction with stakeholders and Community Radio Broadcasts for mining activities at Goodwood.
- Several weekly meetings were held on a weekly or bi-monthly basis depending on availabilities of local Aboriginal Groups on environmental matters. Templates of minutes of meetings are attached (Annex 10) and shared with local Aboriginal Groups. In the course of the year, to adapt and facilitate participation, exchanges with local Aboriginal Groups, the Company agreed to change the format of the weekly meetings to emailed weekly updates with a possibly for Aboriginal Environmental Representatives to share the Community Concerns (Annex 11)
- TSMC participated in the following public events :
    - Community meetings held in Matimekush in June (Annex 12) and July 2018. Following issues raised: red water events, dust & air quality, vehicle cleanliness (Annex 13), employment opportunities, salaries and taxation, haul truck training, IBA payments and confidentiality, community projects for youths, Howse Project timeline, need for Liaison Officer.
        - TSMC has since put in place the following: program for controlling red water infiltration; new car wash to the TSMC Iron Ore site; support to NIMLJ in their Schefferville car wash; continued efforts to prioritize hiring of members of NIMLJ, NNK and Innu Takuaikan Uashat mak Mani-utenam; support to development and financing of heavy equipment/haul truck training program; support to community projects via IBA payments; an employment Liaison Officer was hired.
    - TSMC Recruitment Day held in May, 2018;
    - Career Fair in Uashat, November 2018; (Annex 14)

Citizens continuously have the opportunity to communicate directly with TSMC through its representatives in Environment and Community Affairs by telephone, email, and social media applications, and through the intermediary of representatives of the Community Health, Safety and Environment Committee (the Committee), and anytime by visiting the TSMC Iron Ore Site.

Since 2017, there is an Environmental Liaison in Matimekush, while in Kawawachikamach, there is a new Environmental Liaison since 2018. There is also an Employment Liaison based in Matimekush since 2018.

Community environment representatives play a key role in receiving feedback and complaints pertaining to the Project, from community members which are transmitted to TSMC. The representatives have an important role to play in keeping apprised of mining activities and matters relating to the environment and disseminating to community members.

TSMC's Communication Strategy is attached.

Condition 20

"The Proponent must present to the Administrator, for approval, one year following Project approval, an evaluation program of the perceptions of the Project by land users. This program must allow for the evaluation of the efficiency of the communication methods employed for the various monitoring programs and the receipt of complaints of land users in relation to the Project. The results of this evaluation should be provided to the Administrator, for information, and the complaints received should be attached."

The users of the land involved in Project 2a are primarily the citizens of Matimekush-Lac John and Kawawachikamach, who reside in proximity to the Project.

Following further clarification from the Administrator, an evaluation of perceptions of Project 2a will be carried out by a third party responsible for data collection from users of the land. A survey will be conducted among local groups (hunters and fishers, Council members) in order to determine the efficiency of the means of communication identified under the heading « Condition 19 ». Community environment representatives will participate in the process through the identification of citizens to survey and in the development of survey content.

In order to capture the attribute spectrum of possible responses, the survey will be a combination of quantitative and qualitative questioning. A copy of the questionnaire will be submitted to the Administrator for information purposes. The survey will be conducted in person by a researcher/research assistant.

The information gathered will be consolidated, analyzed and presented in a report that will be submitted to TSMC and the Administrator.

In order to accommodate for the alignment of the new TSMC Environment Department, and to be in a better position to ascertain the results of the monitoring activities, the evaluation program will be conducted in late 2019/early 2020.

In the view of respecting this Condition, Tata Steel Minerals take notes of the recommendation found in the Administrator's Report, especially on the item identified as QC-15 as far as it concerns the framework of interview guidelines. The report will also contain a Feedback and Complaint Process Plan.

Condition 21

"An Environmental and Social Monitoring Committee must be put in place by the Proponent at the onset of mining activities. This Committee must be formed by TSMC representatives, of the community of Kawawachikamach, the Kativik Regional Government, and Makivik Corp., and should meet at least twice annually. This Committee must ensure that the parties present are informed of the different monitoring programs put in place by the Proponent on the evolution of the Project as mining activities occur, as well as the rehabilitation plan. The minutes of each meeting will be transmitted to the Administrator, for information, at least four months following each meeting."

A Community Health, Safety and Environment Committee was established in 2013 and meets in Schefferville three to four times per year. It is comprised of environmental representatives from the NNK, NIMLJ, ITUM, Innu Nation, Nunatukavut Community Council, and TSMC.

An Environmental and Social Monitoring Committee was established in 2015, comprised of KRG, Makivik and TSMC representatives. The Committee met once in 2018; two meetings are planned for 2019. Meeting minutes for 2018 are attached (Annex 15). There are always challenges in setting-up meetings because of difficulty in reaching a consensus on a date and on a venue for such meetings including the challenge of having all Indigenous Groups concerned around the same table while taking into account their political sensitivities and realities.

Project 2A Closure and Rehabilitation Plan

This document was provided to members of the Environmental and Social Monitoring Committee when it was completed in 2016. No comments were received.

The document will be redistributed to the current Committee members for comment, and will be discussed at its meeting to be held in March, 2019.

****

Submitted by Coco Calderhead, Manager, Community Affairs
13 March, 2019

ANNEX 1

PUBLIC NOTICE – SUMMER 2018

Wachiya!

Tata Steel Minerals Canada has commenced the finalization of the wet plant under the dome, while resuming mining operations, which will be occurring this year at Goodwood only.

Exceptionally, there has been an increase in outside workers, including pipefitters, electricians, millwrights, who must be hired through the unions, for specialized work on the wet plant. These works will be completed this Fall, and will allow TSMC to produce superior iron ore from the DSO Project.

In the meantime, we are continuing our recruitment efforts of local Aboriginals for work on the Project, such as Heavy Machinery Operators and Plant Helpers.

On matters relating to the environment, TSMC is planning an information session in August on the environmental monitoring and management linked to the DSO Project.

Moreover, we invite residents to use the bypass road to reach hunting, fishing and recreational areas including Greenbush, Irony Mountain, and Goodwood, and to be vigilant in your summer activities.

We thank you and wish you a safe pilgrimage to Ste-Anne and a good rest of the summer.

Akua Tutamouk!

Tshinashkimitinan !!

TATA STEEL MINERALS CANADA LIMITED
1000 Sherbrooke West, Suite 1120, Montreal, Quebec, H3A 3G4, Canada
Tel: 001 514 764 6700, Fax: 001 514 764 6725
Registered Office: Suite 1700. Park Place. 666 Burrard Street. Vancouver. BC V6C 2X8. Canada

COMMUNIQUÉ – ÉTÉ 2018

Kuei chers citoyens,

Niin Coco Calderhead qui vous salue encore une fois et vous offre des nouvelles sur les activités de Tata Steel Minerals Canada!

TSMC a entamé la finalisation de l'usine de traitement sous le dôme, et reprend ses opérations minières, qui se tiendront cette année à Goodwood uniquement.

Vous remarquerez une hausse exceptionnelle de travailleurs externes, tels que tuyauteurs, électriciens, mécaniciens de machinerie fixe, qui doivent être embauchés à travers les syndicats pour des travaux spécialisés dans l'usine de traitement. Ces travaux seront terminés dès cet automne.

Par ailleurs, nous poursuivons nos efforts de recrutement de la main d'œuvre autochtone locale associé à nos opérations minières, tel que pour opérateurs de machinerie lourde et assistant opérateurs dans l'usine.

Au niveau de l'environnement, et suite à l'assemblé publique tenue à Matimekush en juin dernier, une séance d'information sera tenue autour de la mi-août, afin de présenter les efforts et accomplissements de TSMC au niveau du suivi et de la gestion environnementale. Demeurez à l'écoute pour en apprendre davantage.

D'ailleurs, nous invitons les citoyens de continuer à employer le chemin de contournement pour vous rendre aux endroits de chasse, pêche et villégiature tels que Greenbush, Kauteitnat et Goodwood, et de demeurer vigilant dans vos activités saisonnières.

Nous vous remercions et nous vous souhaitons un beau pèlerinage à Ste-Anne et une bonne continuation de l'été en toute sécurité.

Akua Tutamouk! Tshima Minupeniek !!

TATA STEEL MINERALS CANADA LIMITED
1000 Sherbrooke West, Suite 1120, Montreal, Quebec, H3A 3G4, Canada
Tel: 001 514 764 6700, Fax: 001 514 764 6725
Registered Office: Suite 1700. Park Place. 666 Burrard Street. Vancouver. BC V6C 2X8. Canada

ANNEX 2

AVIS PUBLIC / PUBLIC NOTICE

Ceci est pour aviser les populations locales de Schefferville, Matimekush-Lac John et de Kawawachikamach qu'il y aura des activités de dynamitage au gisement minier de Goodwood, pour la période du 11 au 25 septembre 2018, de 6h à 20h.

Du 11 au 18 septembre, la personne en charge est Jason Baker, qui peut être rejoint à jason.baker@tatasteelcanada.com et du 18 au 25 c'est Robin Goodwin au robin.goodwin@tatasteelcanada.com.

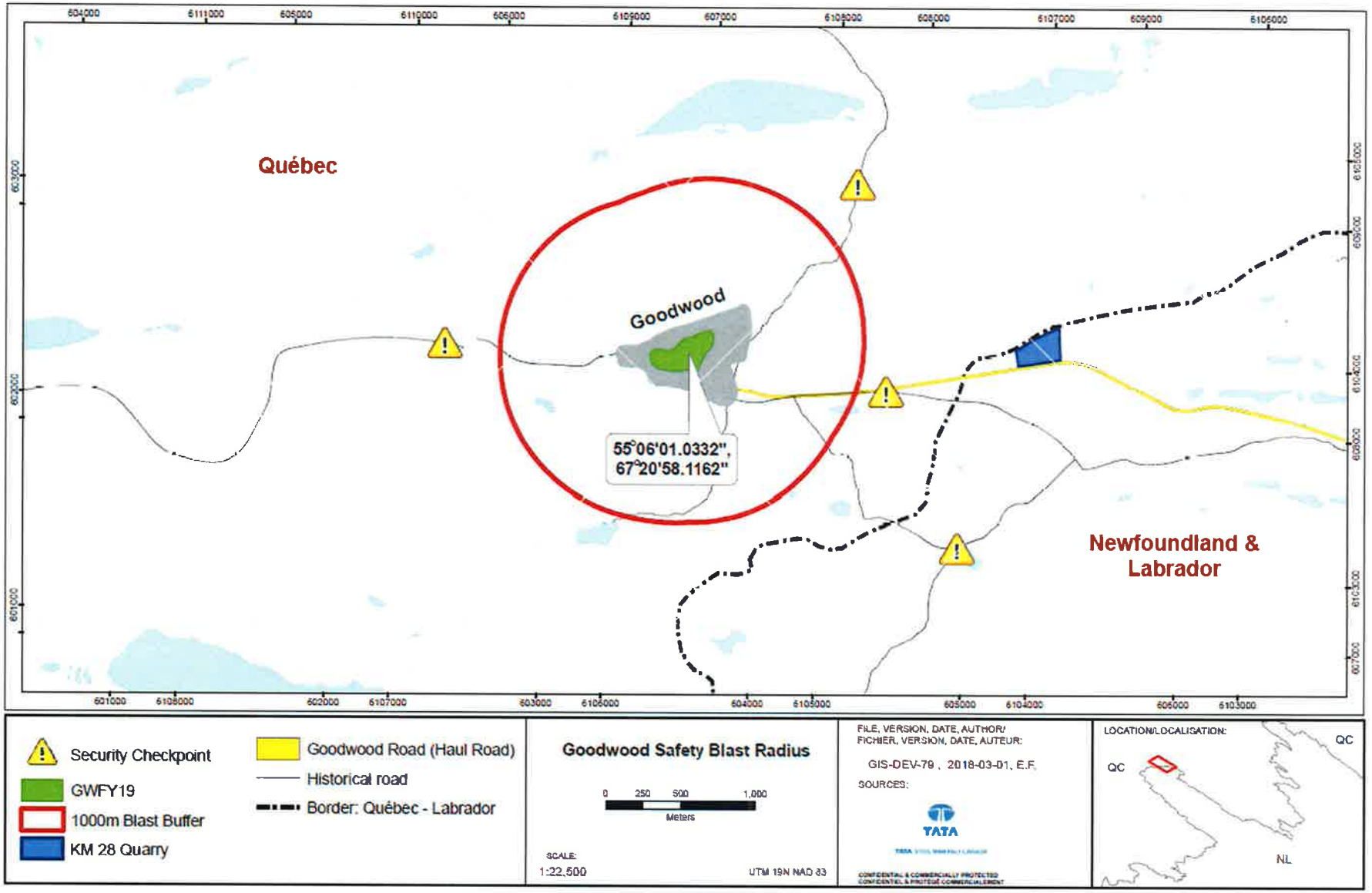
Soyez prudent lorsque vous êtes dans le secteur. Merci!

This is to advise the local communities of Schefferville, Matimekush-Lac John and Kawawachikamach of blasting activities at the Goodwood deposit. The blasting will be conducted between 6 am and 8 pm from 11 to 25 September, 2018.

Between 11 and 18 September 2018, the person in charge is Jason Baker, who can be reached at jason.baker@tatasteelcanada.com, and from 18 to 25 September it is Robin Goodwin at robin.goodwin@tatasteelcanada.com.

Please stay safe. Thank you!

PUBLIC NOTICE / AVIS PUBLIC



TATA STEEL MINERALS CANADA LIMITED

ANNEX 3

Projet 2a
Registre sur consultations/communications avec les groupes autochtones

Groupe(s)	Événement	Date	Sujet(s)	Question(s)/problématique(s) soulevé(s)	Réponse(s) du Promoteur
ITUM	Traditional Activities Committee	1/18/2018	Traditional Activities promotion projects		
ITUM	IBA Implementation Committee	1/18/2018	Project Update; Employment & Contracting statistics	Questions on timeframe for IBA payments; Questions on potential training needs	TSMC provided
Makivik	Conversation par téléphone	1/24/2018	Suivi sur derniers échanges; opérations à Goodwood; possibilités de rencontres du Comité de suivi	Demande qu'une entente entre TSMC et les Inuits de Kativik soit considérée	TSMC a des contrats importants avec des fournisseurs inuits de Kativik. Une discussion à haut niveau pourrait avoir lieu afin de discuter des intérêts, enjeux et aspects d'une entente officielle potentielle
NNK, NIMLJ, ITUM, Innu Nation	HSE Committee	2/20/2018	TSMC Project Update; Environmental Update (wildlife, air quality, noise, vegetationm, waste management; Howse Project water management; Joan Lake Compensation Plan; Update on Health & Safety	Request to further look into possibility of dust dispersion from mine site to local communities	Explained that air modelling indicates dispersion rarely exceeding 5km; however TSMC has agreed to undertake some air quality sampling in Kawawa & Matimekush
NIMLJ	Meeting w/ Council	2/22/2018	Review of Joan Lake Compensation Plan in detail and possible compensation sites	Primarily seeking clarifications on science of compensation process, approaches. Suggestion to rehabilitate Elross Creek area rather than creating new zone, and closing off final discharge Pt @ Timmins 1	In-depth explanations provided by knowledgeable TSMC field person
NNK	Meeting w/ Council	2/23/2018	Review of Joan Lake Compensation Plan in detail and possible compensation sites	Suggestion to introduce Arctic Char	In-depth explanations provided by knowledgeable TSMC field person. Looked into possibility, but not a favoured option because species is not native.
NNK, NIMLJ, ITUM	Meeting w/ FN Leadership	3/29/2018	Project Update; employment; training; environmental matters; Tshiuetin Rail Issues		TSMC pointed out numerous benefits project brings to the communities including in social benefits (employment, training, community projects) as well as business development
NNK	Jimmy Sandy Memorial School Visit of TSMC Site	5/22/2018	High School Student site visit as part of career planning		Students received in Administration building; guest Aboriginal employee spoke on his work and information on Project Activities and types of careers presented.
NIMLJ	IBA Implementation Committee	6/5/2019	Project Update; Benefits Reporting	Questions on payments, contracting opportunities & red water concerns	Clarifications made and contracting opportunities provided
NNK, KRG & Makivik	Environmental & Social Monitoring Committee	6/19/2018	2A Project Update; Goodwood Project; Sedimentation Pond Breach	Questions on measures taken to repair and prevent issues in future	TSMC has actively involved the communities in a timely manner in this matter, including through access to their consultant and field experts. Updates continue to be provided on works to come.
NNK, NIMLJ, KRG, Makivik	Engagement on Goodwood Sedimentation Pond breach	June & July 2018	Regular updates on situation, actions taken. Local communities participated in numerous site visits, and reconnaissance by helicopter	Questions on measures taken to repair and prevent issues in future	TSMC has actively involved the communities in a timely manner in this matter, including through access to their consultant and field experts. Updates continue to be provided on works to come.
NIMLJ	Public Meeting	6/1/2018	Impacts of TSMC Iron Project on local community	Issues raised included: environmental matters (air quality in Schefferville/Matimekush, red water events at Goodwood sedimentation pond and along Goodwood Haul Road); employment & taxation; training; IBA payments & payment of invoices; worker and vehicle cleanliness; need for more transparent communication on IBA matters.	TSMC clarified that it will follow all environmental laws of the land; undertook to accelerate payments and look into taxation matters; greater communication by way of newsletters/radio announcements & hiring of Aboriginal Employment Coordinator; site wide alerts to personnel on vehicle and clothing cleanliness in public places.

Projet 2a
Registre sur consultations/communications avec les groupes autochtones

NNK	Environmental Support Contract	7/1/2018	NNK awarded contract for environmental support work to TSMC'S Environment Team	TSMC encountered a number of issues in the provision of services for this contract	
NIMLI & NNK	Meetings w/ Leadership	7/30/2018 to 08/01/2018	Various IBA Implementation & Co-Existence Issues	Issues raised included: environmental matters (air quality in Schefferville/Matimekush, red water events at Goodwood sedimentation pond and along Goodwood Haul Road); employment & taxation; training; IBA payments & payment of invoices; worker and vehicle cleanliness; meetings between community & company leadership; support of baseball field project	Document addressing issues raised and follow-up conducted on these matters.
NIMLI	Site Rehabilitation Contract		NIMLI awared contract by TSMC for Timmins 4 Site Rehabilitation Work		2018 field work a success for trial phase.
NNK	Meeting on Employment	10/9/2018	Employment statistics, workforce planning, mutual collaboration	Request for TSMC HR Strategy, Aboriginal Employment Coordinator	Strategy & Workforce plan will be provided in early 2019; Aboriginal Employment Coordinator hired
NIMLI	Meeting w/ Chief	11/12/2018	Follow-up on IBA Implementation commitments made	Request for assistance in haul truck driver training; Innu Liaison in process of being hired	TSMC will support
ITUM	Career Fair	11/21/2018	Employment opportunities and qualifications required in TSMC Project		
NIMLI	Meeting on IBA Implementation	12/11/2018	Environmental matters (red water events, Goodwood sedimentation pond breach, diesel spill @ Silver Yards), IBA & Commercial Contract payments, employment opportunities	Suggestion to consider excavation of spill area before spring melt	TSMC will look into possibility; In-depth, in-person meeting between NIMLI & TSMC environment representatives set for 1st week of January 2019
NNK	Meeting on Environment	1/8/2019	Speeding on road to Schefferville Bypass road upgrading.	Quarterly presentations to Council as well as weekly written updates by TSMC Environment in lieu of our weekly phone meetings.	TSMC will provide; NIMLI given access to consultant to provide input on mitigation measures planning.
NIMLI	Meeting on Environment	1/9/2019 & 1/10/2019	Red water events, Goodwood sedimentation pond breach, site restoration @ IOC waste piles	Request for greater measures to be taken to prevent future issues	TSMC will devise a plan for greater mitigation measures, in collaboration with their consultant; NIMLI given access to consultant to provide input on mitigation measures planning
NNK, NIMLI, ITUM, Innu Nation, Nunatukavut Community Council	HSE Commitee Meeting	2/20/2019	Project Update; State of the Environment (air quality, water, wildlife, wastse management, site rehabilitation, spill @ Silver Yards)		
NIMLI, NNK, ITUM	Tool Kit Launch for Aboriginal Women in Non-Traditional Activities	2/26/2019	Employment Opportunities w/ TSMC	How to apply to positions?	TSMC has new employment profile platform online
NNK, KRG, Makivik	Environmental & Social Monitoring Committee	3/28/2019	Planned agenda: Project Update; Goodwood basin follow-up; Restoration Plan; Upcoming Contracting Opportunities		

ANNEX 4

Rencontre du Comité communautaire de la santé sûreté, la sécurité, et l'environnement pour le Projet DSO de Tata Steel Minerals Canada (TSMC) /

Meeting of the Community Health, Safety, and Environment Committee for Tata Steel Minerals Canada's (TSMC) DSO Project

Le 20 février 2018, 13h / *February 20th, 2018, 1:00 PM*
DSO Timmins, Labrador

– Compte-rendu / *Minutes* [1] –

Participants :

Nom / *Name*	**Organisme / *Organization***
1. Anne-Marie Ambroise	NIMLJ
2. Armand Mackenzie	TSMC
3. Bob Garland	TSMC
4. Chef Tshani Ambroise	Nation Innu Matimekush-Lac John (NIMLJ)
5. Coco Calderhead	TSMC
6. Conrad André	NIMLJ
7. Diane Kettle (observer / observatrice)	Agence Canadienne de l'évaluation environnementale (ACÉE) / Canadian Environmental Assessment Agency (CEAA)
8. George Guanish	Naskapi Nation of Kawawachikamach (NNK)
9. Joe Vigder (observer/ observateur)	CEAA / ACÉE
10. Lindsay Richardson	NNK
11. Loic Didillon	TSMC
12. Lucien Mckenzie	NIMLJ
13. Noël André	NIMLJ
14. Pako Vachon	NIMLJ
15. Paula Reid (telephone)	Innu Nation
16. Youness Elhariri	TSMC

1. Réflexion du moment sur la santé et la sécurité / *Safety Moment*

AM rappelle l'importance d'arrêter au poste de sécurité à l'entrée du site minier. TSMC a toujours cherché à assurer un accès aux territoires traditionnels pour les citoyens locaux, et les risques sont importants si un individu passe tout droit sans s'inscrire ou sans permettre à l'agent de sécurité de l'annoncer sur le site de travail. D'autant plus qu'un individu qui n'a pas reçu de formation de conduite sur le site minier DSO Timmins et qui n'a pas de radio pour communiquer avec les conducteurs de camions de halage de minerai, amène des risques majeurs s'il conduit à proximité de ces gros camions.

/

AM recalled the importance of stopping at the security post at the entrance of the mine site. TSMC has always sought to ensure access to traditional lands for local citizens, and the risks are significant if an individual drives through without stopping and signing-in, or without allowing the Security Officer to announce them on the DSO Timmins mine site. Moreover, an individual who

[1] Ce compte-rendu résume les commentaires faits durant la rencontre et s'ajoute à la présentation PowerPoint donnée, dont une copie a été distribuée aux membres. / *These minutes summarize comments made during the meeting and are in addition to the PowerPoint presentation given, a copy of which was distributed to all members.*

hasn't received Driving in the Mine training and doesn't have a radio to communicate with the drivers of the haul trucks, poses a major risk if they are travelling close to a haul truck.

2. Compte-rendu de la rencontre du 29 août, 2017 / *Minutes of the meeting of August 29th, 2017*

Compte-rendu approuvé tel que distribué le 15 février 2018 aux membres du Comité. / *Minutes approved as submitted on February 15th, 2018 to Committee members.*

3. Projet DSO – Mise à jour / *DSO Project – Update*

AM rappelle que ce Comité représente un excellent forum pour échanger sur les questions et préoccupations des communautés. Les membres de l'Exécutif et de la haute direction de TSMC sont informés des enjeux. Il ajoute qu'il n'est pas au courant d'autres compagnies qui maintiennent un tel degré d'échange entre le promoteur et les communautés.

Il explique que la Chine a depuis l'an dernier appliqué des pénalités pour le continu de silice et autres impuretés dans le minerai de fer. Le minerai du Projet DSO est de bonne qualité, à une teneur Fe de 62%. TSMC veut augmenter la teneur à 65% afin d'obtenir une prime pour le minerai, qui s'élève à $90-$95 par tonne. Le défi c'est le haut niveau de silice; la compagnie considère la stratégie à adopter :

1) Des discussions ont eu lieu sur la finalisation de l'usine de traitement à voie humide (une durée de 6 à 18 mois). Les coûts additionnels en pénalités sont d'environ $20/tonne au départ, et les coûts de transport ont doublé depuis l'an dernier;
2) TSMC attend l'approbation du gouvernement fédéral d'ici la fin mars du Projet Howse;
3) TSMC veut assurer la continuité du Projet et des bénéfices aux communautés qui en découlent, tels que les emplois et les contrats.

La cible de production est de 3 à 4 millions de tonnes en 2018, provenant de Goodwood et de Howse, avec les opérations qui commenceraient en avril. Il y a le défi supplémentaire que représente les taux et les travaux d'entretien de Transport ferroviaire Tshiuetin.

/

AM recalled that this Committee serves as an excellent forum to exchange on the questions and concerns of the communities. Members of TSMC's executive and senior management are informed of the issues. He added that he is not aware of other companies that maintain such a level of exchange between the promoter and the communities.

He explained that China has, since last year, assigned penalties for Silica content and other impurities in the iron ore it receives. The ore from the DSO Project is of a high quality, with an Fe content of 62%. TSMC wishes to increase the content to 65% in order to obtain premiums for tis ore, which can fetch $90-$95 per tonne. The challenge is the high Silica content; the company is considering the strategy to adopt:

1) Discussions have taken place on the finalization of the Wet Plant (6 to 18 months' duration). The additional costs in penalties are $20/tonne from the onset, and shipping costs have doubled since last year;
2) TSMC is awaiting the federal government's approval of the Howse Project by the end of March;
3) TSMC wants to ensure that the DSO Project continues and that the benefits to the communities continue, including jobs and contracts.

The production target is 3 to 4 million tonnes in 2018, originating from Goodwood and Howse, with operations beginning in April. There is the additional challenge of rates and maintenance works by Tshiuetin Rail Transportation.

4. Bilan sur l'environnement / *Environment Update*

1) Gestion de l'eau / *Water Management*

a) Plan de compensation du Lac Joan / *Joan Lake Compensation Plan*

LD fait une présentation sur le Plan de compensation du Lac Joan, distribué précédemment aux membres du Comité.

Il rappelle que TSMC doit compenser la perte d'habitat de poisson du Lac Joan, qui se trouve à moins de 500m du gisement Kivivic 5, pour un nouvel habitat de poisson, et ce en consultation avec les communautés autochtones.

La philosophie auparavant était de mettre des poissons dans un nouveau lac, mais de façon plus récente, la création un nouvel habitat, ou des canaux, que les poissons peuvent adopter ou employer (par exemple reconnecter un cours d'eau qui avait été coupé auparavant durant les activités de l'Iron Ore Company of Canada) est favorisé. Il n'est toutefois pas simple de restaurer un ancien site (pentes, acidité). La zone à l'ouest du site d'enfouissement de Schefferville comprend des fosses, au Labrador.

Une option est d'introduire des poissons dans une étendue d'eau qui était inhabitée auparavant. Cependant Pêches et Océans Canada (POC) ne privilégie pas cette option puisqu'il y a des oiseaux qui nécessitent des lacs sans compétiteurs pour se nourrir. POC préfère la restauration d'anciens sites miniers. La plupart de ceux-ci sont près de Schefferville.

Suite à une question de LR, LD explique que POC ne peut pas se prononcer à l'heure actuelle quant au nombre de sites de compensation.

En réponse à une question de TA, LD confirme que la restauration doit être complétée avant l'exploitation de Kivivic 5. Une fois l'exploitation terminée et que le dénoyage de la fosse cesse, le lac Joan sera rempli de nouveau par l'eau souterraine.

L11 et L26 ne sont pas des options favorisées par Environnement Canada. Si les options identifiées dans la diapo 13 de la présentation ne sont pas viables, il existe d'autres options, par exemple P6 (une fosse d'IOC).

BP6 est une option favorisée présentement, mais TSMC est toujours dans les phases préliminaires d'évaluation, et cherche les conseils des communautés. Le gouvernement fédéral prendra la décision finale.

S3 n'est pas nécessairement favorisé puisque c'est une petite aire.

Dans le cas de C6, il faudra enlever la barrière afin de reconnecter les deux étendues d'eau.

CA indique que les lacs profonds ne gèlent pas, cependant le lac Joan n'est pas profond.

TA ajoute que la moucheté, ou la truite rouge, qui pèsent moins de 1 livre, se retrouve dans le lac Joan, mais qu'il n'y a pas d'omble chevalier.

Suite à une demande des représentants de la NIMLJ, TSMC s'engage à traduire la présentation en français et de distribuer.

TSMC pourra organiser une visite de site au printemps avec des représentants des communautés afin d'évaluer les options sur le terrain.

Suite à une suggestion de TA, JFD confirme qu'il rencontrera cette semaine les membres des Conseil de la NIMLJ et de la NNK pour expliquer davantage les options, avec photos et cartes.

/

LD gave a presentation on the Joan Lake presentation previously distributed to the Committee members.

He recalled that TSMC must compensate for fish habitat loss at Joan Lake, which is located less than 500m from the Kivivic deposit, for new fish habitat, in consultation with Aboriginal communities.

The previous philosophy was to move the fish to a new lake, but more recently, the creation of new habitat, or canals, that fish can inhabit or use for travel (for example reconnecting two water bodies that were cut off from one another during Iron Ore Company of Canada activities) has been favoured.

It is not, however, simple to restore an old site (slopes, acidity). The zone to the west of Schefferville has old pits, in Labrador.

One option is to introduce fish to a water body that was previously uninhabited. The Department of Fisheries and Oceans (DFO) does not, however, favour this option because there are birds who require water bodies uninhabited by competitors to feed themselves. DFO favours the restoration of old mining sites. Most of these are near Schefferville.

In response to a question from LR, LD explained that DFO cannot determine at this stage as to the number of compensation sites.

Further to a question from TA, LD confirmed that the restoration works must be completed before Kivivic 5 is mined. Once mining is finished and dewatering ceases, the groundwater will fill Joan Lake once again.

L11 and L26 are not favoured options by Environment Canada. If the options identified in Slide 13 of the presentation are not viable, there are other options, such as P6 (an IOC pit).

BP6 is presently a favoured option, but TSMC is still in the preliminary stages of assessment and is seeking the input from the communities. The federal government will take the final decision.

S3 is not necessarily favoured because it is a small area.

In the case of C6, the barrier will need to be removed in order to reconnect the two water bodies.

CA indicated that the deep lakes do not freeze, but that Joan Lake is a shallow lake.

TA explained that red trout live in Joan Lake, and weigh less than 1 pound, but there is no Arctic char.

Further to a request by the NIMLJ representatives, TSMC undertook to translate the presentation into French and to distribute.

TSMC can organize a site visit in Spring with representatives from the communities in order to assess the options on the ground.

Further to a suggestion made by TA, JFD confirmed that he will meet with the Councils of NIMLJ and NNK to further explain the compensation options, along with photos and maps.

b) Gestion de l'eau à Goodwood / *Goodwood Water Management*

LD explique que les seules choses qui restent sont l'installation de l'eau de traitement et le ponceau. Toutes les eaux de fonte de neige seront captées; le design a été conçu pour une crue centenaire.

Au niveau des eaux rouges, LD explique que l'eau de Goodwood a coulé au Lac Fra. La communauté a soulevé le problème à la fin août.

En réponse à une question de CA, LD explique que la membrane n'a pas été facile à installer, qui a couté 5 à 6 millions de dollars.

TSMC a creusé des trous pour contrôler au moins les particules en suspension. Une barrière a été installée après.

Le gouvernement du Québec est venu inspecter.

CA explique que des membres des communautés voient des problèmes d'écoulement partout et veulent que l'environnement soit la priorité.

LD confirme que c'est ce que fait TSMC et l'exemple d'écoulement était une erreur d'un sous-traitant. D'où l'importance de tous de bien faire leur travail et de TSMC de bien inspecter.

/

LD explained that the only items remaining are the installation of the water treatment unit and the culvert. All spring meltwater will be captured; the design has been conceived based on a 100-year flood.

Regarding red water, LD explained that the water from Goodwood flowed into Fra Lake. The community raised the matter at the end of August.

Further to a question from CA, LD explained that the membrane wasn't easy to install, and cost between $5 and $6 million.

TSMC dug holes to control at least suspended particles. A barrier was installed afterwards.

The Government of Quebec conducted an inspection of the area.

CA explained that community members see runoff problems everywhere and want the environment to be a priority for the company.

LD confirmed that this is what TSMC is doing and the water infiltration incident was an error made by a contractor. Thus, the importance for all to properly do their work and for TSMC to properly inspect.

c) Chemin Goodwood / *Goodwood Road*

LD explique qu'il y a trois (3) zones de priorité : le KM 22, le lac Morley et le ruisseau Joan.

Il y a eu l'idée de se servir de vieux pneus pour contrôler l'écoulement.

- KM 22 : le plan proposé est d'installer 3.5 km de fossé (en palier) qui canalisera l'eau à un bassin de dissipation.

  L'information sur ce plan sera en anglais et en français et sera diffusé.

  POC vient au site à chaque année en juillet/août.

  NA indique qu'il est mieux de venir durant la fonte des neiges.

  LD explique que Terre-Neuve-et-Labrador vient deux fois par année, après la fonte des neiges et avant l'hiver; le Québec vient à la fin de l'année.

  TSMC entreprendra des essais d'un nouveau produit d'Earth Alive, au lieu de l'eau.

- Lac Morley : c'est un lac en long et la coloration rougeâtre s'est produit en phases. Les ingénieurs regardent l'option de dévier l'eau propre et canaliser les eaux rouges, et une autre option.

  TSMC va beaucoup se concentrer dorénavant sur le déneigement avant la fonte et sur la surveillance.

  Un plan sera finalisé dans 1 à 2 semaines.

/

LD explained that there are three (3) priority zones : KM 22, Morley Lake and Joan Brook.

One idea was to use old tires to control runoff.

- *KM 22: the proposed plan is to create 3.5 km of ditching (terraced) which will canalize the water into a dissipation basin.*

  DFO comes to the DSO site every year in July/August.

  NA indicated that it would be better for them to come during Spring melt.

LD explained that Newfoundland-and-Labrador comes to site twice per year, after Spring melt, and in Winter; Quebec comes at the end of the year.

TSMC will be conduction tests of a new product from Earth Alive, instead of water.

- *Morley Lake: this is a long lake and the reddish color took place in phases. The engineers are looking at the option of deviating the clean water and to canalize the contact water, and another option.*

TSMC will be focusing efforts going forward on snow clearing prior to the Spring melt, and on monitoring.

A plan will be finalized in 1 to 2 weeks.

d) Gestion des eaux usées au Camp / Wastewater management at Camp

Les résidus solides sont enlevés à tous les 18 mois et déposés dans un réservoir près du dôme.

Suite à une question de TA, LD explique que TSMC a retenu 2 ou 3 compagnies et elle est en négociation de prix.

e) Howse

LD confirme que TSMC travaille avec le gouvernement dans l'élaboration des conditions pour Howse, et dans les plans de suivi, qui seront distribués aux communautés.

LD explique que le projet est prévu sur 15 ans (y compris les travaux de restauration et de suivi environnemental). Des améliorations aux bassins de sédimentation pourront être observées, une fois construits. La construction de fossés se fera durant la première et la deuxième année.

L'échéancier des travaux est prévu comme suit :

- Avril à juin sera dévoué à la construction de fossés;
- De juin à août, l'enlèvement des déblais se fera;
- D'août à octobre sera l'extraction de minerai; et
- D'octobre à mars sera l'enlèvement de déblais et préparation de morts-terrains.

Des panneaux seront installés pour aviser les travailleurs de ne pas dépasser la zone tampon de Kauteitnat.

AMA remet en question ce raisonnement et demande si c'est nécessaire d'avoir des panneaux. TSMC considérera de nouveau la question.

CC confirme avoir envoyé aux communautés le Plan de développement, de fermeture et de restauration de la mine pour le Projet Howse et peut l'acheminer aux représentants ne l'ayant pas reçu.

TSMC prépare aussi des plans de suivi, y compris un plan de communication et un plan culturel, qui seront envoyés aux communautés pour consultation.

TA souligne que le NIMLJ participera au processus, fera ses commentaires et continuera de chercher des solutions.

/

LD confirmed that TSMC is working with the government on the conditions for Howse, and the follow-up plans, which will be distributed to the communities.

LD explained that the project is planned over 15 years (including rehabilitation and monitoring activities). Improved sedimentation ponds will be evident, once installed. Ditching will be built in Years 1 and 2.

Works are planned as follows:

April to June will be devoted to the construction of ditching;

June to August, removal of overburden will take place;

From August to October, mining or ore will occur; and

From October to March will be removal of overburden and preparation of waste piles.

Signage will be installed for workers to go past the limit of the Irony Mountain buffer area.

AMA questioned this plan and asked whether it is necessary to have signage.

CC confirmed having sent to the communities the Development, Closure and Rehabilitation Plan for the Howse Project and can forward to representatives who did not receive it.

TSMC is also working on Follow-up Plans, including a Communication Plan and a Cultural Plan, that will be sent to the communities for consultation.

TA indicated that the NIMLJ will participate in the process, will provide their comments and continue to seek solutions.

2) Gestion des déchets / *Waste Management*

a) Matières dangereuses / Hazardous Waste

En réponse à une question de TA, LD explique que TSMC garde les matières dangereuses pendant un an, et les envoie ensuite à Chambly.

b) Site d'enfouissement de TSMC / *TSMC Landfill*

LD explique que le site d'enfouissement a été agrandi, en ajoutant une nouvelle cellule. Une meilleure performance est attendue au niveau des ordures qui s'envolent.

Le chemin d'accès sera aussi amélioré.

Englobe a effectué une vérification du site, et parmi les recommandations étaient la mise en valeur des ordures par le recyclage et le compostage. Le consultant a déterminé que le papier et le carton représentent environ 20% du contenu dans le site d'enfouissement; 30% de l'ensemble du contenu pourrait être revalorisé.

Au niveau du nouvel écocentre TriComm, TSMC développe un partenariat avec celui-ci, qui informera TSMC sur sa capacité de prendre des matières du site de TSMC. La conseillère de TriComm, Jézabel Alain-Lacombe, cherche des idées et l'aide des communautés.

Concernant le compostage, TSMC évalue la possibilité de redémarrer le composteur, qui possède une grande capacité. La question est au niveau de la sécurité et l'attraction des ours.

GG confirme que la NNK développe actuellement un Plan d'action sur la gestion des matières résiduelles.

/

LD explained that the landfill was extended with the creation of a new cell. Better performance is expected in the way of garbage dispersion by wind.

The access road will also be improved.

Englobe carried out a site audit, and among the recommendations were creating an added value to waste by recycling and composting. The consultant determined that paper and cardboard represented about 20% of the content in the landfill; 30% of all waste could be revalorized.

3) Qualité de l'air / *Air Quality*

TSMC surveille surtout les poussières et le NO_2.

JFD explique la fonctionnalité des unités de mesure (rondelle, jarre, avec pompe à air, ou filtre). Le type est déterminé en fonction des activités, des modélisations et des points sensibles. TSMC regarde aussi le dépôt de poussières dans l'eau, qui peut affecter l'accès des poissons à la nourriture. Des tests périodiques sont aussi faits sur les poissons.

Cette année, les données des unités fixes, pris à chaque heure et aux 50 secondes, seront disponibles en temps réel.

En réponse à une question d'AMA, les endroits étudiés sont habituellement à l'est des activités à cause de la direction prédominante des vents.

Les études du lichen nécessitent trois (3) ans de données avant de tirer des conclusions. Le lichen, un indicateur très sensible, a la particularité de montrer par année les particules qui ont tombées. TSMC regarde la possibilité d'utiliser le lichen plus près de Schefferville. La compagnie est la première au Canada à effectuer des tests par ce moyen qui provient de l'Europe.

L'impact des poussières a été observé jusqu'à 500 m de la route.

Les prochaines stations de suivi seront probablement à Schefferville, Kawawa et Howse.

En réponse à une question de CA, LD explique qu'il n'y a pas beaucoup de poussière provenant des activités d'exploration parce que l'eau est utilisée pour creuser. D'autant plus que les chemins d'exploration sont compactés.

LD indique que les modélisations de dispersion de particules démontrent des normes de 5 km, ce qui est davantage mesurable. LM remet en question cette base et explique que les poussières peuvent tomber et repartir en deuxième et troisième phases.

LD indique que les poussières ont de multiples sources possibles, humaines et naturelles. TSMC fera le suivi est en fonction des limites raisonnables d'enquête. Un représentant en environnement de TSMC ira avec les communautés observer les conditions au niveau de la poussière rouge, durant les différentes saisons. En hiver, il n'y a à peu près pas de poussière générée.

Un échantillonneur passif et le PQ 200 seront installés dans les communautés.

/

TSMC is monitoring mostly dust and NO_2.

JFD explained the functionality of the measurement units (puck, jar, with air pump or filter). The type is determined according to the activities, the modelling and sensitive areas. TSMC is also looking at dust deposition in water bodies, which can affect access of fish to food. Periodic testing is also conducted on fish.

This year, the data obtained from the fixed units, taken every hour and every 50 seconds, will be available in real time.

In response to a question from AMA, the areas studied are usually to the east of the Project area due to the direction of the predominant winds.

Studies on lichen require three (3) years of data before drawing conclusions. Lichen, a very sensitive indicator, has the particularity of being able to show the particles that have fallen each year. TSMC is looking at the possibility of using lichen closer to Schefferville. The company is first in Canada to conduct testing by this means, which originates in Europe.

The impact of dust has been observed up to 500m from the road.

The next monitoring stations will probably be in Schefferville, Kawawa and Howse.

In response to a question from CA, LD explained that there is not very much dust created from exploration activities because water is used for digging. Moreover, exploration roads are compacted.

LD indicated that particle dispersion modelling showed 5km norms, which is more measurable. LM questioned this basis, explaining that dust can fall et lift again in second and third stages.

LD explained that dust has many possible sources, both human and natural. TSMC will carry-out monitoring within what is reasonable in terms of research limits. A TSMC Environment representative will go with the communities to observe red dust occurrence, during different seasons. In Winter, there is almost no dust generated.

A passive sampling unit and a PQ 200 will be installed in the communities.

4) Plan de fermeture et de restauration / *Closure and Rehabilitation Plan*

TSMC cherche les commentaires et la participation des communautés sur ses plans de fermeture et de restauration. Il y aura des besoins au niveau de support technique, de main d'œuvre et de location d'équipements. L'arrosage demandera beaucoup de travail.

Un des plus grands défis au niveau de la restauration est qu'il y a peu ou pas de matière organique avec lequel effectuer la revégétalisation. Le climat et la quantité très importante de résidus miniers sont aussi des défis importants.

La compagnie cherche à identifier une bactérie qui peut vivre sans sol et qui peut s'implanter dans les racines des plantes. Les plantes natives seront favorisées.

Le processus d'ensemencement hydraulique est envisagé, ce qui comprend l'emploi de granules de gel bleu pour faciliter la croissance. Environ 30 000 graines de bouleau ont été envoyé à Montréal pour des essais de germination.

Également, l'idée d'opération d'une serre dans la région de Schefferville devrait être considéré par les communautés étant donné le besoin de TSMC en matière de germination de graines sur plusieurs années.

La zone choisie pour débuter est la fosse Timmins 4, puisque TSMC cherche à commencer à petite échelle.

Pour les secteurs DSO 3 et 4, 100% de la valeur de la réhabilitation du Projet a été transférée au gouvernement de Terre-Neuve-et-Labrador par garantie bancaire. En réponse à une question, LD indique que c'est le gouvernement qui détermine la valeur. La restauration a débuté dans le cas de Labrador Iron Mines, et les argents garanties se libèrent pour ces travaux.

Au niveau du projet 2a, le gouvernement du Québec n'a pas encore assigné une valeur.

La durée des travaux est habituellement de cinq (5) ans après la fin de l'exploitation.

/

TSMC is seeking comments and the participation of the communities on its Rehabilitation and Closure Plans. There will be a need for technical support, labour and equipment rental. Significant watering will also be required.

One of the major challenges in terms of site rehabilitation is that there is little or no organic matter with which to carry out revegetation. Climate and the significant amount of waste rock also represent significant challenges.

TSMC is seeking to identify a strain of bacteria that can live without soil and that can attach itself to the roots of the plants. Native plants will be favoured.

Hydroseeding is also being considered, which involves the use of blue gel granules to facilitate growth. Approximately 30,000 birch seeds have been sent to Montreal for germination trials.

Additionally, the idea of operating a greenhouse in the Schefferville region should be considered by the communities given TSMC's needs for seed germination over several years.

The chosen area to begin with will be the Timmins 4 pit, as TSMC wants to start with small projects.

For the DSO 3 and 4 areas, TSMC has provided to the Government of Newfoundland and Labrador 100% of the rehabilitation value, by bank guarantee. In response to a question, LD indicated that it is the government that determines the value. Site rehabilitation has commenced in the case of Labrador Iron Mines, and the monies guaranteed for these works are being freed for these works.

For the Project 2a, the Government of Quebec has not yet assigned a value.

The duration of works is usually five (5) years after the end of mining operations.

Points d'action / *Action Items*

- TSMC traduira et enverra la présentation sur le Plan de compensation du lac Joan. / *TSMC will translate and send the Compensation Plan for Joan Lake;*
- TSMC rencontrera les membres des Conseils de la NIMLJ et de la NNK pour discuter des options de compensation pour le lac Joan. / *TSMC will organize meetings with the communities to discuss the compensation plan for Joan Lake;*
- Organiser une visite de site au printemps afin d'évaluer les options sur le terrain de compensation de lac Joan / *Organize a site visit in Spring to evaluate Joan Lake compensation options on the ground;*
- TSMC évaluera la nécessité de panneaux de démarcation à la limite de zone tampon pour Kauteitnat / TSMC will evaluate the need for signage at the edge of the buffer zone with Irony Mountain;
- TSMC installera un échantillonneur passif et le PQ 200 dans les communautés / *TSMC will install a passive sampler and the PQ 200 in the communities*;
- Une fois prêt, TSMC transmettra aux communautés et téléchargera sur son serveur Google Drive, le rapport sur la bioévaluation. / *Once ready, TSMC will send to the communities and upload onto its Google Drive, the report on bioevaluation.*

5. Santé et sécurité / *Health & Safety*

a) Statistiques / *Statistics*

BG explique que TSMC fait face à différent défis avec ses sous-traitants, en termes de pratiques en matière de la santé et la sécurité. Il ajoute que Développement économique montagnais a amélioré à ce niveau à 100%. Il est rendu parmi les meilleurs fournisseurs, et représente un vrai exemple de succès, grâce en particulier à un employé qui prenait cet aspect de la performance personnellement et au sérieux.

Les dommages à la propriété demeurent une réelle problématique. Parfois, ce ne sont pas les bons opérateurs pour le travail; parfois il faut prendre des décisions difficiles en renvoyant les personnes qui ne font pas suffisamment attention.

CA indique qu'il arrive que les employés de fournisseurs se sont plaints du manque de disponibilité d'équipement de protection individuelle (EPI).

BG explique que l'employé a une responsabilité à soulever tout manquement, tel que présenté lors de l'orientation sur le site. Le sujet d'équipement de protection individuelle, du droit au refus, des zones où le port de masque respiratoire est obligatoire.

/

BG explained that TSMC faces various challenges with its sub-contractors, in terms of health and safety practices. He added that Développement économique montagnais has improved 100% in this regard. They are now one of the best contractors, and represent a true example of success, thanks in particular to one employee who took this aspect of performance personally and seriously.

Damages to property remain a very real problem. Sometimes, it is the wrong operators for the work; sometimes difficult decisions must be taken by removing individuals who are not careful enough.

CA indicated that some employees of contractors have complained about the lack of availability of personal protective equipment (PPE).

BG explained that the employee has a responsibility to raise any issue, as presented in the site orientation. The subject of PPE, the right of refusal, and zones where respiratory protection is required.

Formations / *Training*

BG explique que TSMC a 14 pompiers et souhaite avoir 12 par rotation, y compris des pompiers issus des communauté locales.

En termes de formation des premiers répondants, BG indique qu'elle est plus longue que pour les premiers soins, c'est-à-dire 5 jours de durée.

La formation en secours par corde a été donné à des employés, à un coût de $2 500 par personne. Ce type de secours est utilisé pour tous les endroits de travail (plants, dôme, fosses, espaces clos).

Ce sont tous des formations qui ne sont pas livrés par TSMC mais par des organismes externes reconnus, ce qui veut dire que les individus peuvent s'en servir partout au monde.

En réponse à une question de LM, BG confirme que le gaz propane est utilisé sur le site DSO seulement pour la cuisine et la soudure.

/

BG explained that TSMC has 14 firefighters and wishes to have 12 per rotation, including firefighters from the local communities.

In terms of First Responders' training, BG indicated that it is longer than for First Aid, i.e. five (5) days long.

Rope Rescue training was given to employees, at a cost of $2,500 per person. This type of rescue is used in all work areas (plants, dome, pits, confined spaces).

This is all training that are not delivered by TSMC but by recognized external organizations, which means that individuals can use it anywhere in the world.

In response to a question from LM, BG confirmed that propane gas is used on the DSO site only for cooking and welding.

Fin de la rencontre / *End of Meeting*

La rencontre se termine à 17h30. */ The meeting ended at 5:30 pm.*

****

* Compte-rendu préparé par Coco Calderhead, TSMC / *Meeting minutes prepared by Coco Calderhead, TSMC.*

TATA STEEL MINERALS CANADA LIMITED

Project 2A
Environmental Monitoring Committee Meeting
19 June 2018

Agenda

- Introduction of Participants
- Approval of Agenda
- MDDELCC Environmental Authorization Tata Steel Minerals Project 2A
- Environmental Monitoring Committee Mandate and Organization
- Update on Project 2A Mining Activities
  - Spills, Incidents & Inspections
  - Goodwood Approvals
  - Goodwood Water Management
- Air Quality
- Closure & Rehabilitation
- Date and Place Next Meeting.

Environmental Authorization - Ministère de Développement durable, de l'Environnement et de la Lutte contre les changement climatiques

- 11 January 2013
- Condition 21
  - At the onset of mining activities, the Promoter must implement an Environmental and Social Monitoring Committee. The Committee must be formed by representatives from Tata Steel Minerals Canada, the community of Kawawachikamach, Kativik Regional Government, and Makivik and must meet at least twice annually. The Committee must ensure that the parties present of the different monitoring programs put in place by the Promoter, on Project progress as soon as mining activities advance, and on the rehabilitation plan. Meeting minutes will be transferred to the Administrator for information, at the latest four (4) months after each meeting.

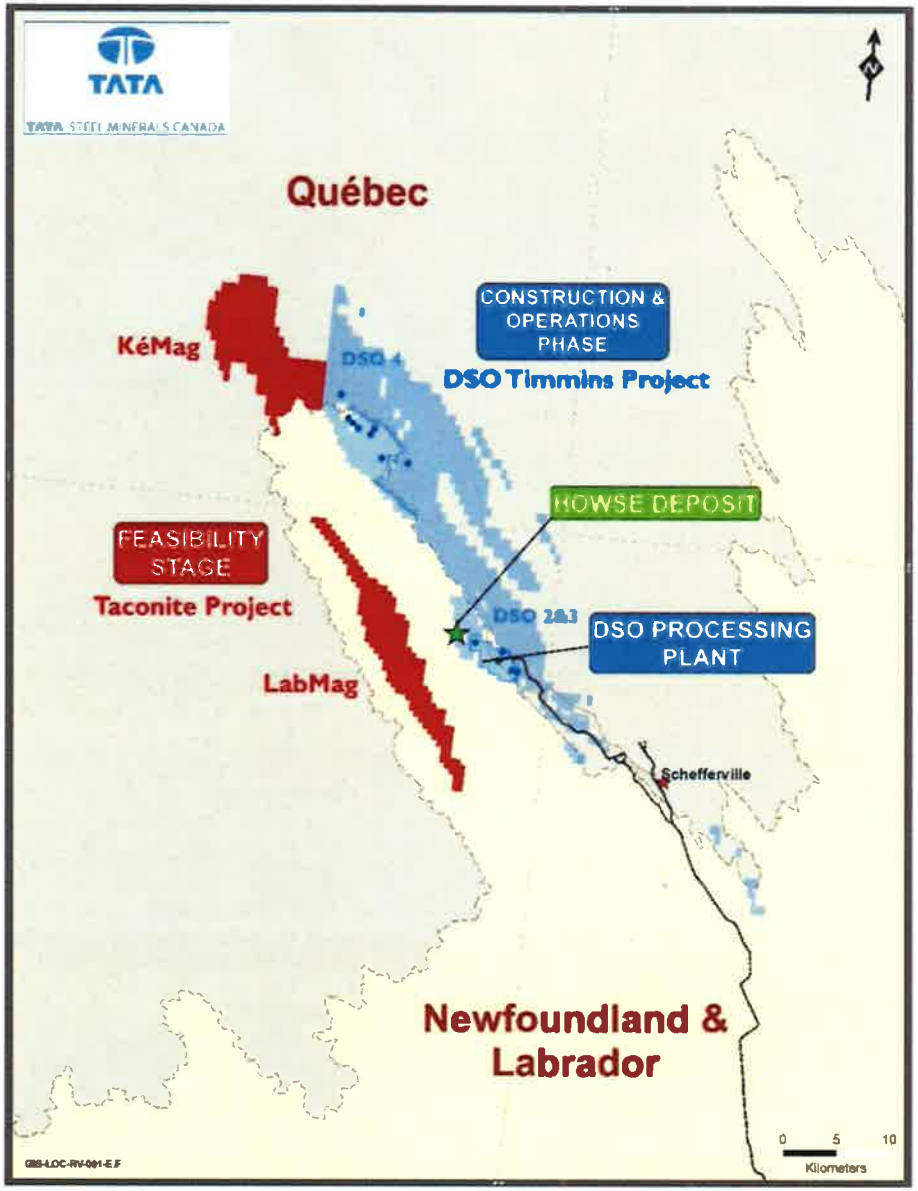
Environmental Monitoring Committee Mandate & Organization

- Terms of Reference
  - For discussion and preparation:
    - General Responsibilities
    - Composition & Functioning
    - Collaboration
    - Environmental Monitoring

Agenda

- Introduction of Participants
- Approval of Agenda
- MDDELCC Environmental Authorization Tata Steel Minerals Project 2A
- Environmental Monitoring Committee Mandate and Organization
- Update on Project 2A Mining Activities
  - Spills, Incidents & Inspections
  - Goodwood Approvals
  - Goodwood Water Management
- Air Quality
- Closure & Rehabilitation
- Date and Place Next Meeting

TATA STEEL MINERALS CANADA



Spills, Incidents and Inspections

Spills and incidents
One major issue – Goodwood sedimentation ponds - in progress
Spring drainage issue (will be discussed in following points)

Governmental inspections
Environment Quebec : August 2017
Environment Quebec on site since June 11 2018

Goodwood Approvals

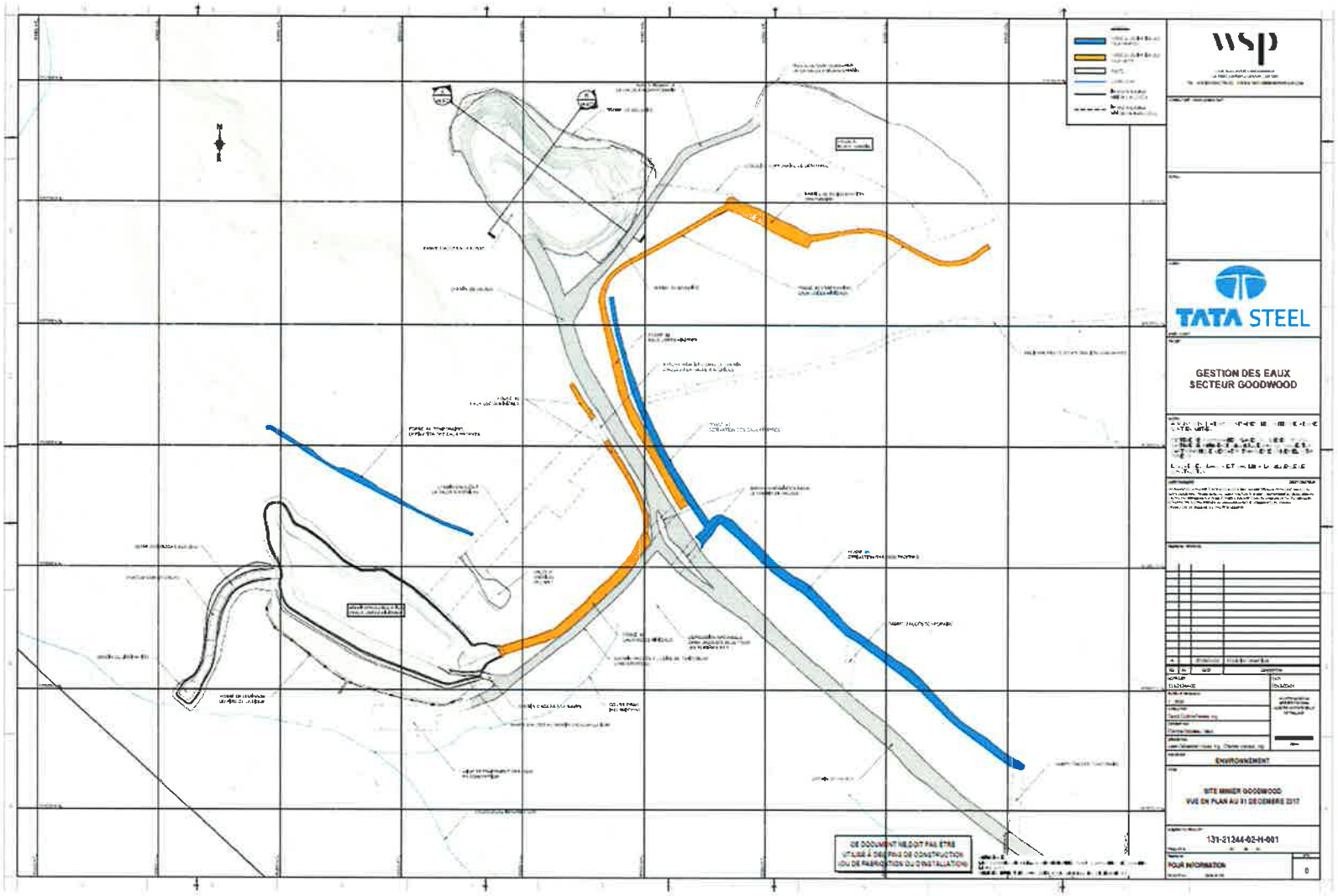
Permit process
2011 – Environmental Release with Conditions
2017 – 1 year permit for Goodwood pit and Water Management
2018 – Full permit operation

Goodwood Water Management

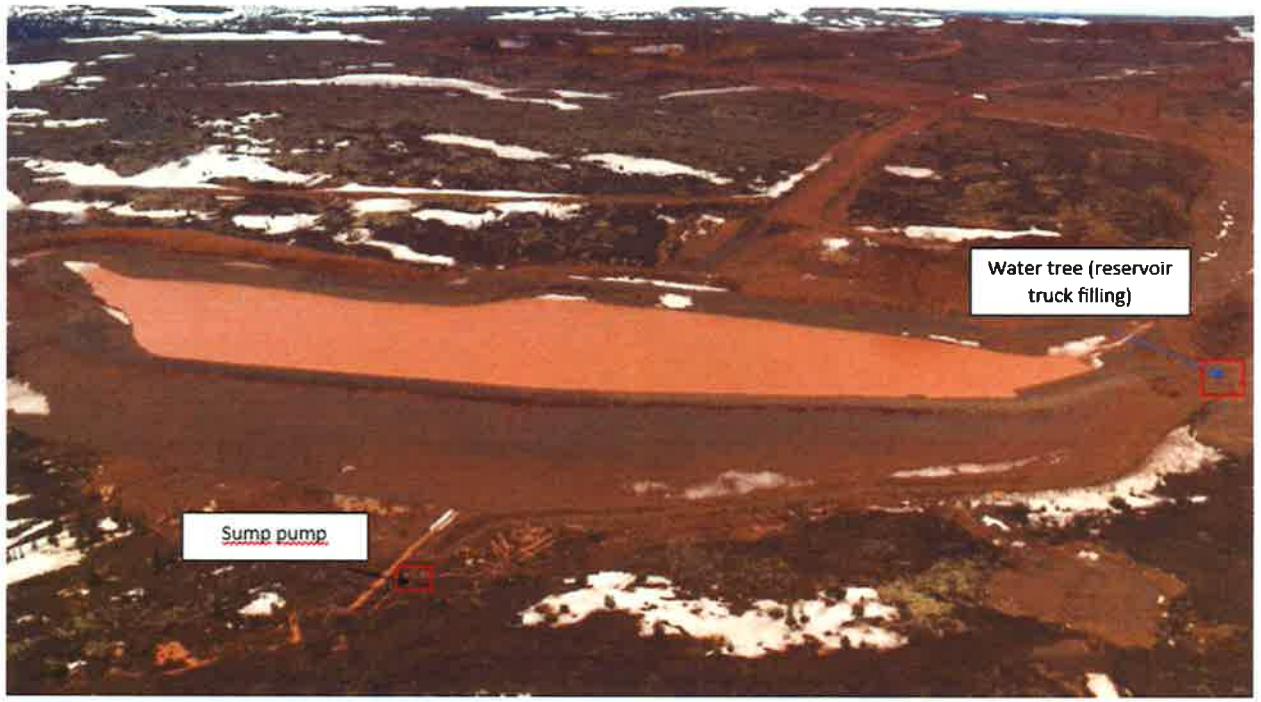
- ❑ Construction of water management infrastructure in 2017
- ❑ Water treatment unit will be operation in July 2018

- ✓ Challenge with water treatment unit
- ✓ Since 2018 challenge with the accumulation basin

Water Management infrastructure



2018 Water Management Issue



- ❑ During regular inspection on 8 june 2018 (mining and environment) exfiltration was observed
- ❑ Third party is on site
- ❑ TSMC advised government
- ❑ Since 11 June government is on site as well

- ✓ Weekly and daily water sampling shows a low level in suspended solids
- ✓ We are pumping water
- ✓ Water level in sedimentation ponds is low – low risk
- ✓ Engineer confirmed minor geotechnical issue

Agenda

- Introduction of Participants
- Approval of Agenda
- MDDELCC Environmental Authorization Tata Steel Minerals Project 2A
- Environmental Monitoring Committee Mandate and Organization
- Update on Project 2A Mining Activities
  - Spills, Incidents & Inspections
  - Goodwood Approvals
  - Goodwood Water Management
- Air Quality
- Closure & Rehabilitation
- Date and Place Next Meeting

Air Quality

Equipment or methods

Continuous monitoring (camp)
Mobile equipment
Nox passive sampler
Dust sampler
Bioevaluation by lichen

Substance tested

Nox
Dust (PM 2.5; PM10)
Heavy metals

Challenges

- 2017 weather condition
- Data transfer to government from the continuous system
- New requirement from Quebec Government (12 days)
- Monitoring in Schefferville

Air Quality Preliminary Results

Nox level is low

PM 2.5 and PM 10 are low

Lichen
Base line done in 2016
Second sampling period in 2017

Metals : no major concern

Agenda

- Introduction of Participants
- Approval of Agenda
- MDDELCC Environmental Authorization Tata Steel Minerals Project 2A
- Environmental Monitoring Committee Mandate and Organization
- Update on Project 2A Mining Activities
  - Spills, Incidents & Inspections
  - Goodwood Approvals
  - Goodwood Water Management
- Air Quality
- Closure & Rehabilitation
- Date and Place Next Meeting

Closure and rehabilitation

Action update
2014 : 3 year research program on revegetation of IOC waste rock – University of Laval (cancelled)
2016 : 3 year research program (U Laval, McGill, private sector)
2017 : Development of a strategic plan for restoration and rehabilitation of the DSO and Howse project.
2018 : First trial – in progress

RESPONDING TO CHALLENGES

Challenges	Mitigation
Overburden and waste dumps are composed of inert material of variable texture and coarse fragment content and size	develop symbiotic microorganisms that significantly increase the growth and resistance of targeted native shrub and tree species
There are blasting residues (ammonium nitrate, diesel and by-products) from mine operations and some naturally present high metal concentrations (iron, manganese, aluminum) in the waste material. These heavy metals may impair the growth of certain plant species.	a strategic restoration plan aimed at determining the best management options, the required human resources, as well as the most promising restoration techniques

Other challenges	Mitigation
No organic soil	develop symbiotic microorganisms that significantly increase the growth and resistance of targeted native shrub and tree species

Agenda

- Introduction of Participants
- Approval of Agenda
- MDDELCC Environmental Authorization Tata Steel Minerals Project 2A
- Environmental Monitoring Committee Mandate and Organization
- Update on Project 2A Mining Activities
  - Spills, Incidents & Inspections
  - Goodwood Approvals
  - Goodwood Water Management
- Air Quality
- Closure & Rehabilitation
- Date and Place Next Meeting

END OF DECK

ANNEX 5


INNU TAKUAIKAN


adidas

ANNEX 6


Cola

ANNEX 7

ANNEX 8

ANNEX 9

Communication Plan

Mars 2019

The content of this document reflects the work, programs and initiatives already ongoing. New ones are introduced as well, reflecting TSMC's commitment to continuously improve its ways and further strengthen its relationships with its stakeholders.

1 GENERAL POINTS

1.1 General Purpose

Ensure that stakeholders:

- receive correct and relevant information concerning the TSMC Iron Ore Project in a timely and consistent manner.
- are consulted when necessary in relation with the TSMC Iron Ore Project.

1.2 Primary audience (Indigenous groups):

Indigenous groups:

- Naskapi Nation of Kawawachikamach
- Nation Innu Matimekush Lac-John
- Innu Takuaikan Uashat mak Mani-Utenam
- Makivik

1.3 Secondary audience:

- Other relevant authorities, including KRG, CQEK and the Town of Schefferville
- Other relevant stakeholders, SQ, Schefferville Airport

1.4 General concept and topics

This general communication plan will be used for:

1. Any consultation with the Indigenous groups;
2. Any general information shared on progress on follow-up programs and on effectiveness of mitigation measures;

in relation to any topic, including, but not limited to:

- Initiation of material change(s) to TSMC Iron Ore Project which may result in adverse environmental effects
- Fish and fish habitat (also water quality; includes all follow-up programs, and effectiveness of mitigation measures)
- Migratory birds (also their nests, eggs and wetlands that support the birds; includes all follow-up programs and effectiveness of mitigation measures)
- Health and socio-economic conditions of Indigenous peoples (dust management, air quality and effects of dust, country foods; all follow-up programs and effectiveness of mitigation measures)

- Current use of lands and resources for traditional purposes (bypass roads, the George River herd of woodland caribou; all follow-up programs including effectiveness of mitigation measures)
- Physical and cultural heritage and structures, sites or things of historical archaeological, paleontological or architectural significance (use of cultural and other sites as a result of noise levels, cultural heritage; all follow-up programs and effectiveness of mitigation measures)
- Emergency Response Plan (ERP)

However, specific communication plans are also necessary for:

- Blasting operations
- The discovery of unidentified structures, sites or things of historical, archaeological, paleontological or architectural significance within the Project area
- An accident and malfunction with the potential to create adverse environmental effect
- Feedback / complaints received from Indigenous groups by the Proponent, and the proponent's response.

1.5 Medium/resources used

As much as possible, existing mediums/resources will be used to communicate and consult with Indigenous groups and relevant stakeholders:

- Weekly environmental update with the Proponent's Environment Team and local First Nations
- Emails between the proponent's representatives and Indigenous groups/relevant stakeholders
- Phone calls between the Proponent's representatives and Indigenous groups/relevant stakeholders
- Announcements on local community radio stations
- Quarterly Health, Safety and Environment (HSE) Committee meeting
- Quarterly newsletter *(new)*
- Annual Report, available in print and on the internet
- Shared drive[1] (*new: with automatic push notice when new material is added*)
- Aboriginal Environmental Representative
- New email address *feedback-complaint@tatasteelcanada.com* to collect complaints and feedback

1.6 Coordinates of key stakeholders

In order to ensure that key stakeholders can be reached in a timely manner, a list of names and contact information is kept and is updated on a regular basis.

[1] A shared drive allows all registered users to securely access remotely, from another computer, documents that were saved on the drive. One becomes a registered user when he/she joins a committee, a meeting, etc. and when the Proponent grants to the person/group the access to the shared drive.

1.6.1 Indigenous groups

Naskapi Nation of Kawawachikamach (NNK): 418 585-2686	
George Guanish	Lindsay Richardson

Nation Innu Matimekush Lac-John (NIMLJ): 418 585-2601	
Conrad André	

Innu Takuaikan Ushuat mak Mani-Utenam (ITUM): 418 962-0327 or 1 800 563-0327	
Maude Régis-Pilot	Counterpart 2

Kativik Regional Government (KRG) : (819) 964-2961 #2271	
Michael Barrett: mbarrett@krg.ca, enviro@krg.ca	Counterpart 2

Makivik : (418) 929-6857	
Jean-Marc Séguin : jmseguin@makivik.org	Counterpart 2

1.6.2 Archaeology (please see also TSMC's Cultural Heritage Control Plan)

Naskapi Nation of Kawawachikamach (NNK):	418 585-2686
Nation Innu Matimekush Lac-John (NIMLJ):	418 585-2601
Innu Takuaikan Ushuat mak Mani-Utenam (ITUM)	418 962-4000

1.6.3 TSMC's Designated Feedback and Complaint Coordinators

In order to ensure that feedback and complaints are treated efficiently, designates key employees to liaise with stakeholders:

TSMC's Environmental Team:	514 764-6700, ext. 374 or 488 feedback-complaint@tatasteelcanada.com environment@tatasteelcanada.com
Emergency Number (24hrs/day, 7 days/week)	1 844 828-2503
Vice-President, Government and Stakeholder Relations	514 618-5289
Manager, Community Affairs	514 258-9116
Corporate Environmental Manager	514 764-6705

1.6.4 Relevant Authorities

Town of Schefferville	1 888 828-2503

1.6.5 Other Entities

Schefferville Airport	418 585-3325
Sûreté du Québec in Schefferville	418 585-2626

2 COMMUNICATION STRATEGY

2.1 General Communication Plan

General Purpose:

To ensure that Indigenous groups and other relevant stakeholders receive accurate and relevant information concerning the TSMC Iron Ore Project in a timely manner.

2.2 Consultation with Indigenous Groups and Relevant Stakeholders

General purpose:

Ensure that Indigenous groups and relevant stakeholders are consulted on plans, their effectiveness and that of mitigation measures, etc. to adopt plans that are effective and efficient in views of all parties. This section applies to HSE Meetings and to Weekly Updates, with some adaptation. (see attached Weekly Update model)

When	What (action)	Why (objective)	To whom (target audience)	How (medium)	Accountability
30 days before Day 0 (collection of views)	Provide counterparts a written notice of the opportunity to provide their views on the subject matter (strategy, follow-up program, mitigation measures, etc.). The notice will include: ▪ Subject matter/follow-up program ▪ Context of subject matter/follow-up program ▪ Possible impact/outcome of subject matter/follow-up program ▪ Reason for soliciting views ▪ Deadline to provide views (Day 0) ▪ Date of availability of all information on the subject matter ▪ General timeline for the subject matter ▪ Method used to collect the views (in writing, meeting, etc.) Upload on the shared drive	Give advance notice of necessity for views	*All stakeholders (General Communication & Consultation):* ▪ First and second designated representatives of the Indigenous groups to be consulted ▪ Relevant authorities ▪ Proponent's staff who should be informed (in cc): ○ Environmental Team ○ Health and Safety Team ○ Vice President of Government and Stakeholder Relations ○ Manager, Community Affairs Aboriginal Environmental Representative All registered users of the shared drive	Email Push notification of the shared drive	Corporate Environmental Manager
Maximum 21 days before Day 0	Send counterpart sufficient information by email (or link to drive) on the scope to prepare their views and information	Make information on subject easily accessible	*All stakeholders (General Communication & Consultation)*	Email	Corporate Environmental Manager

When	What (action)	Why (objective)	To whom (target audience)	How (medium)	Accountability
(collection of views)	Upload all information available on the shared drive in folder bearing the subject name	Raise knowledge on subject		Information on the subject matter Printed documents if needed on subject matter Push notification of the shared drive	
10 days before Day 0	Send reminder of the opportunity to provide views Deposit reminder on the shared drive	Ensure awareness of request	Indigenous groups Relevant authorities Aboriginal Environmental Representative All registered users of the shared drive	Email Push notification of the shared drive	Corporate Environmental Manager
Day 0	Collect views and information of stakeholders	Obtain input and point of view	Indigenous groups Relevant authorities Aboriginal Environmental Representative	Email Data collecting template Meeting	Corporate Environmental Manager
Max Day 30 after meeting	Provide by email an executive summary (easy to follow) identifying adjustments made and the reasoning behind the adjustments, and the relevant adjusted follow-up measures Deposit on shared drive	Keep audiences informed of progress	*All stakeholders (General Communication & Consultation)*	Email Executive summary of adjustments (printed documents if needed) Push notification linked to shared drive	Corporate Environmental Manager

When	What (action)	Why (objective)	To whom (target audience)	How (medium)	Accountability
Annually	Summarize all consultations that took place in the previous year as well as their results	Raise awareness about the Proponent's consultation practises	*All stakeholders (General Communication & Consultation)* *Local stakeholders* All Proponent's employees General public	Annual report (printed and on the internet)	Corporate Environmental Manager

2.3 Blasting

General purpose:

Ensure that Indigenous groups are informed of blasting to take place in delineated area as it may have an impact on noise, air quality, fauna, use of the land, etc. in said area.

When	What (action)	Why (objective)	To whom (target audience)	How (medium)	Accountability
Weekly: Environmental weekly meeting preceding the blast	Communicate proposed blasting schedule and area to be blasted during weekly meeting	Give advance notice	*All stakeholders (General Communication & Consultation)*	Weekly environmental meeting Blasting schedule	Operations
As soon as a schedule is updated	Upload blasting schedule, including validity date, on the shared drive	Make information available	All registered users of the shared drive	Push notification linked to shared drive Blasting schedule	Operations

48 hours prior to each blast	Inform counterparts of the upcoming blast and upload final blasting schedule, including validity date, on the shared drive	Ensure general awareness of all	All members of the Indigenous groups *All stakeholders (General Communication & Consultation)*	Radio announcements in Indigenous language Email Push notification linked to shared drive Blasting schedule	Operations

2.4 Discovery of Unidentified Structures, Sites or Things of Interest

General purpose:

Ensure that Indigenous groups and relevant authorities are informed, and updated, on the discovery of unidentified structures, sites or things of historical, archaeological, paleontological or architectural significance within the TSMC Iron Ore Project.

Note: TSMC has deployed a Cultural Heritage Control Plan meeting all requirements of the *Historic Resources Act* and the *Cultural Property Act*. TSMC also reaffirms in the document its intention to operate in a collaborative manner with the communities with which it works to preserve sites with appropriate buffer. For execution of this section of the Communication, see attached TSMC Cultural Heritage Control Plan.

2.5 Accident and/or Malfunction with the Potential to Create an Adverse Environmental Effect

General purpose:

Ensure that key stakeholders are informed of accident and/or malfunction which may have potential to create adverse environmental effect in a timely manner. Ensure as well that they are heard and able to word views.

Accidents and/or malfunctions of a certain gravity to be declared:

In particular this section applies to: spills, road accidents, fire, explosives, water management failure, slope failures, accidents and malfunctions caused by exceptional natural events and Effects of the environment on the Project

Note: TSMC has deployed an Emergency Preparedness Response Plan (EPR). The current document is meant to support EPR and in no way is it meant to replace it.

When	What (action)	Why (objective)	To whom (target audience)	How (medium)	Accountability
Day 0	*In the event of an accident and/or malfunction, the witness informs the Environmental Group*				
As soon as possible (Day 0)	Inform relevant authorities, Indigenous groups in writing of the accident and/or malfunction The notice is to include: ▪ Description of the accident or malfunction and of its adverse effects ▪ Precise location of the accident or malfunction ▪ Confirmation of immediate corrective measures taken to mitigate the adverse effect ▪ Next steps in the Emergency Response Plan Upload notice on shared drive	Inform of the accident and/or malfunction	Local stakeholders Relevant authorities	Email Phone call Push notification linked to shared drive	Corporate Environmental Manager
If applicable, as soon as possible, on a daily basis	Inform all local stakeholders of the situation, measures taken, alternative routes, etc.	Ensure wide awareness of the situation	*Local stakeholders*	Radio announcements in Indigenous language	Corporate Environmental Manager
Weekly until mitigation measures are completed	Provide update on the situation	Raise awareness of ongoing actions	*All stakeholders (General Communication & Consultation)*	Weekly Environmental Update	Corporate Environmental Manager

When	What (action)	Why (objective)	To whom (target audience)	How (medium)	Accountability
At the latest 30 days after Day 0	Submit a written report to Parties concerned. The report is to include: Description of the accident or malfunction and of its adverse effects Precise location of the accident or malfunction The measures taken to mitigate the adverse effect Any views received from Indigenous groups and relevant authorities on the situation, adverse effects and measures taken to mitigate the adverse effects Description of any residual adverse environmental effects and any modified/additional measures to be adopted Details about the implementation of the Emergency Response Plan Upload 30-day report on shared drive	Report progress made on the accident or malfunction	*All stakeholders (General Communication & Consultation)*	30-day report Push notification linked to shared drive	Corporate Environmental Manager
Quarterly until mitigation measures are completed	Provide update on the situation and mitigation measures taken	Have all stakeholders aware of ongoing measures	*All stakeholders (General Communication & Consultation)*	Quarterly Health, Safety and Environment (HSE) Committee meeting Quarterly newsletter	Corporate Environmental Manager
As views received from Indigenous groups and relevant authorities need to be included in the report, use the "Consultation with Indigenous groups and relevant stakeholders" communication plan					
At the latest 90 days after Day 0	Submit a written report to the Parties concerned. The report is to include: ▪ Follow up on 30-day report ▪ Changes adopted to avoid subsequent occurrence of the event	Report progress made on the accident or malfunction	Relevant authorities *All stakeholders (General Communication & Consultation)*	90-day report Push notification linked to shared drive	

When	What (action)	Why (objective)	To whom (target audience)	How (medium)	Accountability
	▪ Modified or additional measures taken to mitigate and monitor residual adverse effect ▪ Any views received from Indigenous groups and relevant authorities on the situation, adverse effects and measures taken to mitigate the adverse effects ▪ Description of any residual adverse environmental effects and any modified/additional measures to be adopted ▪ Details about the implementation of the Emergency Response Plan Upload 90-day report on shared drive				
Quarterly until Action Plan is completed	Provide update on the situation and mitigation measures taken (using 30- and 90-day reports)	Have all stakeholders aware of ongoing measures	*All stakeholders (General Communication & Consultation)*	Quarterly Health, Safety and Environment (HSE) Committee meeting Summary document of progress (printed if needed) Quarterly newsletter	Corporate Environmental Manager
Bi-annually until Action Plan is completed	Provide update on the situation and mitigation measures taken (using 30- and 90-day reports)	Have all stakeholders aware of ongoing actions	*Local stakeholders*	Bi-Annual Regional Meeting on Mining Summary document of progress (printed if needed)	Corporate Environmental Manager
Annually	Summarize the situation and mitigation measures	Raise awareness about the Proponent's responsiveness	*All stakeholders (General Communication & Consultation* *Local stakeholders* All TSMC's employees General public	Annual report (printed and on the internet)	Corporate Environmental Manager

Provincial law

Provincial laws are designed to protect cultural remains within a given territory:

- They especially govern work that has a direct impact on the physical environment and its subsoil.
- They define what cultural property is and establish the protective measures to be taken to conserve it.
- They allow work to be stopped for a set period of time.
- They permit an expert to be called in to evaluate the find.
- They require professionals to have a research permit.

***Historic Resources Act*, Government of Newfoundland and Labrador**

3. It is against the law to look for and dig up archaeological sites and artifacts in the Province of Newfoundland and Labrador.

10. If you find any archaeological remains in the course of your work, such as stone, bone or iron tools, concentrations of bone, charcoal or burial, fireplaces, house pits and/or foundations, activity in the area of the find, you should cease immediately. Don't move or damage the remains.

18. A person shall not, except with the written consent of the Ministry, move, destroy, damage, deface, obliterate, alter, add to, mark or interfere with, remove from the province or agree to the removal from the province of a provincial historic site or a registered historic site or an object, building, monument, or other structure situated on or in the site, or excavate on or interfere with or damage the site.

31. (1) Where the Ministry or an employee in the division designated by the Ministry is of the opinion that a person is engaged in an activity that is likely to result in damage to or destruction of an historic resource, the Ministry or the employee may issue a temporary stop order requiring that person to stop the activity that is specified in the order for a period of not more than 30 days to permit the

a) salvaging of the historic resource in danger;

b) conducting of an archaeological investigation of the historic resource; or

c) investigation of alternatives to damaging or destruction of the historic resource.

31. (2) The Ministry may extend the period of a temporary stop order for a further 60 days where in the opinion of the Ministry it is necessary to do so.

***Cultural Property Act*, Quebec (R.S.Q., Chapter B-4)**

1. Cultural property is a historic property, historic monument, or archeological site. Archeological property is any property indicating prehistoric or historical human occupation. An archeological site is a place where archeological property is found.

35. No person may make, on an immovable owned by him or others, excavations or surveys to find archaeological property or sites without having previously obtained an archaeological research permit from the Ministry.

40. Whoever discovers an archeological property or site must inform the Ministry of it without delay.

41. Whoever, during excavation or construction work undertaken for other than archaeological purposes, discovers an archaeological property or site must inform the Ministry of it without delay. The latter may, to permit the examination of the place by experts, order the suspension, for a period not exceeding fifteen days, of any excavation or construction that might compromise the integrity of the property or site discovered.

42. When a discovery described in section 41 reveals property which would have been classified if discovered before the beginning of the work, the Province may, on the recommendation of the Ministry, who shall obtain the advice of the Commission :

a) Order continuance of the suspension of work until the expiry of thirty days from the date of its suspension

b) Allow the making of excavations necessary to uncover the discovered property or site

c) Order any change that it considers necessary to the plans for excavation or construction to ensure the integrity or the value of the property or site discovered.

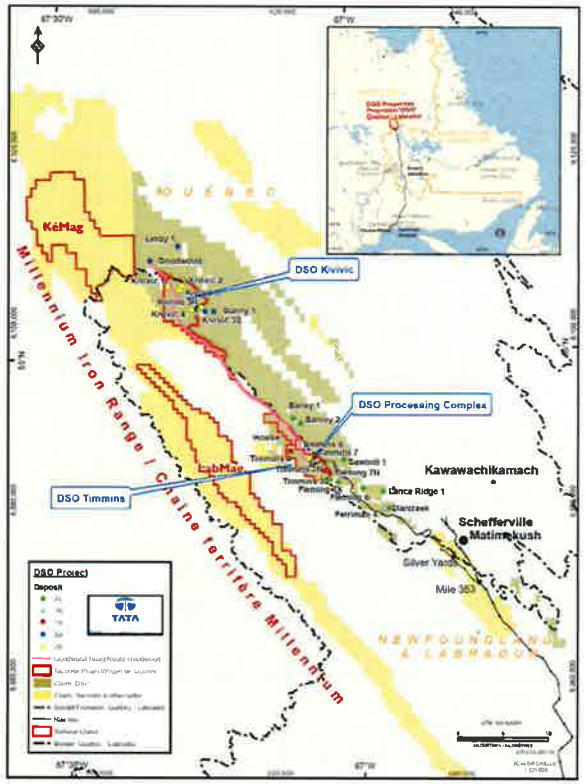
Federal law

Federal jurisdiction is limited to Crown land. Parks Canada must be contacted if a fortuitous archeological discovery is made. If there is a known archaeological site in the work area, Parks Canada must be notified before the work starts.

As part of its Direct Shipping Ore Project (DSO), Tata Steel Minerals Canada Ltd. (TSMC) has established a protection plan for archeological and historical resources in compliance with:

1) Federal laws and provincial laws of Newfoundland and Labrador and of Québec
2) Commitments to Aboriginal groups impacted by our activities.

This plan is designed to assist workers and managers in the identification and protection of cultural heritage resources in the DSO area.



1 A LITTLE HISTORY

Aboriginal presence

Aboriginals were present in North America well before the arrival of the first Europeans. The period of contact between the two civilizations profoundly marked Aboriginal history. To reflect this, archeologists divide Aboriginal history into two periods: the **prehistoric period** covering events that occurred before contact with Europeans and the **historical period** covering the post-contact era.

Prehistoric period

- The study area has been occupied by humans for at least 5,000 years
- Evidence of occupation includes various structural elements, often visible at the surface:
  - Vestiges of dwellings identified by a circle of stones or raised earth
  - Remains of campfire sites made up of piles of small stones (1) containing charcoal and whitened bones
  - Stone structures (food caches, traps, inukshuks, etc.).
- Aboriginals used tools (2) made of stone, bone, wood, and antlers (arrowheads, knives, scrapers, hooks, spears, and so forth).
- The study area is rich in the lithic raw materials used to make tools. There are numerous rocky outcrops (3) containing quartz, quartzite, and high quality chert associated with the Labrador Trough.

Human graves are surely present in the area, but none have so far been found in the immediate area of the worksite. They would probably resemble piles of stone or small rectangular mounds.

Historical period (17th century to today)

Aboriginal populations in the area maintained their traditional lifestyle following contact with Europeans. New objects appeared, however, as did new materials like metal.

- Remains of Aboriginal dwellings can still be seen in the form of stone or earth circles, but on more recent remains, wooden poles (4) and pieces of fabric or canvas that replaced animal skins can often be seen.
- Various abandoned structures such as canoe racks, skin and meat drying racks (5), sleds, etc., can also be seen.
- The area is sometimes indicated by surface markers such as disorderly piles of stones or more organized structures such as inukshuks.
- Aboriginals quickly began using various metal objects: pots, utensils, knives, traps, guns and ammunition, metal pans (6), usually rectangular in shape and resting on small wooden stakes or on stones, etc.
- Several recent graves have been discovered nearby, most of them near riverbanks. Graves are sometimes marked by a fence, a structure, or a mound of stones.
- Evidence of places of worship or commemoration with crosses or statues (7) have also been found.

Non-Aboriginal presence

- Non-Aboriginal populations have used the area since around the 1930s when mining-related activities started.
- Cultural remains consist of vestiges of temporary dwellings such as canvas tents with wooden floors (8).
- Metal parts from various types of machinery were often abandoned on site, as were manufactured objects.

Paleontological resources

Since mining operations fragment the rock in various ways, fossil remains (9) of plants, insects, fish, shells, and so forth may be brought to light.

2 DSO SITE INSTRUCTIONS: WHAT TO DO TO PROTECT ARCHAEOLOGICAL / CULTURAL HERITAGE RESOURCES

What to do:

Before earthworks begin:

- visually scan the area for archaeological remains, particularly features with a higher archaeological potential, such as elevated topography, pockets of well-drained sandy soil, especially within areas of heavy soil or rocky ground, distinctive land formations, and resource extractions areas.

If remains are found:

- the on-site TSMC Environment Representative must be notified immediately;
- work must stop until the authorities have decided on the protective measures to be taken before the work continues;
- the site must be clearly identified and delimited using, applying a 30m buffer zone;
- during the operation of heavy equipment, the equipment must not be moved as physical evidence might be destroyed
- the remains must be covered with canvas to protect them; and
- all pedestrian and vehicular traffic is prohibited.

What not to do:

- archeological artifacts and other cultural remains must not be moved or removed without the permission of a professional archeologist with a ministerial mandate;

Human graves or remains

The following steps must be taken if human bones are found on or in the ground:

- They must not be moved. Police authorities must be notified (the Royal Newfoundland Constabulary if in NL or Sûreté du Québec if in QC).
- The same protective measures as those for archeological sites must be taken.
- If a grave site is marked by above-ground indicators such as a fence, a metal or wooden cross, a structure, etc., the nearest communities should be contacted for permission to consider measures to be taken before work continues.

CE QUE LA LOI DIT

PROTECTION DU PATRIMOINE CULTUREL
DÉPLIANT pour travailleurs sur le terrain

TATA STEEL MINERALS CANADA

Loi fédérale

La loi fédérale se limite aux territoires appartenant à la Couronne. Dans le cas de découvertes archéologiques fortuites, l'Agence Parcs Canada doit être contactée. Si un site est connu dans la zone où sont effectués les travaux, il faut avertir l'Agence Parcs Canada avant le début des travaux.

Lois provinciales

Les lois provinciales visent à protéger les biens culturels sur un territoire donné :

- elles encadrent particulièrement les travaux qui ont un impact direct sur l'environnement physique et son sous-sol.
- elles définissent ce qu'est un bien culturel et établissent les mesures de protection à prendre pour sa sauvegarde.
- elles autorisent l'arrêt des travaux pour une période déterminée.
- elles permettent de faire appel à un expert pour évaluation.
- elles exigent un permis de recherche par un professionnel.

Loi sur les Biens culturels du Québec (L.R.Q., chapitre B-4)

1. Un bien culturel est un bien historique, un monument ou un site archéologique, ...Un bien archéologique est tout bien témoignant de l'occupation humaine préhistorique et historique. Un site archéologique est un lieu où se trouvent des biens archéologiques.

35. Nul ne peut effectuer sur un immeuble lui appartenant ou appartenant à autrui des fouilles ou des relevés aux fins de rechercher des biens ou des sites archéologiques sans avoir au préalable obtenu du ministère un permis de recherche archéologique.

40. Quiconque découvre un bien ou un site archéologique doit en aviser le ministère sans délai.

41. Quiconque, à l'occasion de travaux d'excavation ou de con struction entrepris pour des fins autres qu'archéologiques, découvre un bien ou un site archéologique doit en informer le ministère sans délai. Ce dernier peut, afin de permettre l'examen des lieux par des experts, ordonner la suspension, pour une période n'excédant pas quinze jours, de toute excavation ou de toute construction de nature à compromettre l'intégrité du bien ou du site découvert.

***Historic Resources Act*, Gouvernement de Terre-Neuve-et-Labrador**

3. It is against the law to look for and dig up archaeological sites and artifacts in the Province of Newfoundland and Labrador.

10. If you find any archaeological remains in the course of your work, such as stone, bone or iron tools, concentrations of bone, charcoal or burial, fireplaces, house pits and/or foundations, activity in the area of the find, you should cease immediately. Don't move or damage the remains.

18. A person shall not, except with the written consent of the Ministry, move, destroy, damage, deface, obliterate, alter, add to, mark or interfere with, remove from the province or agree to the removal from the province of a provincial historic site or a registered historic site or an object, building, monument, or other structure situated on or in the site, or excavate on or interfere with or damage the site.

31. (1) Where the Ministry or an employee in the division designated by the Ministry is of the opinion that a person is engaged in an activity that is likely to result in damage to or destruction of an historic resource, the Ministry or the employee may issue a temporary stop order requiring that person to stop the activity that is specified in the order for a period of not more than 30 days to permit the

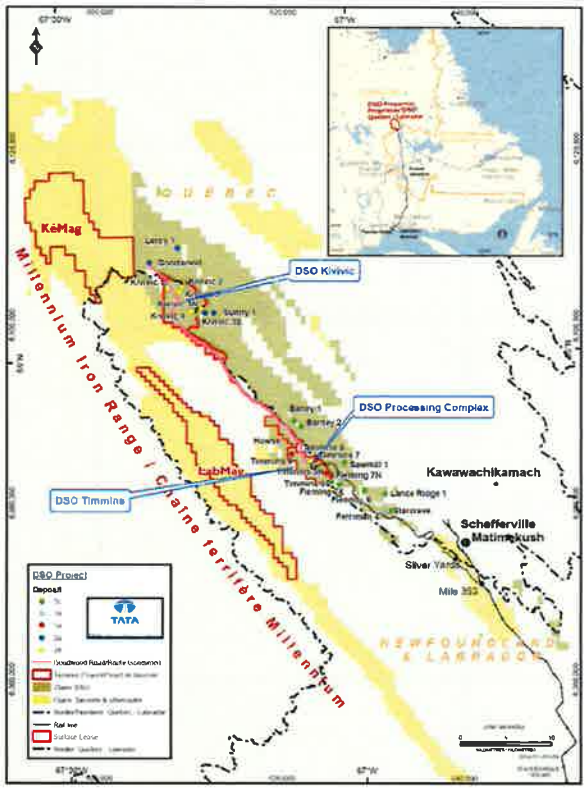
a) salvaging of the historic resource in danger;

b) conducting of an archaeological investigation of the historic resource; or

c) investigation of alternatives to damaging or destruction of the historic resource.

31. (2) The Ministry may extend the period of a temporary stop order for a further 60 days where in the opinion of the Ministry it is necessary to do so.

Tata Steel Minerals Canada Ltd. (TSMC) a développé un plan de protection des biens archéologiques et culturels . Ce dépliant sert à aider les travaillers et superviseurs dans l'identification et la protection de ces ressources dans la zone du Projet de minerai de fer à enfournement direct (DSO).



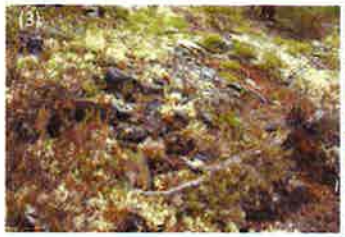
INSTRUCTIONS POUR LE SITE DSO: QUE FAIRE POUR PROTÉGER LES BIENS ARCHÉOLOGIQUES / CULTURELS

Les procédures suivantes doivent être suivies par tout travailleur qui effectue, ou par tout Superviseur responsable pour, les travaux sur le terrain.

Que faire :

Avant que les travaux de terrassement débutent

- Effectuer une **inspection visuelle** à la recherche de biens archéologiques et culturels (voir photos numérotées), qui peuvent comprendre :
  - vestiges de foyers constitués (1) d'amas de pierres de petites dimensions, contenant du charbon de bois et des os blanchis
  - structures de pierre & marqueurs en surface (caches à nourriture, pièges, inukshuk, etc.)
  - outils (2) en pierre, en os, en bois et en andouiller (pointe de flèche, couteau, grattoir, hameçon, harpon)
  - affleurements rocheux (3) qui contiennent du quartz, du quartzite et du chert de grande qualité, associée à la fosse du Labrador
  - perches de bois (4) et des pièces de tissu ou de toile qui ont remplacé les peaux animals
  - structures abandonnées (supports à canot, tendeurs pour faire sécher les viandes (5), traîneaux, tentes en toile avec planchers de bois (8))
  - objets en métal : chaudron, poêle, ustensile, couteau, piège pour la trappe, fusil et munition, machineries et objets usinés abandonnés (6)
  - lieux de culte ou de commémoration marqués par des croix ou des statues (7)
  - sépultures (souvent près des rives des rivières), parfois marquées par une clôture, une structure ou une butte de pierres
  - empreintes fossiles (9) de plantes, d'insectes, de poissons, de coquillages



Si des biens sont trouvés :

- le **représentant en environnement de TSMC** doit être avisé immédiatement
- **Le travail doit cesser** jusqu'à ce que les autorités ont décidé sur les mesures à prendre avant que le travail se poursuit
- le site doit être clairement identifié et délimité , et une **zone tampon de 30m** doit être respectée
- les équipements lourds ne doivent pas être déplacés puisque l'indice matériel pourrait être détruit
- le bien doit être couvert de toile pour le protéger
- tout le trafic piétonier et motorisé est interdit

À ne pas faire:

- le bien ne doit pas être déplacé ou enlevé

Sépultures ou ossements humains

Si une sépulture ou des ossements humains sont trouvés en surface et/ou en sous-sol :

- ils ne doivent pas être déplacés. Les autorités policières (GRC au QC ou le Royal Newfoundland Constabulary en TNL) doivent être informées.
- les mêmes mesures de protection que celles prévues pour les sites archéologiques doivent être prises ;
- si un lieu d'inhumation est identifié en surface par la présence d'une clôture ceinturant la fosse, de croix de métal ou de bois, de structure, etc., il convient alors de contacter les communautés les plus près et d'obtenir leur accord pour évaluer les actions à entreprendre avant la poursuite des travaux.

ANNEX 10

Mackenzie, Armand

From: Sinha, Pallav
Sent: Friday, March 22, 2019 3:15 PM
To: Mackenzie, Armand
Cc: Trindade, Mariana; Oak, Tara
Subject: Community Meeting Minutes - Records
Attachments: Community Meeting Mins (22 October 2018); Weekly Environment and Community Affairs Meeting; Weekly Environment and Community Affairs Meeting; Weekly Environment and Community Affairs Meeting; Weekly Environment and Community Affairs Meeting; Weekly Environment and Community Affairs Meeting; Weekly Meeting - Environment and Community Affairs; Environment and Communities - Weekly Meeting 3 May 2018; Environment and Communities - Weekly Meeting 3 May 2018; Minutes: Weekly Community Meeting 26Apr18

Good afternoon Armand,

Please find attached some community minutes and invites from 2018. There are meeting minutes and agendas in the calendar items for detail.

Hope this helps.

Best regards

Pallav Sinha
Environmental Coordinator
TATA STEEL MINERALS CANADA
1000 Rue Sherbrooke Street West, Suite 1120,
Montreal, Quebec H3A 3G4
Tel:- +1 514.764.6700 x374/488
Cell: +1 226.500.0065
Email:- pallav.sinha@tatasteelcanada.com

Mackenzie, Armand

From: Sinha, Pallav
Sent: Thursday, October 25, 2018 12:52 PM
To: Trindade, Mariana
Cc: Oak, Tara; Calderhead, Coco; Mackenzie, Armand
Subject: Community Meeting Mins (22 October 2018)

Hi Mariana,

Please find below the updated minutes from the meeting on 22 October 2018:

Attendees: Lindsay Richardson, Noah Mokoush, Billy Shecanapish, Conrad Andre, Lucien Mckenzie, Tara Oak, Mariana Trindade, Larry Johnston, Pallav Sinha

- **Safety Moment** - Complete clearing of frosting on the windshield and windows in vehicles being operated during the winter is necessary. Clear passenger and driver windows help maintain peripheral vision increasing awareness and decreasing the chances for untoward incidents to occur.
- **Sitewide Alerts Issued -**
  - Cleanliness of vehicles and personnel going to Schefferville
  - Feeding of Wildlife around site

- **Agenda:**

1. **Goodwood Sed Pond** – Work commencing from Tuesday (Oct 23) onwards with initial work on original designs. Designs for new ditching will be available on Friday and work will commence on these. New dyke design will be available after these designs are prepared. Local communities requested presence during the work. Visits will be managed/scheduled due to safety considerations in the area. First planned visit on Thursday morning (Oct 25). Goodwood preliminary action plan was sent to both he communities.
   - Follow-up: Notification to be sent to communities 24 hours before a planned visit. K1C pit capacity needs to be considered/verified for Goodwood dewatering.

2. **Goodwood Water Treatment Plant** – Work in the winter was postponed to spring/summer after the melt to prevent any unforeseen environmental incidents when the area can fully stabilize. Explained to local communities as advised by Michel due to TSMC commitment. Communities will be notified if any updates - status quo for now.

3. **Carwash** – Discussions on the undercarriage issue with trucks bringing mud into Schefferville and carwash bay in town next year. TSMC is looking at long-term solution for this issue. An update was requested from NIMLJ representatives regarding the carwash in town - reps indicated they will get back to TSMC on this item.
   - Follow-up:

- TSMC: Issued sitewide alerts to all personnel reminding them to wear clean clothes and ensure their trucks are clean when presenting themselves at the security gate to head into town enforced by security personnel. Schefferville town administration was happy with the alert and recently observed cleanliness of personnel and trucks
- NIMLJ: Update pending on carwash to be set up in town.

4. **Dustjars** – Michel advised the Conseil regarding the tampering of dustjars. No more dustjars sampling until Spring 2019 due to limitations of the protocol.

5. **Goodwood Haul Road Water Management** – Soil sampling will occur in the spring due to frozen conditions on the road. Design work for the water management issues surrounding the Goodwood Haul Road will be ongoing in the meantime. As a part of the report received from Michel, including a list of most concerning locations with respect to red water management issues, TSMC is prioritizing the required work to improve water management on site starting with the biggest concerns.

6. **Air Quality Assessment** - TSMC is preparing a PO with consultants BBA to reassess the air quality data and modelling of the site. Part of the mandate will be to consult the local communities regarding the air quality concerns.
   - Follow-up: Local communities will be notified when the project will commence.

Best regards

Pallav Sinha
Junior Environmental Technician
TATA STEEL MINERALS CANADA
1000 Rue Sherbrooke Street West, Suite 1120,
Montreal, Quebec H3A 3G4
Tel:- +1 514.764.6700 x374/488
Cell: +1 226.500.0065
Email:- pallav.sinha@tatasteelcanada.com

Mackenzie, Armand

Subject:	Weekly Environment and Community Affairs Meeting
Location:	Call
Start:	Thu 8/23/2018 3:30 PM
End:	Thu 8/23/2018 4:00 PM
Show Time As:	Tentative
Recurrence:	(none)
Meeting Status:	Not yet responded
Organizer:	Sinha, Pallav
Required Attendees:	gguanish@naskapi.ca; Lindsay Richardson; georges.roy@matimekush.com; lucien.mckenzie@matimekush.com; tshani.ambroise@gmail.com; Didillon, Loic; Calderhead, Coco; Mackenzie, Armand; Oak, Tara; Dion, Jean-Francois; Johnston, Larry; Chemaganish, George; Jha, Praveen

1-877-808-8096 / Participant #1001956.
Sur le site: contactez J-F, Pallav, ou Larry pour les informer de votre visite (si vous voulez participer au meeting en personne).
On site: please reach J-F, Pallav or Larry to let them know you will attend in person.

****PLEASE SEE BELOW FOR MINUTES FROM THE LAST WEEKLY ENVIRONMENT AND COMMUNITY AFFAIRS MEETING****

Ordre du jour:

1) Moment de sécurité au travail
2) Incidents / déversement (point principal : bassin de sédimentation de Goodwood)
3) Faits saillants de la semaine : monitoring, gestion des déchets, etc.
4) Communautés locales: autres points à discuter

Good morning to all,
Because of some changes in the Environment Department's timetable, please be aware of the weekly meeting new schedule. Also, as discussed on the phone last week, the format was changed to make the meeting shorter and less oriented on the operational aspect of the ENV Department. The purpose is to now focus on the highlights of the week & the topics relevant to the communities. Although, be ensured that there is a point in the agenda for the communities' questions/comments and all subjects can be addressed. Also, if any subject need debate or longer discussions, a separate meeting will be organized.

Agenda:

1) Safety moment
2) Incidents / spill review (main point is Goodwood Sed Pond)
3) Highlights of the week: monitoring, waste management, etc.
4) Local Communities: current or new topics

Weekly Environment & Community Affairs Meeting – Minutes 15th August 2018

Attendees: Lindsay Richardson, Pallav Sinha, Coco Calderhead, Lucien Mckenzie and Conrad Andre Mackenzie

1. **Safety Moment:**
   - Bear activity around the camp area has been limited due to effective housekeeping measures being taken. All garbage is being disposed off responsibly in the appropriate receptacles which had limited bear presence. All personnel should keep at these best practices.

2. **Incidents and Spills:**
   - No new spills or incidents were recorded on site over the last week.
   - Goodwood Sedimentation Pond Incident:
     - The sedimentation pond is empty. No dewatering is being carried out into the pond due to leak issues and the only significantly small input is from precipitation. This precipitation water leaks out to the exfiltration sump and is being pumped back into the pond.
     - The exfiltration sampling has been stopped since no water from the pit is being sent into the pond after discussion with the QC Gov. The exfiltration water is clear to the naked eye.
     - Engineering consultants WSP are carrying out testing and will provide an updated design to remedy these issues. The Goodwood water treatment unit has arrived on site and the commissioning is to occur in the next few weeks. As discussed, the water treatment unit will be drawing water from the sedimentation pond and treating it. Due to this, the operation of this treatment unit will be contingent on the time when the pond is fixed. Although it must be noted that there is no water being pumped from the pit into the pond to be treated.
     - **Lucien and Conrad have requested the WSP Action Plan when ready and would like to be present at the pond when work commences.**
   - Locomotive Diesel Spill on 2nd August 2018 at Silver Yard:
     - Undetermined amount of diesel (possibly 5,000L) spilled from Locomotive 411 parked at Silver Yard due to mechanical failure – metal fuel filter bracket fatigued and broke apart, diesel filled and overflowed the belly pan under the engine.
     - No sheen observed on nearby waterbodies.
     - ENV and H&S collaborating on investigation (causes, actions, sequence of events).
     - Local communities and regulatory authorities were notified (Environment Canada/Coast Guard, Transportation Safety Board (TSB), NL Pollution Prevention Division). Follow-up reporting to regulatory authorities is required.
     - Englobe delineated the spill on Monday (06 Aug 2018) and will propose remediation options.
     - TSB approval was acquired to drain remaining diesel from belly pan and pull the locomotive to Sept- Îles for repairs.
     - **Lucien and Conrad have requested a copy of the Englobe Report when available.**

3. **Activities:**
   - Water monitoring was done at DSO4, DSO3, Howse over the last two weeks.

- Dustjars and NO2 pucks were replaced at all the air quality stations over the last two weeks. Dustjars were also installed at 3 locations in Schefferville over the last two weeks.
- Air Monitoring with the portable equipment continues all over site.
- The Canadian Environmental Assessment Agency (CEAA) was on site from August 14th-15th for inspection and compliance promotion of the Howse project.
- Consultants Groupe Hemisphere are on-site conducting the Satellite Water Monitoring Campaign and supporting with CEAA visit for the Howse project.

4. **Community Concerns and Queries**
   - **Naskapi Site Visit** – A site visit for George and Billy from the Naskapi Nation including the Goodwood Pit will be coordinated as soon as they are available – **Lindsay to provide details when possible**.
   - **Kawawa Air Monitoring** - TSMC Environment will be coordinating secure locations to set up remote air monitoring and dustfall jars after an inspection of suitable and secure locations – **Lindsay to help coordinate.**
   - **Bear Population Issue** - Meetings were held on the 10th and 16th of August at Schefferville regarding the bear populations becoming a safety concern for the local communities. The QC Wildlife Safety Officer (Simon Charbonneau) was a part of these discussions. Conrad suggested that the NL Wildlife Authorities also be contacted regarding the bear issue at the site landfill. The QC Officer will be touching base with the NL authorities as well. TSMC will also follow up on the status of their Bear Protection Permit.
   - Remote Air Monitoring equipment technical issues with the Gov recommended vendor (Consulair) were discussed. TPM sampler still out of commission but PM2.5 air monitoring continues.

ANNEX 11

Mackenzie, Armand

From: Trindade, Mariana
Sent: Thursday, March 7, 2019 1:07 PM
To: Michel La Haye; Tshani Ambroise; françois lévesque; Noël André; Anne-Marie Ambroise (annemarieambroise57@gmail.com); jeannette.vollant@matimekush.com; Pako vachon; conrad.andre@matimekush.com
Cc: Calderhead, Coco; Oak, Tara; Dion, Jean-Francois; Sinha, Pallav; Jha, Praveen; Mackenzie, Armand; Ghose, PK
Subject: TSMC Environment weekly update

Hi everyone,
Here is TSMC Environment's weekly community update:

Topic	Item	Details/update	Community comments
Dust in town/ ***oussière en ville***	Site wash bay/ *Station de lavage des camions au site*	**No Change** Request for bids initiated. TSMC is assisting NIMLJ with environmental permits for the wash bay in town. Environmental Public Health Officer, Environmental Public Health Services Quebec Region / First Nation and Inuit Health Branch, Department of Indigenous Services Canada / Government of Canada is aware of the issue and agrees that road conditions cause dust in town. Health Canada is also aware. We are working on our plans for the site wash bay: plan is to have the wash bay operation on June 1st. We have heard your concerns about red water runoff from truck washing and washing of the undercarriage: these two concerns are being taken into account in our planning. ***AUCUN CHANGEMENT***	

		L'appel d'offres a été lancé. TSMC assiste la NIMLJ avec leurs permis environnementaux pour la station de lavage des camions en ville. *Agent en santé publique et environnementale, Services de santé environnementale et publique, Région du Québec / Direction générale de la santé des Premières nations et des Inuits, Ministère des Services aux Autochtones / Gouvernement du Canada est au courant de la situation et est d'accord que la conditions des routes en ville est la principale cause de la poussière en ville. Santé Canada est aussi au courant.* *Nous travaillons à planifier notre station de lavage des camions au site. Nous avons entendu vos préoccupations sur l'écoulement d'eau rouge de la station ainsi que la nécessité de nettoyer le dessous des camions : ces deux items font partie de notre planification.*	
Red Water / *Eau rouge*	Haul Road / *route de halage*	**Update:** TSMC is looking into procuring silt fences to be installed this spring at strategic locations along the haul road to minimize red water runoff. Consultant is gathering baseline data that will allow them to accomplish the engineering phase without field work. The earthworks for the Haul Road will take place in late-summer 2019. This will allow us enough time to finalize the engineering plans with sufficient field data as well as procure all the necessary equipment and specialists for the job. ***Mise à jour :*** *TSMC est en processus d'achat de matériaux pour installer des barrières à sédiments ce printemps à des endroits stratégiques le long de la route de halage.* *Notre consultant est à la recherche de données de base afin de pouvoir faire avancer les travaux d'ingénierie pendant l'hiver. Nous planifions que les travaux de terrain se feront à la fin de l'été 2019. Ceci fera en sorte que nous aurons le temps de finaliser les plans d'ingénierie, et se procurer l'équipement et les spécialistes nécessaires.*	
Environmental Monitoring / *Suivi environnemental*	Air Quality / qualité de l'air	None (winter)	
	Water quality / qualité de l'eau	None (winter)	
	Noise / bruit	None (winter)	

Incidents	Silver yard	**UPDATE** TSMC will take action this spring to mitigate potential effects of Silver yard spill. Details to come. Thank you to the NNK for providing details on available equipment. ***MISE A JOUR*** *TSMC va agir au printemps pour minimiser les impact potentiels à Silver Yard. Détails à venir. Merci à la NNK de nous avoir fourni des détails sur l'équipement disponible.*	
Déchets / *Waste*	Hazardous/ *Dangereux*	**NO CHANGE** We are working on developing a plan to collect, treat and ship hazardous waste off site. ***AUCUN CHANGEMENT*** *Nous travaillons à élaborer un plan pour ramasser, traiter et envoyer les déchets dangereux du site.*	
Déchets / *Waste*	Landfill / *Dépotoir*	We are working on a plan for our site landfill. *Nous travaillons à élaborer un plan pour le dépotoir au site.*	
Meetings	-	**UPDATE:** Next Community Health Safety and Environment Committee – June 2019 ***MISE A JOUR :*** *Prochaine réunion du Comité communautaire en Santé, sécurité et environnement – juin 2019*	
Howse	Consultation	Minor Update sent to Aboriginal communities for Comment. *Mise-à-jour mineure transférée à la communauté pour commentaire.*	
Goodwood	Spring / *Printemps*	**NO CHANGE** No comment received on our plan for how to manage the water from the spring melt at the Goodwood site.	

		AUCUN CHANGEMENT *Aucun commentaire reçu sur le plan printanier de gestion du bassin de Goodwood.*	
Goodwood	Construction (Goodwood Sed Pond repairs) / *Construction (réparation du bassin de sédimentation)*	**Update:** We have re-initiated discussions on the commissioning of the water treatment unit and the weather station at Goodwood for 2019. Engineering plans for repairs to the Goodwood basin in summer 2019 are in progress. ***Mise à jour*** *: Nous avons re-initié les discussion pour mettre en place l'usine de traitement des eaux et la station météorologique à Goodwood.* *Les plans d'ingénierie pour les réparations du bassin de Goodwood avancent.*	

I hope everyone is having a good week!

Mariana Trindade, PhD
Corporate Environmental Manager / Gestionnaire des questions environnementales
Environment Department / Département de l'environnement

TATA STEEL MINERALS CANADA LTD
1000 Sherbrooke West, Suite 1120
Montreal, Qc, H3A 3G4
T.: 514-764-6705
C: 514-220-9937
F.: 514-764-6725
Email: mariana.trindade@tatasteelcanada.com

ANNEX 12

ANNEX 13

Site Wide Alert 18-10-18-016 Respectful Coexistence

- A respectful relationship with the local communities is a company priority
- Your vehicle and clothing, including boots, should be clean when entering public places in Schefferville, including airport and restaurants
- All traffic rules including speed limits and stop signs must be obeyed
- LVs must reduce speed commencing at Schefferville landfill
- Amber lights must be deactivated prior to entering Schefferville town limits
- Avoid Matimekush streets (use Montagnais/Laurentide, Wishart, Atlantic)

ANNEX 14


TATA
TATA STEEL MINERALS CANADA
EXPLORE THE MINES
DELL

ANNEX 15

Tata Steel Minerals Canada's Project 2A

Minutes of the Meeting of the Environmental and Social Monitoring Committee held on June 19th, 2018 at 10 AM by Conference Call [1]

Participants :

Name	Organization
1. Armand Mackenzie	Tata Steel Minerals Canada (TSMC)
2. Billy Shecanapish	Naskapi Nation of Kawawachikamach (NNK)
3. Coco Calderhead	TSMC
4. Jean-Marc Séguin	Makivik Corporation (Makivik)
5. Kabimbetas Mokoush	NNK
6. Loic Didillon	TSMC
7. Michael Barrett	Kativik Regional Government (KRG)

1. Introductions and Committee Mandate

The meeting participants introduced themselves at this second meeting of the Project 2a Environmental and Social Monitoring Committee (the Committee). CC recalled that the first Committee meeting was held on 19 June 2015.

In light of Condition 21 issued by the Ministère de développement durable, de l'Environnement et de la Lutte contre les changements climatiques (MDDELCC) for the Project 2a, it was agreed that Terms of Reference of the Committee should be prepared.

MB undertook to share proposed wording with the group.

Action Items
➢ MB will distribute to the group proposed wording for the Terms of Reference for the Committee.

2. Project 2a – Update

LD explained that the development of the Sunny deposit has been set aside for now; Leroy pit was removed from the Environmental Assessment. TSMC is currently focusing on the Goodwood deposit, the largest of the two in Project 2a.

Spills, Incidents & Inspections

CC explained that regular updates have been communicated to the local communities and to Makivik and the KRG on the water management issues at the Goodwood sedimentation pond. Although some communications from other sources have suggested that a toxic spill occurred, it is rather what is sometimes referred to as a "red water event", that is now under control.

AM added that an interview was held with Radio-Canada on the drainage issue at Goodwood, as their Press Release was giving an alarming and misleading message.

LD confirmed that clear water is presently flowing from the Goodwood sedimentation pond. Two representatives from Urgences Environnement have been on site since 11 June. Local community representatives have made a number of site visits and a helicopter flyover. Temporary measures were put in place to ensure the safety of visitors and workers.

[1] These minutes summarize comments made during the meeting and are in addition to the PowerPoint presentation given, a copy of which was distributed to all members.

Once the incident is closed, in approximately one to two weeks, TSMC will review its emergency response plan, and determine what to improve, such as the chain of command.

In response to a comment from MB regarding spill notices, CC confirmed that TSMC sends these to the NNK, KRG and Makivik.

In response to a question, LD confirmed that there is a fueling station for heavy equipment at KM 24, in Labrador.

Goodwood Approvals

LD confirmed that the life of mine is approximately 13 years and is based on volume.

The plan for this year is for operations to take place until the end of July or early August.

In response to a question from MB regarding a Certificate of Conformity, LD confirmed that TSMC received from the Regional Office a certificate of operation for the pit and a certificate of operation for the water treatment system.

AM confirmed that TSMC already has all the necessary permits for the project but can clarify with the Regional Office regarding the question of a Certificate of Conformity.

Goodwood Water Management

LD explained that the as-built design for the water management system was completed in December 2017. The sedimentation pond was built in late Fall, which in light of the current situation, wasn't the ideal time to build.

He explained that the yellow area on the map shows the contact water from mining operations, which is collected and sent to the sedimentation pond. The blue area illustrates clean water, which is deviated to the environment without treatment. There is also an emergency spillway to the left of the sedimentation pond. However, water levels never exceeded 1.2 metres.

Suspended solids are currently not detectable.

It appears that the sedimentation pond breach occurred as a result of soil movement after the winter, causing the membrane to rip and leakage to occur.

LD added that TSMC is in daily discussions with the Government of Quebec (GoQ). TSMC has asked the Government of Newfoundland and Labrador (GNL) to pump the water from Goodwood to the Kivivic 1 and Kivivic 2 pits in Labrador, which GNL has accepted. A sump pump was installed and the water is being sent through a long pipe.

Inspectors are still on-site conducting sampling and reporting. They want to be sure that the matter is being taken seriously by TSMC. Company leaders in Montreal and India are aware of the situation and have had many questions. TSMC and its consultant WSP are preparing a report and an action plan for upgrading the sedimentation pond.

In response to a question from JMS, LD confirmed that the required work to repair is not major. It is expected that the pumping will continue for two to three days, and that within two weeks, the sedimentation pond will be emptied, inspected and repaired.

If the water treatment unit is installed before the pumping is finished, the water will be sent through that system.

MB confirmed that the KRG is in regular contact with the MDDELCC's Regional Office.

Air Quality

LD explained that TSMC has installed equipment for cross-border measurements. In the case of continuous monitoring, measurements are taken every second and displayed on Newfoundland and Labrador real-time monitoring website.

New equipment is being installed that will enable the public to follow the data.

The mobile equipment gets moved to 25 difference locations, so each point is monitored for 24 hours/month. TSMC has been asked by the GoQ to monitor each point every 12 days. The company will attempt to do so but the difficulty lies in moving the equipment and recharging the batteries.

Bioevaluation: tests on lichen, which is a very good indicator, but a period of three years is necessary for reliable data to be analyzed. Therefore, after 2018, we will be able to show the impact of traffic on the air.

Closure & Rehabilitation

TSMC has reviewed efforts in this area, across Canada. An important challenge for the DSO Project is having sufficient organic soil on-site.

Timmins 4 will be the first trial in 2018. LD explained that the local communities are very involved in the planning and execution of works. Furthermore, the IBAs dictate the approval of the Rehabilitation & Closure Plans.

KM explained that he is involved in research on the environment and culture, and works with universities, and can assist with ways to communicate with the local population. He is often involved in meetings and interviews with Elders. He added that he participated in job shadowing with Jean-François Dion, TSMC Environment, as part of the Mining Essentials training program.

In response to a question, LD explained that the Environmental Team at site is composed of two Environmental Technicians and one Coordinator per shift, in addition to many consultants.

CC undertook to ensure that all Committee members have access to the Rehabilitation Folder on the shared Google Drive.

Next Meeting

The next meeting will be scheduled at a later date for approximately 6 months from now, i.e. December 2018.

End of Meeting

The meeting ended at 11:30 am.

****

* Compte-rendu préparé par Coco Calderhead, TSMC / *Meeting minutes prepared by Coco Calderhead, TSMC.*