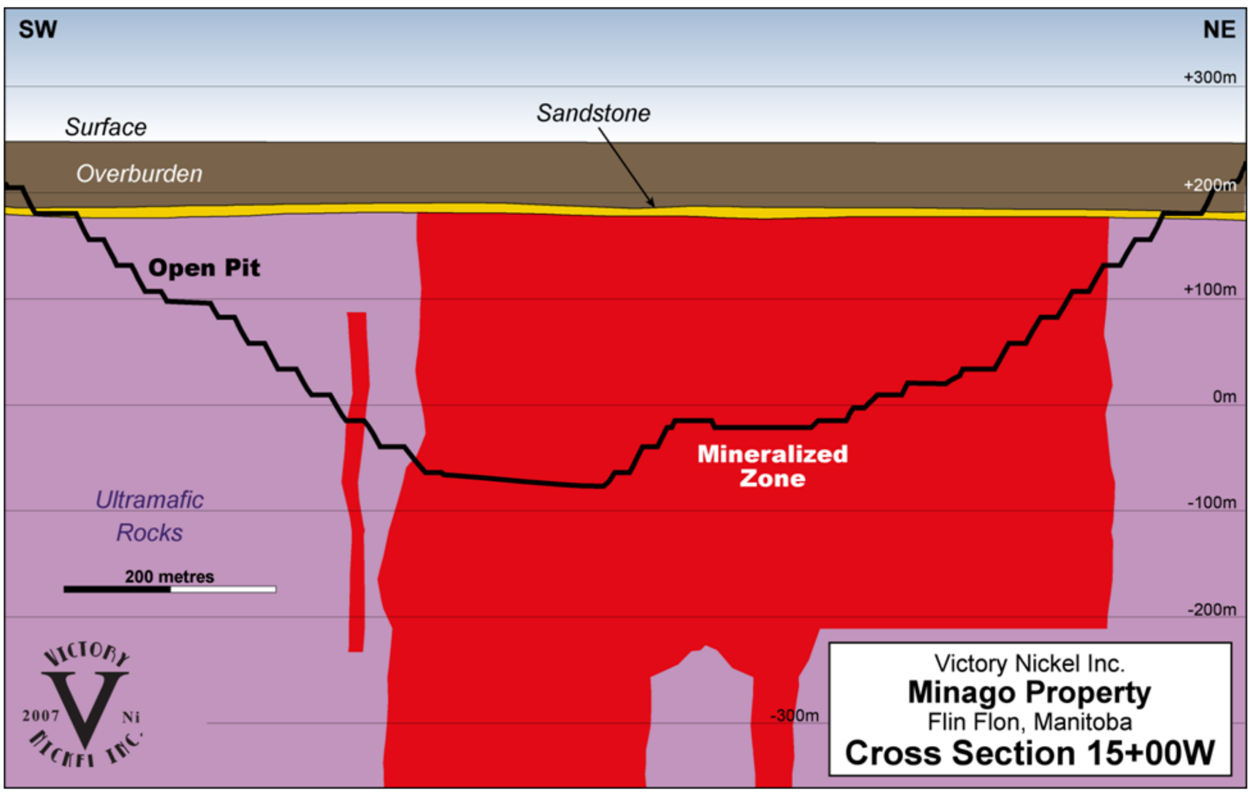
VICTORY NICKEL INC.

MINAGO PROJECT



CLOSURE PLAN

EXECUTIVE SUMMARY

EXECUTIVE SUMMARY

In keeping with high standards for environmental and social responsibility and the *Manitoba Closure Regulation 67/99*, Victory Nickel will implement an environmentally sound and technically feasible decommissioning and closure plan for the Minago Project. The closure planning and implementation will be undertaken with appropriate environmental care, to meet these Provincial and Federal laws and regulation, satisfy the interests of the public, and achieve the company's environmental standards. In so doing, Victory Nickel will exercise reasonable efforts to plan, design, construct and operate the facilities for closure, with a goal of achieving a walk-away scenario.

In addition to the final closure stage, the decommissioning and closure plan considered "Temporary Suspension (TS)" and "State of Inactivity (SI)" stages. Temporary Suspension means that mining and milling production activities have been suspended, while State of Inactivity means that mine production and mining operations have been suspended indefinitely. The Temporary Suspension may turn into a State of Inactivity, if the suspension period is longer than planned. Similarly, the State of Inactivity may turn into Permanent Closure, if prevailing conditions for resumption of operations are not favorable. For each of these closure stages, the respective decommissioning and closure aspects have been developed.

The proposed Minago Project is an open pit mining project to produce nickel concentrate and frac sand.

The Minago Property (Property) is located in Manitoba's Thompson Nickel belt on Highway 6, approximately 225 km south of Thompson, Manitoba, Canada. The site is located within the Nelson River sub-basin, which drains northeast into the southern end of the Hudson Bay. The basin has two more catchments in the Minago River and the Hargrave River, which enclose the project site. There are two more tributaries, the William River and the Oakley Creek present at the periphery of the project area. The catchments of these two tributaries are within the Lake Winnipeg basin and drain northward into the Nelson River sub-basin

The mine site is situated within a topographically low area of water-saturated peat and forest terrain. The area is almost entirely swampy muskeg with vegetation consisting of sparse black spruce and tamarack set in a topographic relief of less than 3 m. Although this low area extends for significant distances to the north and east, elevated limestone outcrops exist to the south and west at a distance of 7 to 20 km from the site.

The Minago Project is within the Norway House Cree Nation. Traditional use of the project area is within Treaty 5.

Victory Nickel Inc. (VNI) has a 100% interest in the mineral claims that comprise the Minago Project.

The deposit has potential as a large tonnage, low-grade nickel sulphide deposit (25.2 Mt at 0.43% nickel (Ni), 0.20% cut-off grade) and contains 14.8 Mt million tons of marketable frac sand. The potential of the Property is supported by a recent metallurgical test program, where very high grade nickel concentrate was produced. The excellent recoveries for the ore from the open pit mine are substantiated by historical and current metallurgical testing data.

In addition to the nickel ore concentrating plant, the installation of a frac sand processing plant will generate further revenues for the project. The financial analysis assumes that critical revenue streams will be developed from both the nickel and frac sand resources. The proposed production schedule by year, for the waste, the nickel ore and the sand is given below.

Production Schedule by Year and Product

	2012	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**Total**
Dolomite (kt)	*42,655*	*43,179*	*15,183*	*1,0015*	*0*	*0*	*0*	*0*	*0*	*0*	*111,032*
Granite (kt)	*0*	*1,744*	*20,890*	*20,440*	*35,711*	*24,459*	*9,784*	*4,944*	*3,832*	*199*	*122,005*
Ultramafic (kt)	*0*	*861*	*7,941*	*5,524*	*5,667*	*5,732*	*4,382*	*3,026*	*2,297*	*229*	*35,659*
Sand (kt)	*0*	*5,289*	*2,092*	*7,466*	*0*	*0*	*0*	*0*	*0*	*0*	*14,847*
Total Ore (kt)	*0*	*112*	*3,000*	*3,600*	*3,600*	*3,600*	*3,600*	*3,600*	*3,600*	*453*	*25,166*
% Ni(S), Grade Ore	*0.000*	*0.374*	*0.419*	*0.429*	*0.430*	*0.413*	*0.436*	*0.431*	*0.447*	*0.468*	*0.430*
Total Tonnage (kt)	*42,655*	*51,186*	*49,105*	*47,045*	*44,979*	*33,792*	*17,766*	*11,570*	*9,728*	*881*	

The mine life is estimated to be seven full years and two partial years, with concentrate production mirroring ore production. The frac sand which is to be mined at the start of mining is produced throughout the life of the mine and beyond. The first partial year's ore production (2013) will be stockpiled pending commissioning of the ore processing plant in 2014.

The Project features an open pit bulk tonnage mining method, a 3.6 Mt/a nickel ore processing plant, and 1.5 Mt/a sand processing plant producing various sand products, including 20/40 and 40/70 frac sand, and other finer sized sands. The Project will be built over a three year period at a capital cost of $596.3 million. The nickel ore processing plant is scheduled to come online in the spring of 2014 and the frac sand plant to come online in the spring of 2013.

VNI is committed to the development of an environmentally and socially responsible project, which optimizes benefits to Manitoba and its people. In order to reduce project-related effects, the project has been designed to minimize the geographic extent of disturbance and for eventual permanent, passive closure. The site will be reclaimed in accordance with site-specific criteria in a planned and timely manner.

The Minago mine site is favorably located close to existing infrastructure, including Manitoba Provincial Highway 6, a 230 kV high voltage transmission line running directly beside Highway 6 on the east side of the road, the OmniTRAX Canada Railway Line, and the town of Grand Rapids.

The major components of the proposed Minago Project are as follows. The proposed Project will comprise an open pit mine, an ore concentrating plant, a frac sand plant, and supporting infrastructure. The supporting infrastructure will be comprised of:

- a tailings management facility for the co-deposition of tailings and ultramafic rock;
- waste rock dumps and overburden dump;
- an Explosives Plant and explosives storage;
- water treatment facilities;
- de-watering systems with associated pipelines and pumping stations;
- roads and laydown areas;
- staff accommodations for 300 people and facilities;
- open pit mining equipment, including trucks, shovels, loaders, and drills;
- truck repair and maintenance facilities; and
- associated electrical and mechanical systems.

Construction activities will be completed by 2013. The extraction and processing of ore will begin in 2012. Based on the assumed resource of 25 Mt, nickel processing will occur from 2014 until 2021 with decommissioning and closure shortly after. The extent of the mineable reserves in the Nose deposit is not fully known and an extended mine life is possible. There is potential for going underground in the Nose deposit and also the North Limb.

Process water will be reclaimed from the Polishing Pond and recycled for use in the process plant. The Polishing Pond will operate in a water surplus requiring daily release of effluent into the receiving environment. Based on the water balance and contaminant loading assessment, there will be no Contaminants of Concern (CoC). The effluent meeting MMER Guidelines will be pumped on a controlled basis to the Minago River and to Oakley Creek by gravity. During closure, the pit will be flooded and the effluent from the Polishing Pond will be discharged to Oakley Creek. The water quality downstream the mixing zones for both the Minago River and Oakley Creek will be monitored and assessed using CCME and *Manitoba Tier II Guidelines for the Protection of Aquatic Life*.

The mine decommissioning and closure aspects include but are not limited to the determination of mitigative measures. This involved an assessment of the key site components that may place the public or environment at risk after mine closure.

The plan was developed to meet the environmental, health and safety objectives including:

1. Protection of public health and safety;

2. Implementation of environmental protection measures that prevent adverse environmental impact;
3. Ensuring land use commensurate with surrounding lands;
4. Implementation of progressive reclamation measures during mine operations;
5. Post-closure monitoring of the Project site to assess effectiveness of closure measures for the long term; and
6. Achieving a walk-away post-closure monitoring and management until the mine presents evidence of long-term compliance with closure criteria.

Mitigation measures were designed to address public safety issues and environmental concerns, with post-closure monitoring and inspections planned at the commencement of the project to ensure that closure objectives are met. Once the effectiveness of the mitigation measures is assured, management of the site can be safely reduced to a level that is consistent with the mine closure objectives and related measures. Post-closure monitoring has been designed to ensure that performance objectives are closely monitored and inspected during the initial years following implementation of closure measures. Victory Nickel anticipates that final determination of the effectiveness of closure measures for walkway status of the project will be subject to review and concurrence with regulatory agencies and the public.

Where possible, performance-based criteria have been adopted for the development of the decommissioning and closure plan. The *Metal Mines Effluent Regulations* (MMER) end-of-pipe effluent discharge standards were used as criteria for waters emanating from the final effluent Polishing Pond. *CCME Canadian Water Quality Guidelines for the Protection of Freshwater Aquatic Life* (CCME, 1999) and Manitoba Tier II water quality guidelines were used to assess effectiveness of closure measures to local downstream receiving waters. These same performance-based criteria will be used to determine the effectiveness of closure measures during the post-closure phase. Post closure monitoring and inspection results will be reviewed to ensure that objectives continue to be met well after decommissioning the project. If these objectives are not met, maintenance or contingency plans will be developed as necessary to address potential areas requiring further mitigation.

The plan calls for progressive reclamation during various project phases. The selection criteria for candidate areas for progressive reclamation initiatives will take into account the redundant nature of site components with respect to inherent risks and impacts on the receiving environment and budgetary constraints. The components that will be required for the ongoing running of the operations will not be subjected to progressive reclamation. Necessary environmental protection measures have been adopted in the development of the overall project plan to ensure that a healthy environment exists after mine closure.

One other aspect that the closure plan considered is reclamation research to develop workable and field proven reclamation programs. As the company continues to operate and manage the site, additional information about the site will be gathered to develop an optimal closure plan that will be cost- effective and environmentally and technologically feasible.

Mill tailings are deemed to be Non Acid Generating (NAG). The ultramafic waste rock is Potentially Acid Generating (PAG) and is expected to be disposed of under the planned closure scenario with the tailings under a “wet” closure. This is intended to avoid ARD or ML from the ultramafic rock stored in the TWRMF. A permanent water cover is proposed in order to keep the materials saturated. The co-disposal approach has been implemented to seal the ultramafic rock to mitigate Acid Rock Drainage (ARD) within the non reactive tailings.

Going forward, the company will undertake research studies to develop and optimize the proposed co-disposal mitigation measures. The areas of studies will include but not be limited to ARD and Metal Leaching (ML) studies specific to Minago Project mine wastes. This includes ultramafic waste rock; Site-Specific Water Quality Objectives (SSWQO) investigations specific for the Oakley Creek watershed to replace the generic guidelines used at the inception of the project. Typical guidelines are the *CCME Canadian Water Quality Guidelines for the Protection of Freshwater Aquatic Life* and the Environmental Effects Monitoring (EEM) program. These steps will enable a better understanding of the impacts of the discharges on the receiving environment.

In addition, VNI will undertake vegetative trials using local plant species such as green alder for the reclamation of disturbed areas; undertake hydrological and hydro-geological studies to optimize the site water balance; and fine-tune the Tailings Waste Rock Management Facility (TWRMF) operational phase wet cover option to prepare for the closure phase.

All of the above studies will be undertaken during the operational, temporary closure, and state of inactivity and post-closure phases. If required, Victory Nickel will work with consultants and other technical groups to address the environmental constraints associated with aspects such as ARD and/ or ML and overall site issues of concern.

Overall, the closure plan addresses the long-term physical, chemical and biological stability of the site including reclamation of surface disturbances. A program is presented for site management and monitoring both during implementation of closure and after decommissioning and reclamation measures are completed. Although the plan is based on the best information available at this time, as additional planning information, and/or experience at the site become available, the details of the plan will be updated and/or altered as necessary. Decommissioning cost estimates are provided and the financial security requirements reviewed.

During Temporary Suspension and State of Inactivity, VNI intends to be a responsible steward:

- By demonstrating a commitment to reopening the site.
- By continuing to have the site under the care and maintenance of an on-site caretaker.
- By continuing to maintain the main access road in a manner that heavy equipment can be brought to the site on short notice to deal with any environmental emergency.
- By continuing to adequately monitor and maintain buildings and facilities such as the Tailings and Waste Rock Management Facility (TWRMF) on the site.
- By ensuring that major fixed equipment and buildings remain essentially intact on site.

If closure is deemed to be permanent, then implementation of the Decommissioning and Closure Plan must occur. It is important to note that there may be a need for the development of an updated closure plan to reflect the state of the site at the time.

The mine closure phase at the Minago Project will commence with cessation of open pit mining and the milling of ores and stockpiles. Once all mineable ore reserves have been processed, the mill and concentrator will be flushed out and the buildings and infrastructure will be dismantled, decommissioned and demolished. The pit will be left to flood, tailings and ultramafic rock contained in the TWRMF will be submerged under 1-2 metres of water, and the Polishing Pond will receive discharge from TWRMF and eventually will naturally turn into a wetland.

To identify potential, local and native revegetation species, the established shrub and vascular herb strata were reviewed in light of succession potential. These succession studies reported in the literature have identified pioneer vegetation species and their seed dispersal capability, reproductive capabilities, and timeframes for establishment. The disturbed areas will be revegetated.

Established shrubs and herbs in the dominant tree and shrub units at the Minago Project were identified during the vegetation assessment. Based on the baseline study results, green alder (Alnus crispa), willows (Salix spp.), and potentially paper birch (Betula papyrifera) and/or shrub birch (Betula glandulosa) appear to be candidates for successful revegetation at Minago Project. Victory Nickel intends to use green alder and willows to revegetate disturbed areas with approximate plant density of 0.1 alder per m^2 and willows will be planted in isolated islands amongst the alders to facilitate their establishment and seed dispersal during progressive revegetation. It is anticipated that there will be approximately one Willow Island per hectare consisting of 50 stems.

A custom seed mix will also be developed or obtained for Minago Project to seed small areas prone to erosion or areas for which revegetation with shrubs is not suitable. From the reclamation point of view, the only permanent vegetation losses will be the areas occupied by the waste rock dumps, the TWRMF, the pit area and to some extent the overburden dump. The company will exercise reasonable efforts to revegetate the industrial area, once all buildings have been decommissioned, the waste rock dumps, and all access roads not required during the post closure period.

Monitoring programs have been developed for all phases of the project. Operational monitoring program results will be used to refine the post closure monitoring requirements. The monitoring program is designed to monitor chemical, biological and physical parameters including the following:

- Monitoring of physical parameters for site structures;
- Monitoring of physical water parameters and chemical water quality;
- Monitoring of biological aspects as per MMER for a three year period;
- Permit requirements;

- Analysis of vegetation metal uptake;
- Monitoring plant growth, mortality and diversity for the revegetated areas;
- Monitoring dam stability review as per CDA and permit requirements; and
- Monitoring diversion system's physical integrity.

Monitoring reports will be submitted to the regulatory agencies and communities of interest as required obtaining feedback on the success of the reclamation program.

Costs to decommission demolish and remove infrastructure; land reclamation and post closure site management and monitoring were developed using market prices for similar work recently completed or quoted on other sites. Using rates for the demolition of buildings solicited from local contractors, typical demolition unit rates were evaluated. Other unit rates for associated work were also solicited from Contractors with experience on similar projects. The demolition costs have been estimated assuming that salvaged material is the property of the contractor after the removal of process equipment. On the basis of the cost estimates, the overall closure cost is estimated to be Cdn$7,260,590.

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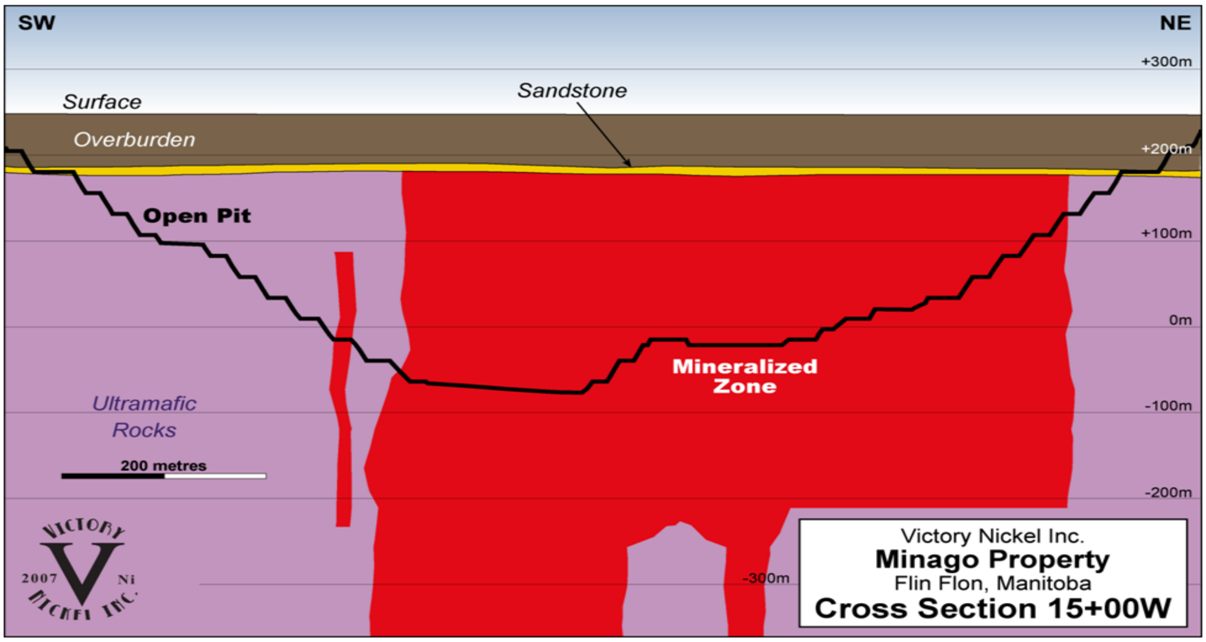
CLOSURE PLAN



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Vice President, Environment and Sustainable Development

JULY 15, 2010

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

1. INTRODUCTION

1.1 Minago Project Overview

In keeping with its high standards for environmental and social responsibility, Victory Nickel will implement an environmentally sound and technically feasible decommissioning and closure plan for the Minago Project. This report presents the decommissioning and closure plan of the Minago project complete with project description.

The Minago deposit has potential as a large tonnage, low-grade nickel sulphide deposit suitable for open pit bulk tonnage mining methods. The Property is favourably located adjacent to provincial Highway 6, a 230-kV Manitoba Hydro power line parallel to the highway and the OmniTRAX Canada railway line 60 km north.

In 2006, Nuinsco Resources Ltd. (Nuinsco) retained Wardrop to provide the Preliminary Economic Assessment (PEA) of the Property, which was submitted on November 24, 2006. Ownership of the Property was transferred to Victory Nickel Inc. (Victory Nickel), a wholly owned subsidiary of Nuinsco in 2007. On April 24, 2007, Victory Nickel engaged Wardrop to prepare the Minago Feasibility Study and a NI 43-101 compliant report. The feasibility study was completed during the first quarter of 2010.

The potential of the Property is supported by a recent metallurgy test program, where a very high grade nickel concentrate was produced. The current recoveries for the open pit mine are substantiated by existing metallurgical testing data.

Wardrop estimates that the Minago deposit contains a measured resource of 9.1 Mt grading 0.47% NiS above a cutoff grade of 0.2% NiS. In addition, the deposit contains 35 Mt of indicated resource at 0.42% NiS above a 0.2% NiS cutoff grade. An inferred resource of 12 Mt at 0.44% NiS above a 0.2% NiS has also been estimated (Wardrop, 2009b). The potential of the Minago Property is further supported by metallurgical testing in which very high grade concentrate was produced.

The deposit has potential as a large tonnage, low-grade nickel sulphide deposit (25.2 Mt at 0.43% nickel (Ni), 0.20% cut-off grade) and contains 14.8 Mt million tons of marketable frac sand. The potential of the Property is supported by a recent metallurgical test program, where a very high grade nickel concentrate was produced. The excellent recoveries for the ore from the open pit mine are substantiated by historical and current metallurgical testing data.

Wardrop also identified a sandstone horizon averaging ten metres thick above the unconformity of the main nickel bearing serpentinite. These well rounded silica sand particles in the sandstone formation were identified as being suitable for use as hydraulic fracturing sand, or “frac sand”. When used as proppants in oil or gas wells these sands will improve the porosity of the shale beds leading to improved recovery and enhanced production. Currently, in onshore US wells, approximately 50% of the gas wells and 30% of the oil wells are hydraulically fractionated (Wardrop, 2009b).

The deposit is overlain by 80 m of overburden, limestone, and sand, leading to a high open pit strip ratio. In the case of Minago, the 10 m sand layer just above the ultramafic ore bearing rock contains marketable hydraulic fractionating sand (frac sand), which offsets the cost of the stripping.

The mine life is estimated to be seven years and two partial years for nickel mining and processing with frac sand being processed throughout the life of the mine and beyond. Accommodation facilities associated facilities will be provided for the majority of the workforce, that will manage, operate, and maintain the mine on a rotational basis. To the extent possible, the workforce will be comprised of members of the local First Nations community.

As currently configured, the proposed project will comprise of an open pit mine, an ore concentrating plant, a frac sand plant, and supporting infrastructure. The Ore Concentrating Plant will process 10,000 t/d of ore through crushing, grinding, flotation, and gravity operations. The Frac Sand Plant will be capable of producing between 1,200,000 t/a to 1,350, 000 t/a of various sand products including 20/40 and 40/70 frac sand, glass sand, and foundry sand products.

The supporting infrastructure will be comprised of:

- tailings management facility (TWRMF);
- waste rock dumps # 1, 2 and 3;
- overburden dumps;
- explosives plant and explosives storage;
- water treatment and effluent treatment facilities;
- de-watering systems with associated pipelines and pumping stations;
- roads and laydown areas;
- staff accommodations and facilities;
- open pit mining equipment incl. trucks, shovels, loaders, and drills; and
- truck repair and maintenance facilities.

Feasibility Study

In 2007, Victory Nickel retained Wardrop to undertake a Feasibility Study of the Minago Project following positive results of the Scoping Study completed in 2006. The Feasibility Study was completed in the first quarter of 2010. The results of the Feasibility Study are summarized in the following

The deposit has potential as a large tonnage, low-grade nickel sulphide deposit (25.2 Mt at 0.43% nickel (Ni), 0.20% cut-off grade) and contains 14.8 Mt million tons of marketable frac sand. The potential of the Property is supported by a recent metallurgical test program, where a very high grade nickel concentrate was produced. The excellent recoveries for the ore from the open pit mine are substantiated by historical and current metallurgical testing data.

The economic aspects of a deposit would be constrained by some 80 m of overburden, limestone, and sand resulting in a high open pit strip ratio. However, in the case of the Minago Project, the 10 m sand layer just above the ultramafic ore bearing rock contains marketable frac sand, which offsets the cost of the stripping.

In addition to the nickel ore concentrating plant, the installation of a frac sand processing plant will generate further revenues for the project. The financial analysis assumes that critical revenue streams will be developed from both the nickel and frac sand resources.

Table 1-1 Production Schedule by Year and Product

shows the proposed production schedule by year, for the waste, the nickel ore and the sand.

Table 1-1 Production Schedule by Year and Product

	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	Total
Dolomite (kt)	42655	43179	15183	10015	0	0	0	0	0	0	111032
Granite (kt)	0	1744	20890	20440	35711	24459	9784	4944	3832	199	122005
Ultramafic (kt)	0	861	7941	5524	5667	5732	4382	3026	2297	229	35659
Sand (kt)	0	5289	2092	7466	0	0	0	0	0	0	14847
Total Ore (kt)	0	112	3000	3600	3600	3600	3600	3600	3600	453	25166
% Ni(S), Grade Ore	0.000	0.374	0.419	0.429	0.430	0.413	0.436	0.431	0.447	0.468	0.430
Total Tonnage (kt)	42655	51186	49105	47045	44979	33792	17766	11570	9728	881	

During the development of this Feasibitly Study certain concepts were pursued in the interests of cost and efficiency. In place of the mechanical removal of the overburden, Wardrop has selected a dredging option to reduce costs significantly and create more favorable spoil areas. By co-depositing the potentially acid generating, metal leaching ultramafic rock and sealing these within the tailings, significant infrastructure and legacy costs are eliminated. Finally, by shortening the production life of the Frac Sand Plant to match that of the Ore Processing Plant, general and administrative and surface facility costs are minimized.

The mine life is estimated to be seven full years and two partial years, with concentrate production mirroring ore production. The frac sand which is to be mined at the start of mining is produced throughout the life of the mine and beyond. The first partial year's ore production (2013) will be stockpiled pending commissioning of the ore processing plant in 2014.

The Project features an open pit bulk tonnage mining method, a 3.6 Mt/a nickel ore processing plant, and 1.5 Mt/a sand processing plant producing various sand products, including 20/40 and 40/70 frac sand, and other finer sized sands. The Project will be built over a three year period at a capital cost of $596.3 million. The nickel ore processing plant is scheduled to come online in the spring of 2014 and the frac sand plant to come online in the spring of 2013.

The work undertaken for the Feasibility Study and Environmental Baseline Studies form the basis of the EIS. A copy of the Feasibility Study for the Minago Project can be obtained at www.sedar.com.

1.2 Location and Site Access

The Minago Property is located in Manitoba's Thompson Nickel belt, approximately 225 km south of Thompson, Manitoba, Canada (Figure 1-1).

The Minago site is situated within a topographically low area of water-saturated peat and forest terrain. The Property is almost entirely swampy muskeg and topographic relief is less than 3.0 m with vegetation consisting of sparse black spruce and tamarack. This low area extends for a significant distance to the north and east, but is bounded to the south and west by elevated limestone outcrops, at a distance of 7 to 20 kilometres from the site.

Geographically, the project site is located within the Nelson River sub-basin, which drains northeast into the southern end of the Hudson Bay. The basin has two more catchment in the Minago River and the Hargrave River, which enclose the project site. There are two more tributaries, the William River and the Oakley Creek present at the surroundings of the project area. The catchments of these two tributaries are within the Lake Winnipeg basin and drain northward into the Nelson River sub-basin.

The average elevation of the property is approximately 245 m above mean sea level with a level topography apart from a low bluff to the west of the site. A network of diamond drill roads enables pick-up truck travel on the property in the winter and all-terrain vehicle travel in the summer.

The Minago mine site is favourably located close to existing infrastructure:

- Manitoba Provincial Highway 6, which is a major transportation route in northern Manitoba, is a paved two-lane highway directly adjacent to the site.
- A Manitoba Hydro 230 kV High Voltage Transmission Line runs directly beside Highway 6 on the east side of the road.
- The Omnitrax Canada Railway Line, which connects the southern prairie region to Churchill, Manitoba, crosses Highway 6 at approximately 60 km north of the site.
- The town of Grand Rapids with provisions for food and accommodation is located 107 km south of the mine site. Although smaller than Grand Rapids, a further community of Snow Lake with similar facilities is located to the north of the mine.
- Grand Rapids is served by an RCMP Detachment, a nursing station, daily bus and truck transportation to Winnipeg, and an airstrip in addition to the small supply and service businesses.
- The provincial capital City of Winnipeg is located 485 km to the south-southeast, approximately 6 hours driving time to the south of the mine.

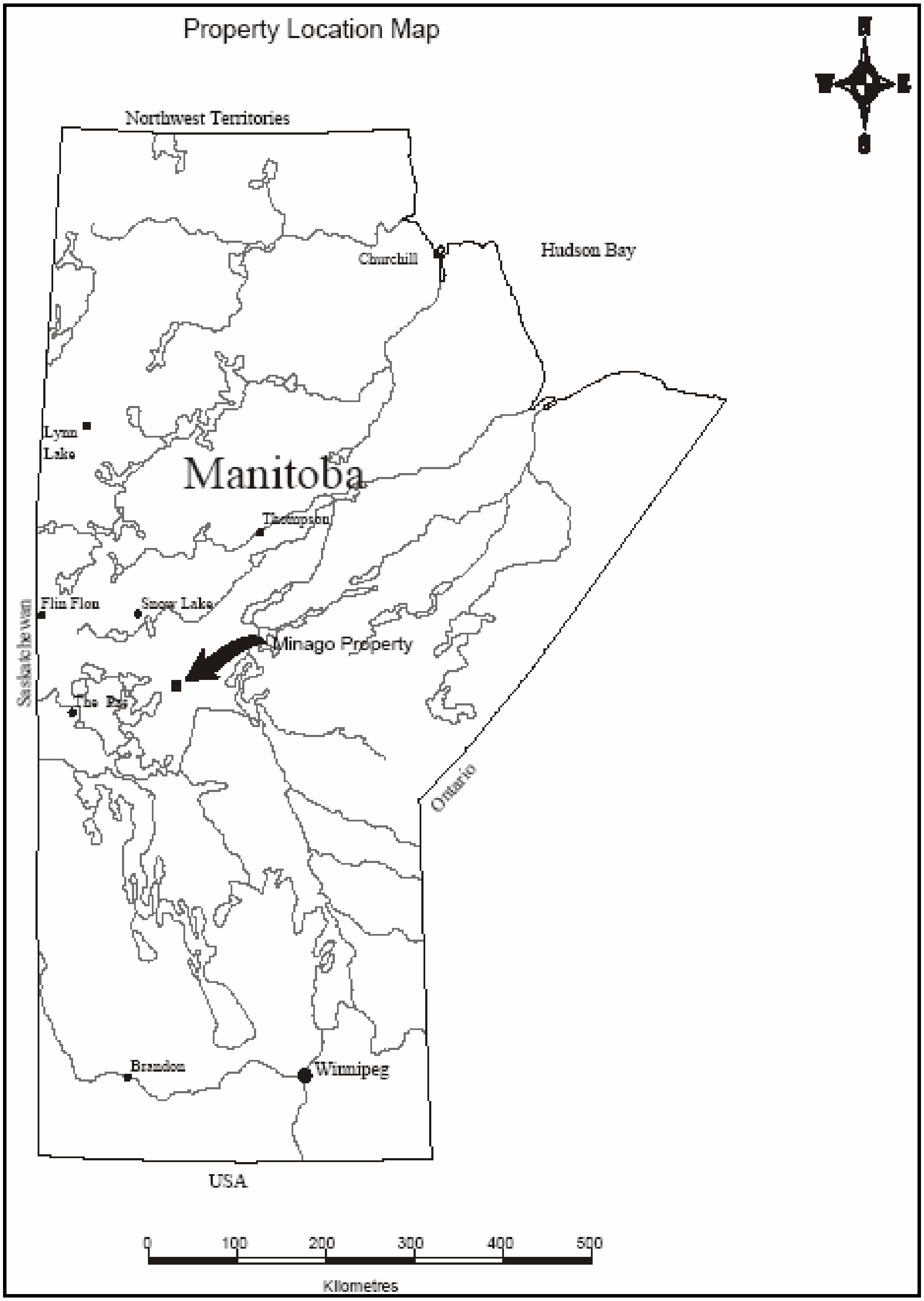


Figure 1-1: Property Location Map

1.3 Site Description, History of the Property and Ownership

1.3.1 Site Description

Given that the location of the mine is determined by the ore body, the plant and infrastructure facilities have been located as close to the open pit mine as possible. Given this requirement the results of the geotechnical investigation identified the closest location with the best foundation conditions for the heavy equipment. A location to the north east of the mine was identified where the limestone founding strata was reasonably close to the surface at between 5 to 10 metres below the surface. Typically on the balance of the site within close proximity of the open pit mine, the limestone horizon is 10 to 12 metres below the surface. The overall site layout is given in Figure 1-2.

In line with many mining plants in cold climates, a fairly tight arrangements of buildings has been created to minimize travel distances. The General Maintenance Building supporting the Truck Repair Shops is located close to the Ore Concentrator Building and the Modular Complex is similarly close to the process areas. The Electrical Sub-Station, Emergency Diesel Generator Set, Site Fuelling Area and Water Treatment Plant are also located close to the process area.

The location of the Tailings and Waste Rock Management Facility (TWRMF) is determined by the difficult foundation conditions although this is still reasonably close to the open pit mine. The remaining dumps, Dolomite and Country Rock Dumps, and the Overburden Dump are located around the pit to minimize the haul distances to the extent possible. Large areas will be required for the TWRMF, Waste Rock Dumps, and the Overburden Dump due to minimal foundation strength which limits height.

The arrangements of roads is determined by the locations of the dumps, facilities and the ring road around the open pit mine which is essential to access the de-watering wells. An access and maintenance road to service the discharge line to the Minago River is positioned to relate to the Flood Retention Area and the associated pump houses. Discharge to Oakley Creek will be through a ditch.

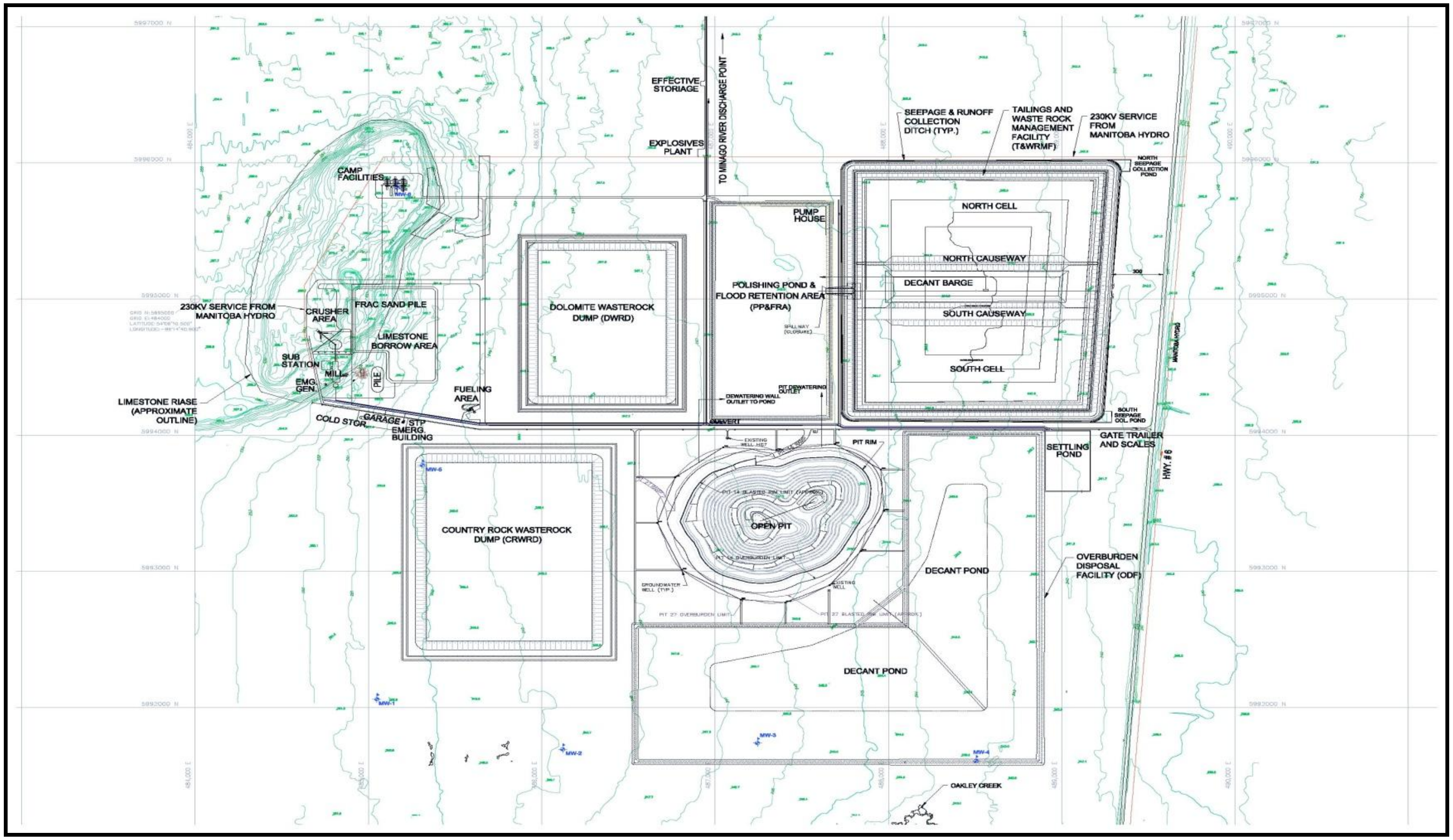


Figure 1-2 Overall Site Layout

1.3.2 History of the Property and Ownership

Geophysical Reservation 34 (GR 34), covering an area of 19.2 km x 38.4 km, was granted to Amax Potash Ltd. (Amax) on November 1, 1966 for a period of two years, extended to April 30, 1969 in 1968. In March of 1969, Amax converted the most prospective area of GR 34 to 844 contiguous claims and in April of 1969 an additional 18 claims were staked.

In 1973, the claims that were believed to have the greatest potential for economically viable nickel mineralization were taken to lease status as Explored Area Lease 3 (North Block) and Explored Area Lease 4 (South Block). The subsequent agreement dated December 12, 1973, granted Granges Exploration Aktiebolag (Granges) an option on the Explored Area Leases.

- On May 18, 1989 Black Hawk Mining Inc. (Black Hawk) purchased the Amax interest in the explored area leases and on August 2, 1989 the Granges interest and NSR royalty in the explored area leases.
- On April 1, 1992 Explored Area Lease 3 and Explored Area Lease 4 were converted to Mineral Lease 002 and Mineral Lease 003 respectively.
- On March 18, 1994 a portion of Mineral Lease 002 was converted to mineral claims KON 1, KON 2, and KON 3.
- On March 18, 1994 a portion of Mineral Lease 003 was converted to mineral claim KON 4.
- On November 3, 1999 Nuinsco purchased the Black Hawk interest, subject to a graduated NSR royalty based on nickel prices.

The scope of the exploration work is summarized as follows:

1. AMAX EXPLORATION WORK – 1966 TO 1972:

Amax conducted a regional scale exploration program on the southern extension of the Thompson Nickel Belt.

2. Granges Exploration Work – 1973 to 1976

Granges focused their efforts on the Minago Nickel deposit conducting resource estimates, mining, metallurgical, and milling studies. The work concluded that the Minago Nickel Deposit was sufficiently confirmed and that further delineation and exploration should be conducted from underground workings.

3. BLACK HAWK EXPLORATION WORK – 1989 TO 1991

Black Hawk conducted a deep penetrating ground electromagnetic survey, resource estimates, mining, metallurgical, and milling studies. A helicopter borne electromagnetic and magnetic survey covering the Property was obtained from Falconbridge Limited and interpreted.

1.4 Ownership

Victor Nickel has 100% ownership of the Minago Project and also the Mines and Minerals Act entitles mineral claims owners the rights as given below:

The holder (Victory Nickel) of a mineral claim has the exclusive right to explore for and develop the Crown minerals, other than the quarry minerals, found in place on, in, or under the lands covered by the claim (The Mines and Minerals Act, 73[1]).

The lessee (Victory Nickel) of a mineral lease has the exclusive right to the Crown minerals, other than quarry minerals, that are the property of the Crown and are found in place or under the land covered by the mineral lease. The lessee also has access rights to open and work a shaft or mine, and to erect buildings or structures upon the subject land (The Mines and Minerals Act, 108[a], [b], [i], [ii]).

With respect to the pending quarry lease, the lessee of a quarry lease has the exclusive right to the Crown quarry minerals specified in the lease (in this case limestone) that are found on or under the land covered by the lease and that are the property of the Crown (The Mines and Minerals Act ,140[1] [a]).

There are no instruments registered with the Mining Recorder at Manitoba Energy, Mines, Science and Technology Ministry on any of the mineral dispositions with respect to liens, judgments, debentures, royalties, back-in rights or other agreements.

1.5 Encumbrances

Encumbrances on the mineral dispositions include:

- For Norway House District: Registered Trap Line (RTL) # 150-07 covering all mineral dispositions.
- For Forestry Branch, Forest Management Licence: (FORM REPAP W 0012 and FORM REPAP 2 0012 covering all mineral dispositions.
- For Manitoba Hydro, Transmission Line and Easement Agreement: Right of Way 319.735 m wide, plan number 5830 N.L.T.O for portions of BARNEY 1, BARNEY 2, BARNEY 6, and MIN 5.
- For Manitoba Department of Highways: Right of way 91.44 m wide that is split 65.532 m west of the centre line and 25.908 east of the centre line, plan number 6149 N.L.T.O for portions of BARNEY 1, BARNEY 2, BARNEY 3, BARNEY 6, MIN 4, and MIN 5.
- For Manitoba Department of Highways: Quarry Withdrawal, plan number 6148 N.L.T.0.for southeast corner of ML-003.

With respect to the pending quarry lease, royalties are applicable to quarry products such as limestone and frac sand at varying rates depending on their end use. Currently, a rehabilitation levy of $0.10/t will not apply to quarry production.

There is no mining-related infrastructure on the Property although the Minago River Nickel Deposit, previously referred to as the Nose Deposit, is located on mineral lease ML-002.

There are no environmental liabilities attached to the Property.

1.6 Tenure Rights

The holder of a mineral claim has the exclusive right to explore for and develop the Crown minerals, other than the quarry minerals, found in place on, in, or under the lands covered by the claim (The Mines and Minerals Act, 73[1]).

The lessee of a mineral lease has the exclusive right to the Crown minerals, other than quarry minerals, that are the property of the Crown and are found in place or under the land covered by the mineral lease. The lessee also has access rights to open and work a shaft or mine, and to erect buildings or structures upon the subject land (The Mines and Minerals Act, 108[a], [b], [i], [ii]).

The lessee of a quarry lease has the exclusive right to the Crown quarry minerals specified in the lease (in this case limestone) that are found on or under the land covered by the lease and that are the property of the Crown [The Mines and Minerals Act, 140 (1) (a)].

1.6.1 Option Agreement with Xstrata Nickel

As a result of an option agreement entered into with Xstrata Nickel on claims BRY 18, BRY 20, BRY 21, BRY 22, TOM F, and DAD and subsequently fully exercised at year- end 2008, a NSR is payable to Xstrata on any exploited mineralization found on the claims. The NSR, consists of a 2% royalty when the London Metal Exchange (LME) three-month nickel price is greater than, or equal to, US$13,227.74/t, and a 1% NSR when the three-month price of nickel is less than US$13,227.74/t. All other metals will be subject to a 2% NSR.

2. REGIONAL AND SITE SETTINGS

2.1 Geology and Description of Deposit

2.1.1 Regional Geology

This section is a brief summary of the regional geology of the Thompson Basin.

The regional geology comprises the eastern edge of the Phanerozoic sediments of the Western Canada Sedimentary Basin that unconformable overlie Precambrian crystalline basement rocks, including the Thompson Nickel Belt. The basin tapers from a maximum thickness of about 6,000 m in Alberta to zero at the north and east, where it is bound by the Canadian Shield. The Property is located near the northeast corner of the basin, where it comprises approximately 53 m of Ordovician dolomitic limestone underlain by approximately 7.5 m of Ordovician sandstone.

The Precambrian basement rocks of the Thompson Nickel Belt form a northeast southwest trending 10 to 35 km wide belt of variably reworked Archean age basement gneisses and Early

Proterozoic age cover rocks along the northwest margin of the Superior Province. Lithotectonically, the Thompson Nickel Belt is part of the Churchill Superior boundary zone.

The Archean age rocks to the southeast of the Thompson Nickel Belt include low to medium grade metamorphosed granite greenstone, and gneiss terranes and the high grade metamorphosed Pikwitonei Granulite Belt. The Pikwitonei Granulite Belt is interpreted to represent exposed portions of deeper level equivalents of the low to medium grade metamorphosed granite greenstone and gneiss terranes. The Superior Province Archean age rocks are cut by mafic to ultramafic dikes of the Molson swarm dated at 1883 mega annum (Ma). Dikes of the Molson swarm occur in the Thompson Nickel Belt, but not to the northwest in the Kisseynew domain. The early Proterozoic rocks to the northwest of the Thompson Nickel Belt comprise the Kisseynew domain that is interpreted to represent the metamorphosed remnants of a back arc or inter arc basin.

The variably reworked Archean age basement gneisses constitute the dominant portion (volumetrically) of the Thompson Nickel Belt. The Early Proterozoic rocks that occur along the western margin of the Thompson Nickel Belt are a geologically distinguishable stratigraphic sequence of rocks known as the Opswagan Group.

2.1.2 Geology and Mineral Resources

Victory Nickel Inc. (Victory Nickel) owns 100% of the mining dispositions on the Minago Property. Wardrop conducted a mineral resource estimate of the Precambrian nickel sulphide mineralization, and the Paleozoic Sandstone immediately above. The estimation was completed for total nickel (Ni%), nickel sulphide (NiS%) and Frac Sand using data from historic and recent drilling.

An indicated resource of 15 Mt of Frac Sand within the Winnipeg Sandstone Formation has also been identified. Approximately 10% to 20% of the Frac Sand will report to the 20/40 size fraction, while approximately 68% to 83% will report to the 40/140 size fraction (Wardrop, 2009b).

The Minago deposit has demonstrated potential as a large tonnage low-grade nickel sulphide deposit amenable to open pit, and possibly to underground bulk tonnage mining methods. Significant parts of the deposit below a depth of 400 m require additional drilling to upgrade the resource class from inferred to indicated (Wardrop, 2009b).

The sandstone layer must be removed to access the mineralization within the proposed open pit mine.

The regional geology comprises the eastern edge of the Phanerozoic sediments of the Western Canada Sedimentary Basin that unconformably overlie Precambrian crystalline basement rocks including the Thompson Nickel Belt. The Precambrian basement rocks of the Thompson Nickel Belt form a northeast southwest trending belt of variably reworked Archean age basement gneisses and Early Proterozoic age cover rocks along the northwest margin of the Superior Province.

2.2 MINERAL DEPOSITS

The Property is comprised of one contiguous group of claims and one mineral lease, augmented by an isolated claim and a second adjacent mineral lease (Figures 2-1 through and 2-6). The contiguous block consists of one mineral lease and 40 unpatented mineral claims with a combined surface area of 7,298.23 hectares (ha) (Tables 2-1 and 2-2).

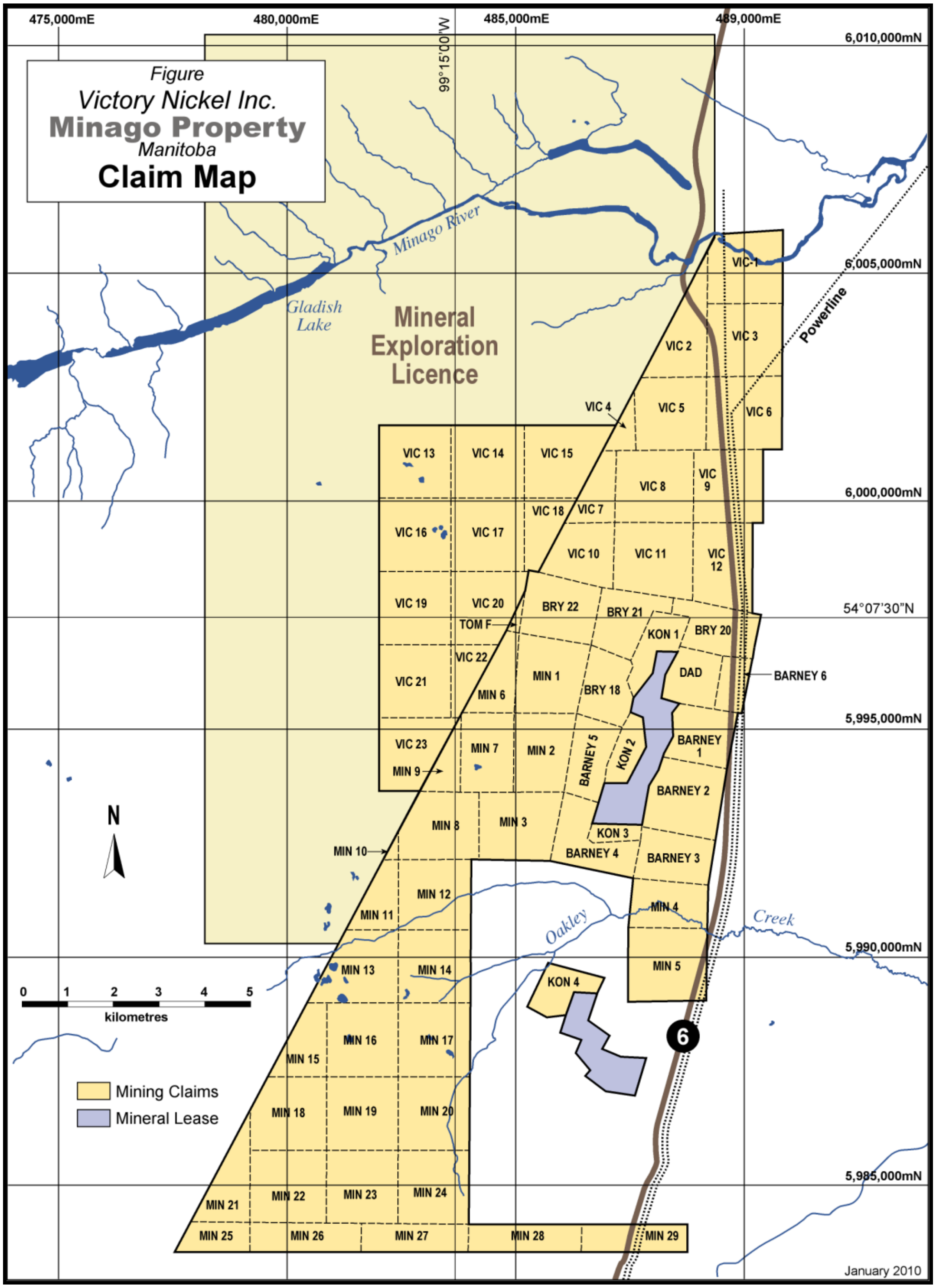


Figure 2-1 Minago Mineral Dispositions

Table 2-1 Minago Claim Group

Claim Name	Claim Number	Claim Holder	Date Staked	Date Recorded	Expiry Date	Area (ha)
KON 1	P2527F	Victory Nickel Inc.	1994/03/08 16:30	18/03/1994	17/05/2021	108
KON 3	P2529F	Victory Nickel Inc.	1994/03/10 16:05	18/03/1994	17/05/2021	43
KON 2	P2528F	Victory Nickel Inc.	1994/03/11 11:50	18/03/1994	17/05/2021	73
KON 4	P2530F	Victory Nickel Inc.	1994/03/13 11:00	18/03/1994	17/05/2021	105
BARNEY 1	MB5390	Victory Nickel Inc.	2004/07/04 15:45	26/07/2004	24/09/2022	168
BARNEY 2	MB5391	Victory Nickel Inc.	2004/07/05 16:00	26/07/2004	24/09/2022	242
BARNEY 3	MB5392	Victory Nickel Inc.	2004/07/06 16:00	26/07/2004	24/09/2022	170
BARNEY 4	MB5393	Victory Nickel Inc.	2004/07/07 16:15	26/07/2004	24/09/2022	184
BARNEY 5	MB5394	Victory Nickel Inc.	2004/07/08 15:45	26/07/2004	24/09/2022	155
BARNEY 6	MB5395	Victory Nickel Inc.	2004/07/17 13:30	26/07/2004	24/09/2022	76
MIN 1	MB7027	Victory Nickel Inc.	2006/11/06 19:20	27/11/2006	26/01/2009	235
MIN 2	MB7028	Victory Nickel Inc.	2006/11/07 19:30	27/11/2006	26/01/2009	214
MIN 3	MB7029	Victory Nickel Inc.	2006/11/08 18:30	27/11/2006	26/01/2009	252
MIN 4	W48594	Victory Nickel Inc.	2006/07/27 19:00	04/08/2006	03/10/2009	162
MIN 5	W48595	Victory Nickel Inc.	2006/07/27 19:30	04/08/2006	03/10/2009	256
MIN 6	MB7030	Victory Nickel Inc.	2006/11/06 19:05	27/11/2006	26/01/2009	135
MIN 7	MB7031	Victory Nickel Inc.	2006/11/07 19:15	27/11/2006	26/01/2009	204
MIN 8	MB7033	Victory Nickel Inc.	2006/11/10 18:20	27/11/2006	26/01/2009	205
MIN 9	MB7032	Victory Nickel Inc.	2006/11/10 16:00	27/11/2006	26/01/2009	78
MIN 10	MB7066	Victory Nickel Inc.	2007/01/09 14:20	23/01/2007	24/03/2009	57
MIN 11	MB7067	Victory Nickel Inc.	2007/01/09 13:40	23/01/2007	24/03/2009	121
MIN 12	MB7141	Victory Nickel Inc.	2007/01/10 15:22	23/01/2007	24/03/2009	250
MIN 13	MB7142	Victory Nickel Inc.	2007/01/11 16:51	23/01/2007	24/03/2009	256
MIN 14	MB7143	Victory Nickel Inc.	2007/01/10 16:51	23/01/2007	24/03/2009	256
MIN 15	MB7144	Victory Nickel Inc.	2007/01/12 14:37	23/01/2007	24/03/2009	138
MIN 16	MB7145	Victory Nickel Inc.	2007/01/12 16:05	23/01/2007	24/03/2009	256
MIN 17	MB7146	Victory Nickel Inc.	2007/01/11 15:15	23/01/2007	24/03/2009	247
MIN 18	MB7147	Victory Nickel Inc.	2007/01/13 16:05	23/01/2007	24/03/2009	247
MIN 19	MB7148	Victory Nickel Inc.	2007/01/14 16:01	23/01/2007	24/03/2009	256
MIN 20	MB7149	Victory Nickel Inc.	2007/01/13 15:26	23/01/2007	24/03/2009	243
MIN 21	MB7150	Victory Nickel Inc.	2007/01/15 13:43	23/01/2007	24/03/2009	181
MIN 22	MB7151	Victory Nickel Inc.	2007/01/14 16:15	23/01/2007	24/03/2009	256
MIN 23	MB7152	Victory Nickel Inc.	2007/01/15 15:44	23/01/2007	24/03/2009	256
MIN 24	MB7153	Victory Nickel Inc.	2007/01/08 16:24	23/01/2007	24/03/2009	241
MIN 25	MB7154	Victory Nickel Inc.	2007/01/16 13:09	23/01/2007	24/03/2009	88
MIN 26	MB7155	Victory Nickel Inc.	2007/01/16 15:45	23/01/2007	24/03/2009	145
MIN 27	MB7156	Victory Nickel Inc.	2007/01/07 16:20	23/01/2007	24/03/2009	145
MIN 28	MB7157	Victory Nickel Inc.	2007/01/08 15:40	23/01/2007	24/03/2009	153
MIN 29	MB7158	Victory Nickel Inc.	2007/01/07 15:51	23/01/2007	24/03/2009	153
TOM F	MB8549	Victory Nickel Inc.	2008/04/16 15:40	12/05/2008	11/07/2010	14
DAD	MB8497	Victory Nickel Inc.	2008/05/22 16:00	28/05/2008	27/07/2010	132
TOTAL						**7156**

Table 2-2 Minago Mineral Leases

Lease Name	Lease Number	Lease Holder	Expiry Date	Area (ha)
Mineral Lease 2	ML-002	Victory Nickel Inc.	01/04/2013	247.2
Mineral Lease 3	ML-003	Victory Nickel Inc.	01/04/2013	176.9

Mineral Lease 2 and Mineral Lease 3, which were issued on April 1, 1992, for a period of 21 years, may be renewed after that time at the discretion of the Minister of Manitoba Industry, Economic Development, and Mines. The annual rental cost of the mineral leases is $1,984 for Mineral Lease 2 and $1,416 for Mineral Lease 3, both due annually on April 1.

Mineral claims KON 1 through KON 4 are in good standing until May 17, 2021 plus 60 days. Thereafter the cost to keep the KON mineral claims in good standing is $25.00/ha per year in the form of work conducted and submitted for assessment or payment in lieu thereof.

Mineral claims BARNEY 1 to BARNEY 6 inclusive are in good standing until September 24, 2022 plus 60 days. After that, the costs to keep the BARNEY claims in good standing is $25.00/ha per year in the form or work conducted and submitted for assessment or payment in lieu thereof.

The mineral claims MIN 1 through MIN 29 are in good standing. The earliest expiry date for this claim group is January 26, 2009. After expiry, the cost to keep the MIN claims in good standing is $12.50/ha per year until the year 2017 in the form of work conducted and submitted for assessment or payment in lieu thereof. Thereafter the cost to keep the MIN mineral claims in good standing is $25.00/ha per year in the form of work conducted and submitted for assessment or payment in lieu thereof.

Mineral claims VIC 1 through VIC 12 are in good standing until April 17, 2021 plus 60 days. Thereafter the cost to keep the KON mineral claims in good standing is $12.00/ha per year in the form of work conducted and submitted for assessment or payment in lieu there of.

Mineral claims VIC 13 through VIC 23 are in good standing until December 21 2011 plus 60 days. Thereafter the cost to keep the KON mineral claims in good standing is $12.00/ha per year in the form of work conducted and submitted for assessment or payment in lieu of.

As a result of an option agreement entered into with Xstrata Nickel on claims BRY 18, BRY 20, BRY 21, BRY 22, TOM F, and DAD and subsequently fully exercised at year- end 2008, a NSR is payable to Xstrata on any exploited mineralization found on the claims. The NSR consists of a 2% royalty when the London Metal Exchange (LME) three-month nickel price is greater than, or equal to, US$13,227.74/t, and a 1% NSR when the three-month price of nickel is less than US$13,227.74/t. All other metals will be subject to a 2% NSR.

Victory Nickel has also obtained a quarry lease (QL-1853) with an area of 69.88 ha on a portion of the mineral lease ML2. Four additional quarry leases, surrounding and contiguous with QL-

1853 have been applied for. These pending quarry leases area totals an additional 244 ha. Victory Nickel has also applied for an additional quarry lease within claims MIN 1 and MIN 2 (4).

Quarry lease QL-1853 has a term of 10 years and may be renewable for further terms of 10 years subject to the discretion of the Minister. The annual rental cost for the quarry lease is $1,677.12 payable on the anniversary date.

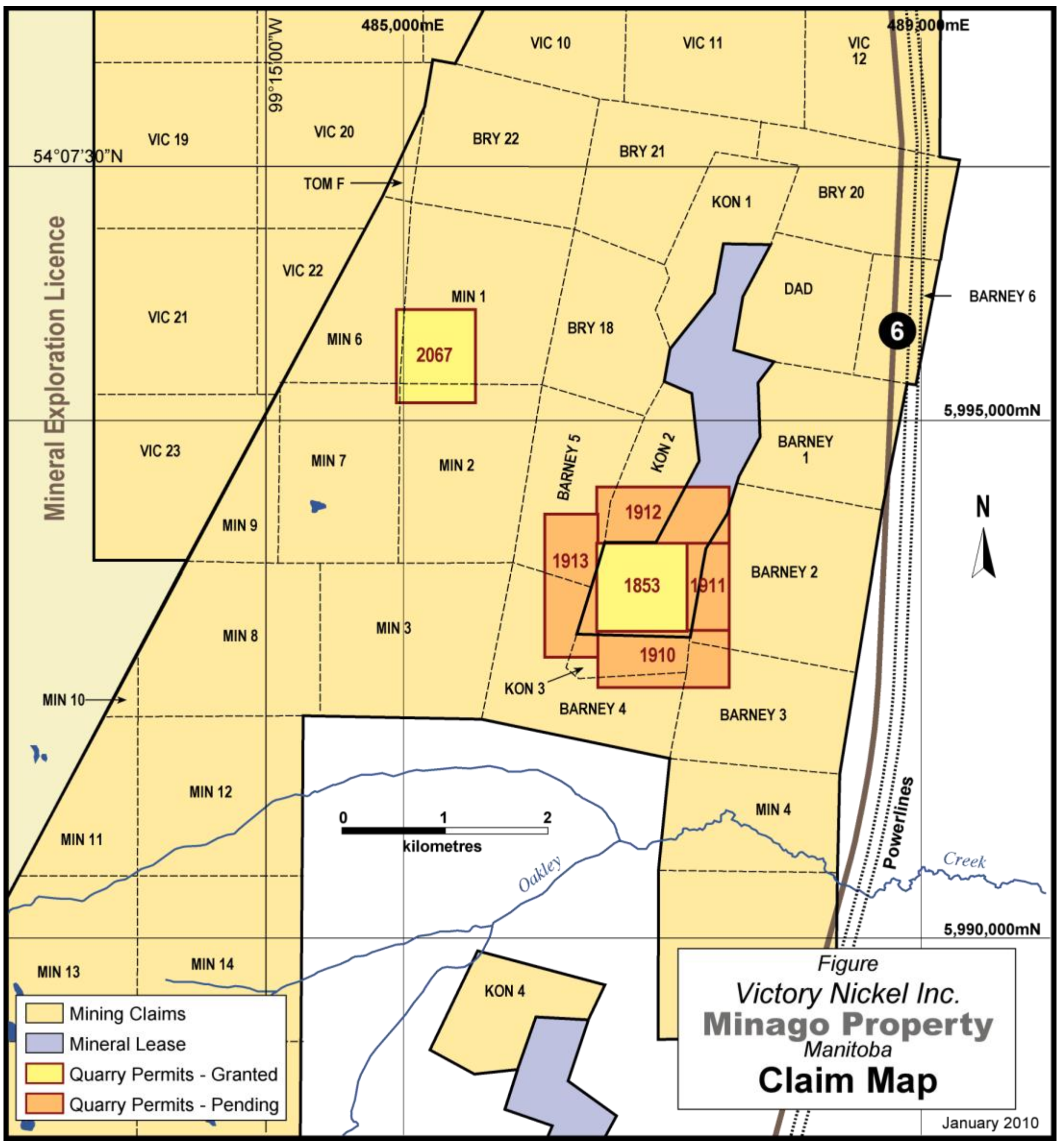
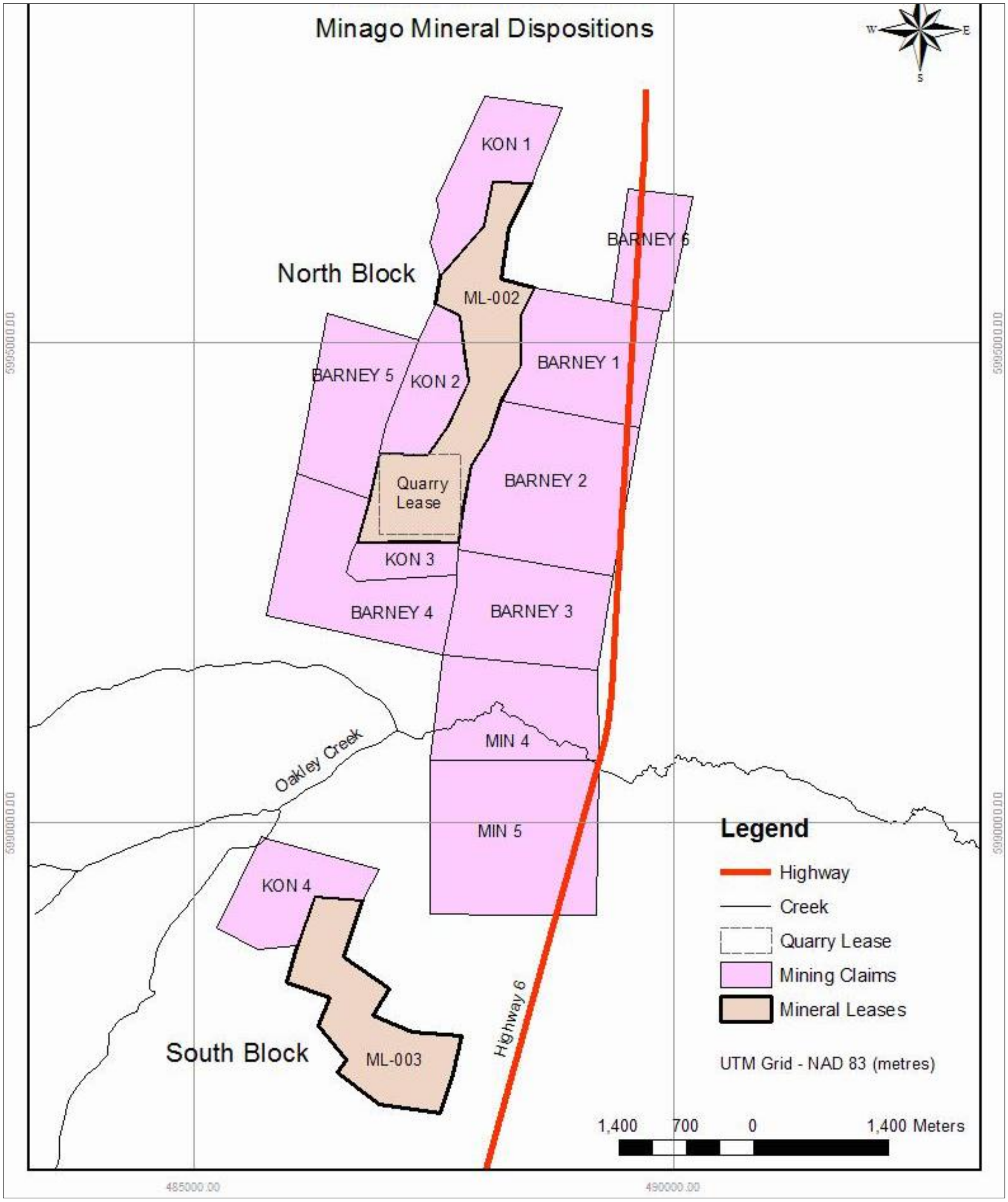
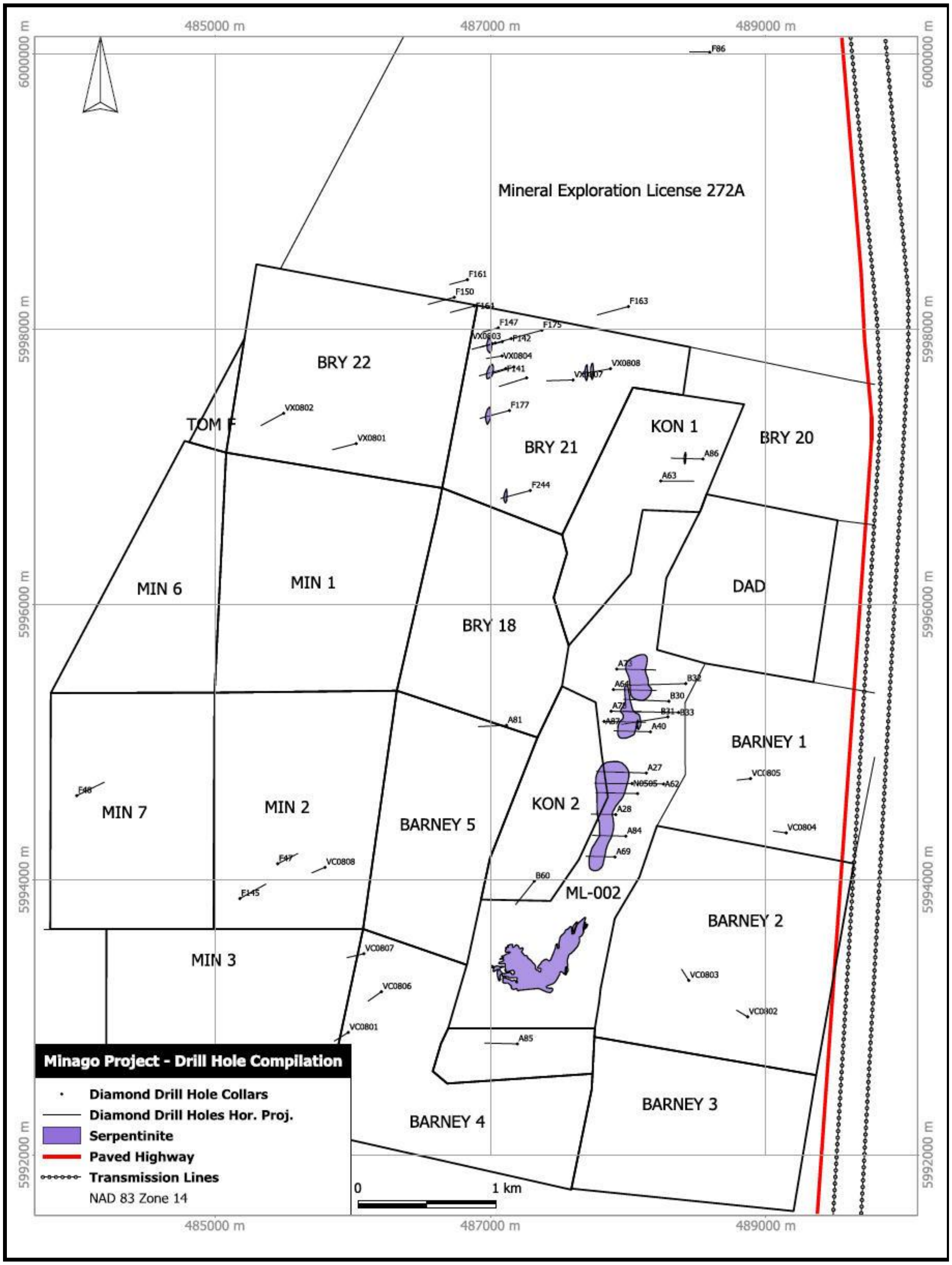


Figure 2-2 Minago Property Quarry Lease Status



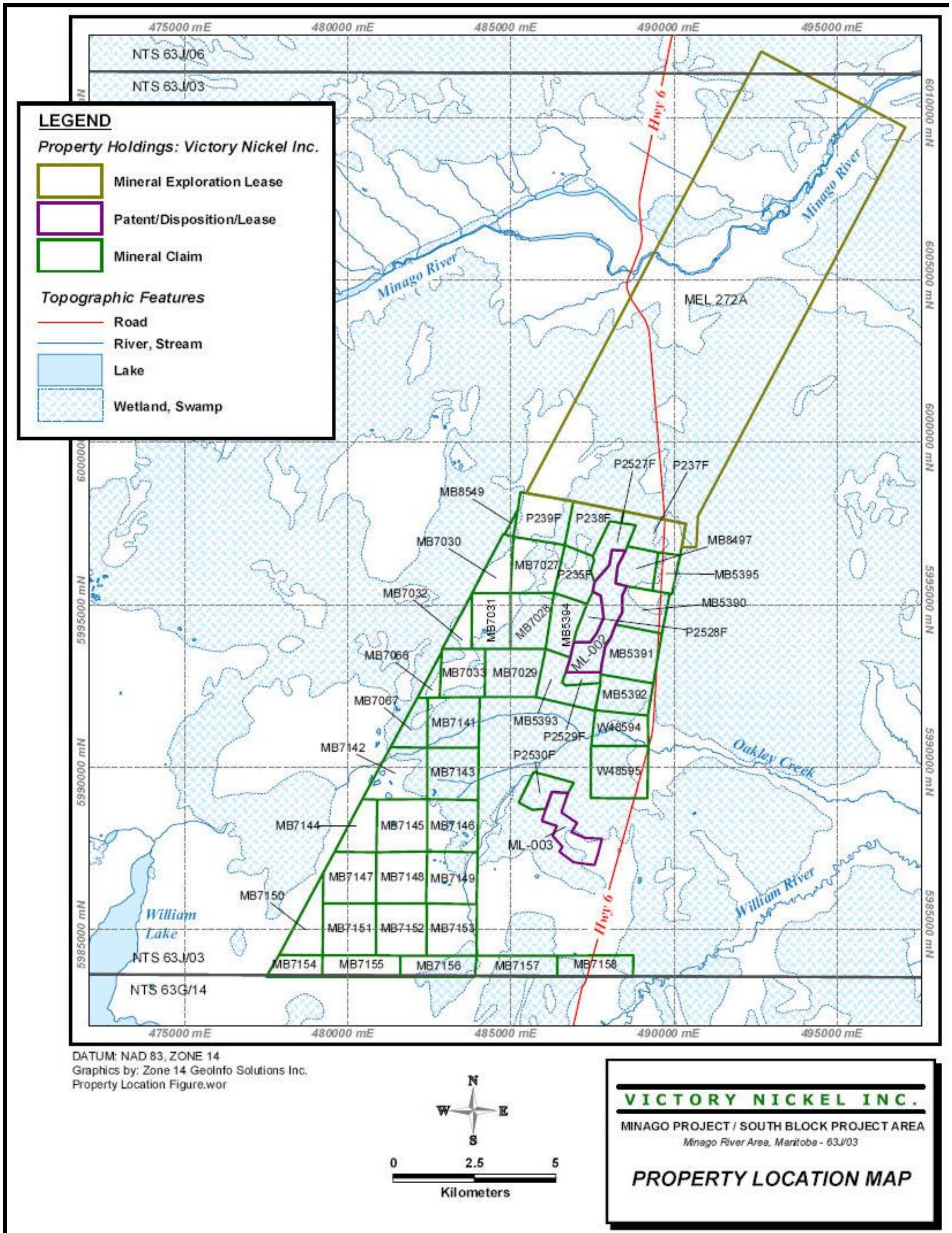
Source: Wardrop, 2006

Figure 2-3 Minago's Historical Mineral Dispositions



Source: Wardrop, 2009

Figure 2-4 Minago's North Limb Mineral Deposition



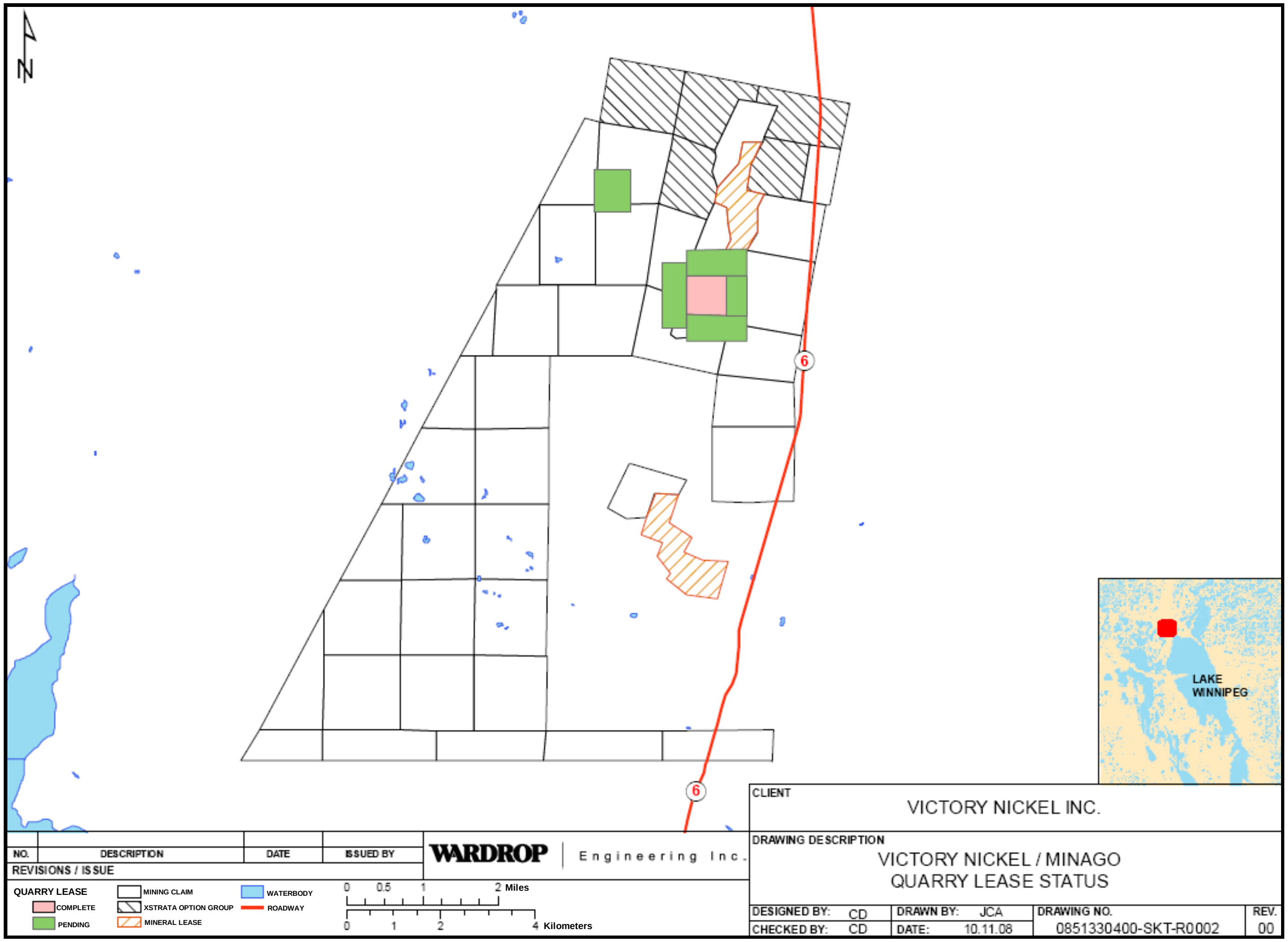
Source: Wardrop, 2009b

Figure 2-5 Detailed Minago Mineral Dispositions

Victory Nickel has made the initial payment of $150,000 and incurred expenditures of at least $500,000 on the claims prior to September 30, 2008. Payment of the remaining outstanding 'cash in lieu' is on the books of Manitoba Science, Technology, Energy, and Mines. The NSR consists of a 2% royalty, payable to Xstrata, when the London Metal Exchange (LME) three-month nickel price is greater than, or equal to, US$13,227.74/t, and a 1% NSR when the three-month price of nickel is less than US$13,227.74/t. All other metals will be subject to a 2% NSR.

Victory Nickel has also obtained a quarry lease (QL-1853) with an area of 69.88 ha on a portion of the mineral lease ML2. Four additional quarry leases, surrounding and contiguous with QL-1853 have been applied for. These pending quarry leases area totals an additional 244 ha. Victory Nickel has also applied for an additional quarry lease within claims MIN 1 and MIN 2.

Quarry lease QL-1853 has a term of 10 years and may be renewable for further terms of 10 years subject to the discretion of the Minister. The annual rental cost for the quarry lease is $1,677.12 payable on the anniversary date. Victory Nickel also obtained a quarry lease (QL-2067) for the area around the limestone bluff.



Source: Wardrop, 2009b

Figure 2-6 Minago Property Quarry Lease Status

3. MINING ACTIVITIES AND PROCESSING

3.1.1 Open Pit

For this project, Wardrop determined that the mining operation was amenable to a conventional open pit mining operation. The mine would provide mill feed of sulphide ore at a rate of 10,000 t/d for a total of 25.2 Mt of ore grading 0.43% over a period of approximately 8 years. Further drilling is proposed to reclassify some of the inferred into the measured and indicated categories.

In addition, the open pit will provide sand feed to a frac sand process facility at a rate of about 4,100 t/d of sand for a total of 14.8 Mt of frac sand over a period of about 10 years. Although the sand will be mined over a period of 3 years at the start of the mining period and stockpiled, the throughput of the sand plant will be set to roughly match the same operational period as the ore processing plant.

The overall waste-to-ore ratio (tonne per tonne, t/t) to mine both the nickel sulphide ore and frac sand is outlined in Table 3-1 below.

Table 3-1 Open Pit Design 14 Stripping Ratios

Case	SR (t/t) (No Overburden)	SR (t/t) (With Overburden)
Frac Sand Only	7.48	8.23
Nickel Ore Only	11.27	11.71
Nickel Ore and Frac Sand	6.72	7.00

The overall mining sequence was developed in three phases: one initial pit phase and two pushback phases. Each phase corresponds to a designed open pit that is mined in sequence in accordance with the ore grade and stripping ratio. The mine development for the ore and the waste will progress using 12 m high benches.

The development of the mine will be predicated on a number of push-backs, or phases, designed to meet the following objectives:

- Enable the accelerated removal of limestone rock for use in construction of roads to the Hasten access to the Frac Sand zone, in order to generate short-term revenues to pay for stripping.
- Mine and stockpile the nickel sulphide ore in time for the operation of the mill in “Year 2” (2014).
- Provide a balance in the haul truck fleet.

- In the case of the Minago Mine, the three phases have been identified to develop the ultimate pit. Wardrop designed the three mineable phases based on the measured and indicated mineral resources and the selected optimized pit.

3.1.1.1 Phase I

Phase I is the first pit that was designed from the initial economic shells generated by the WhittleTM optimization run. The initial economic shells prioritize the high grade ore mining at the top portion of the orebody, and at the lowest amount of waste stripping. The objective of this prioritizing is to maximize cash flow and speed the capital recovery during the initial years. Phase l would mine 2.5 Mt of frac sand, 1.7 Mt of NiS ore at 0.387% Ni(S) and total material is about 44.8 Mt.

3.1.1.2 Phase II

Phase II geometry was expanded in all directions from Phase I to mine the next high grade blocks of the orebody. The final highwalls were reached in the west and southwest side of the ultimate pit shell to achieve the required minimum mining width. Phase ll would mine 4.9 Mt of frac sand, 9.4 Mt of NiS ore at 0.438% Ni(S) for a total material of about 93.6 Mt.

3.1.1.3 Phase III

Phase III would mine the remaining ore inside the ultimate pit shell to achieve the final highwalls. Phase lll would mine 7.47 Mt of frac sand, 14.03 Mt of NiS ore at 0.429% Ni(S) for a total material of about 105 Mt.

3.1.1.4 Ultimate Pit

Overall, the ultimate pit contains 14.8 Mt of frac sand, 25.17 Mt of Ni(S) ore at 0.430 % Ni(S) for a total with waste of about 308.7 Mt. Figure 3-1 shows the Ultimate Pit Design, Table 3-2 the Overall Pit Mining Schedule, Table 3-3 the General Pit Statistics.

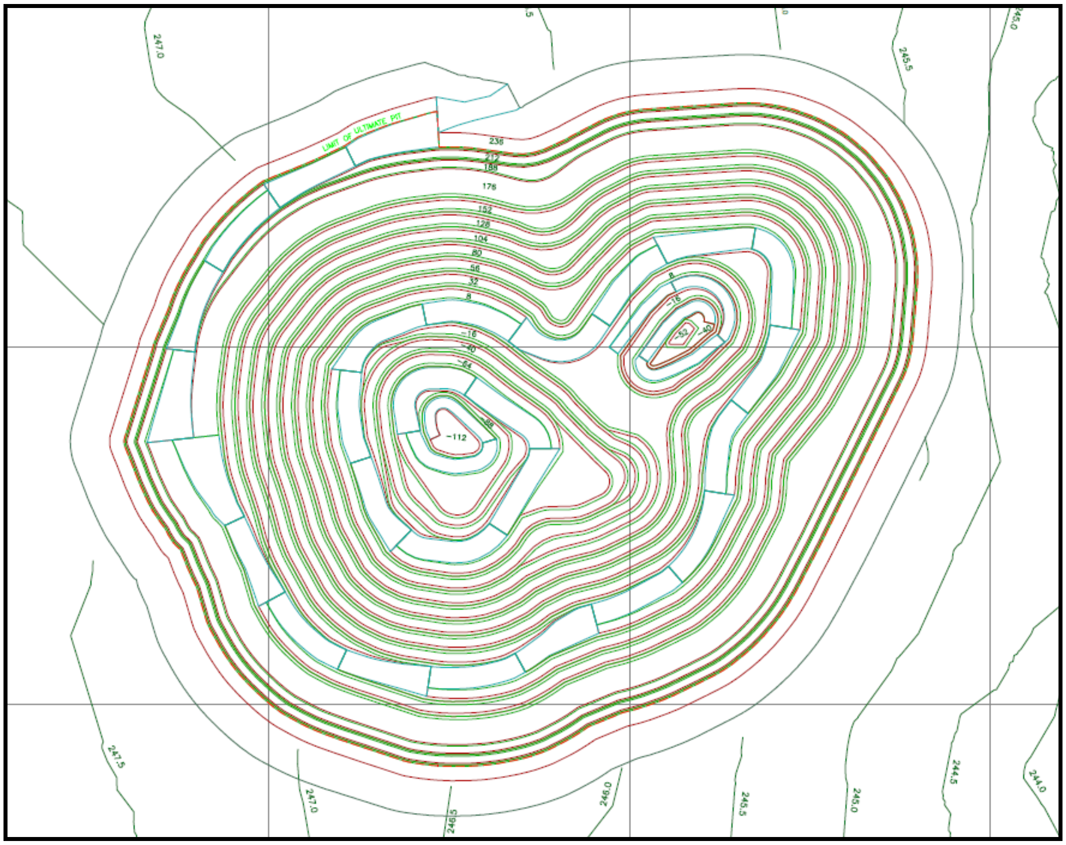


Figure 3-1 Ultimate Open Pit Mine

Table 3-2 Overall Pit Mining Schedule

	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021		
Dolomite (kt)	42655	43179	15183	10015	0	0	0	0	0	0	Dolomite	111032
Granite (kt)	0	1744	20890	20440	35711	24459	9784	4944	3832	199	Granite	122005
Ultramafic (kt)	0	861	7941	5524	5667	5732	4382	3026	2297	229	Ultramafic	35659
Sand (kt)	0	5289	2092	7466	0	0	0	0	0	0	Sand	14847
Total Ore (kt)	0	112	3000	3600	3600	3600	3600	3600	3600	453	Ore	25166
Grade Ore (%)	0.000	0.374	0.419	0.429	0.430	0.413	0.436	0.431	0.447	0.468	Grade	0.430
Total Tonnage (kt)	42655	51186	49105	47045	44979	33792	17766	11570	9728	881		

Table 3-3 General Pit Statistics

Item	Size
Pit Top Elevation	Approx. 247 m
Pit Bottom Elevation	-112 m
Pit Depth	. 359 m
Volume of Pit	156.7 million m^3
Area of Pit Top	1.0 million m^2
Perimeter at the Top of the Pit	3.7 km
Length from East to West	1.2 km
Length from North to South	1.1 km

The mine would start delivering frac sand ore in the year just prior to Frac Sand production at the start of "Year-1" (2013). The delivery of nickel sulphide ore would begin in late "Year 1" (2013) in preparation for Ore Processing at the start of "Year 1" (2014) and will continue until "Year 8" (2021). The mine production would peak at 51.2 Mt in "Year 1" (2013) because of the high proportion of waste rock.

The delivery and placement of overburden, limestone, and basement rock would closely follow the geotechnical parameters governing the construction of waste dumps, tailings dams, and overburden containment areas.

Each phase or pushback is designed at a mining width of about 65 m to accommodate mining equipment that will operate on a bench. The mining width allows for 35 m of double-sided loading if, for example, a Komatsu PD4000 electric hydraulic shovel was used. The road width of 30 m is designed to accommodate safety berms and two lanes of typical 240-ton haul trucks.Tables 3-4 and Table 3-5 show materials mined by phase by year.

Table 3-4 Total Material Mined by Phase by Year

	2012	2013	2014	2015	2016	2017	2018	2019	2020	202 1	202 2
Minago Phase 1 (kt)	1706	1706	9003	1643							
Minago Phase 2 (kt)	1279	2559	2521	1527	1234	2392					
Minago Phase 3 (kt)	1279	8531	1489	3012	3263	3140	1776	1157	9728	881	

Table 3-5 Mined Ore Tonnage by Grade by Period

	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Ore Tonnes (kt)		112	3000	3600	3600	3600	3600	3600	3600	453	
Grade (% Ni(S))		0.37	0.42	0.43	0.43	0.41	0.44	0.43	0.45	0.47	

The overall stripping ratios (waste-to-ore ratio tonne/tonne, t/t) to mine both the nickel sulphide ore and frac sand is outlined in **Table 3-6** below.

Table 3-6 Open Pit Design 14 Stripping Ratios

Case	SR (t/t) (No Overburden)	SR (t/t) (With Overburden)
Frac Sand Only	7.48	8.23
Nickel Ore Only	11.27	11.71
Nickel Ore and Frac Sand	6.72	7.00

Mine development will commence with the removal of trees and roots, and then the dredging removal of the muskeg and clay overlying the dolomitic limestone. For this initial stage of the mining operation, the work will be performed using contractors as part of capital expenditures. Mechanical removal using excavators for removal, trucks for transportation and dumping is difficult because of the soft clays. Given the challenges and costs associated with the mechanical removal of the overburden, a dredging method has been selected to remove the muskeg and clay.

3.1 Mill

3.1.1 Milling Process Description

The milling process will consist of conventional processes including crushing, grinding, flotation using reagents and concentrate dewatering using filter presses and bagging of the concentrate. Figure 3-2 gives a simplified process flow sheet. Brief descriptions of the individual process components are given in the next sections.

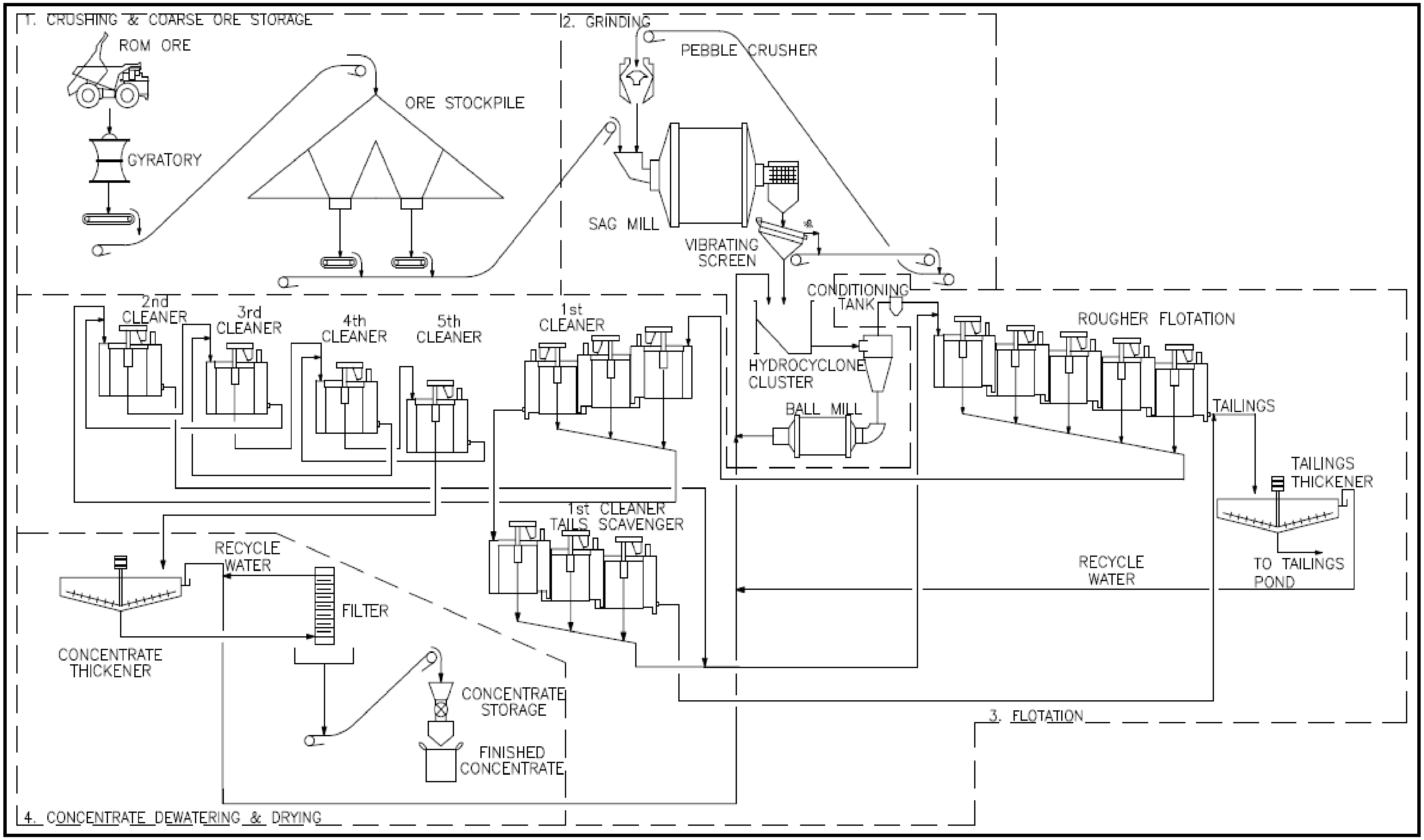


Figure 3-2 Process Flow Sheet for Milling and Concentrating

3.1.1.1 Crushing and Crushing Operations

The mineral processing plant will process nickel ore at a nominal rate of 10,000 t/d. The process will consist of a primary gyratory crusher and hydraulic rock breaker capable of crushing the ore to an optimal size for grinding. A primary crusher apron feeder will feed a transfer conveyor to deposit the material to the ore stockpile. Two apron feeders below the ore stockpile will feed the grinding feed conveyor.

3.1.1.2 Grinding

The grinding circuit, consisting of one semi-autogenous grinding (SAG) mill and one ball mill, will grind the ore prior to flotation. An intermediate crushing stage consisting of one pebble cone crusher will crush oversized product from the grinding circuit for recirculation to the SAG mill. A single vibrating screen will be utilized to classify the SAG mill discharge and the oversize that will be crushed. A hydrocyclone cluster will classify the ball mill discharge and the underflow of the vibrating screen. Underflow from the hydrocyclone cluster (oversize ball mill product) will be recycled to the ball mill feed while the overflow (undersize) will gravity flow to the conditioning tank at the start of the flotation circuit.

3.1.1.3 Flotation

The flotation circuit will consist of conventional rougher, scavenger and cleaner cells to produce a high-grade nickel concentrate and final tailings. One bank of rougher cells, one bank of scavenger cells, and five banks of cleaner cells will be utilized throughout the flotation circuit. The final flotation concentrate will be thickened in an indoor conventional concentrate thickener and stored in a stock tank. Concentrate from the stock tank will be dried for shipment in a horizontal plate filter press. The filter press will dewater the concentrate to 8.6% moisture content. A bagging machine will bag the final concentrate in 2 t bags for shipping.

A high rate tailings thickener will clarify the final tailings from the flotation circuit and distribute the tailings underflow to the tailings management area.

3.1.1.3.1 Typical Reagent Consumption – Flotation

Flocculants will be used in each thickener to assist in settling and generating a precipitate from solution. Reagents including potassium amyl xanthate (PAX) and sodium hexametaphosphate (SHMP or Calgon) will be added to the ore in the grinding stage to enhance the flotation performance downstream. Methyl isobutyl carbinol (MIBC) and depramin C (CMC) will also be added to the cleaner flotation to aid in concentrate quality. The projected reagent addition rates are given in Table 3-7.

Table 3-7 Reagents and Flocculants in the Mining and Milling Process

					Dosage (g/tonne)	Dosage (kg/day)
CMC	Carboxmethyl Cellulose	wood product (used to make creamy soups)	Depressant	Depressant for Talc(MgO) coats talc particles to make them hydrophilic	700	7000
PAX	Potassium Amyl Xanthate		Collector	Collector for minerals coats mineral particles to render them hydrophobic so that are attracted to air bubbles and reject water	425	4250
SHMP	Sodium hexametaphophate	Calgon (water softener)	Dispersant	Dispersant for Talc keeps talc particles from adhering to mineral particles	500	5000
MIBC	Methyl isobutyl carbinol	similar to dish soap	Frother	Frothing agent to create stable froth bubbles in flotation cells to float metal particles	70	700
Flocculant (Tails)	Anionic polyacrylamide	used in water treatment	Coagulant	used in thickeners and clarifiers to collect particles so that they will agglomerate and sink	23	227
Flocculant (Conc.)	Anionic polyacrylamide	used in water treatment	Coagulant	used in thickeners and clarifiers to collect particles so that they will agglomerate and sink	5	0.63

Flotation optimization will be provided by on-stream samplers, particle size analyzers and an on-line x-ray analyzer. The samplers and analyzers will be used to monitor performance of the flotation process to optimize concentrate grade and nickel recoveries. An assay and metallurgical laboratory will be incorporated into the mill building to perform laboratory tests.

3.1.2 Process Plant and Frac Sand Plant

3.1.2.1 Nickle Ore Processing

The mineral processing plant will process nickel ore at a nominal rate of 10,000 t/d beginning with the haulage of ore to the primary gyratory crusher and hydraulic rock breaker capable of crushing the ore to an optimal size for grinding (Figure 3-3).

The grinding circuit, consisting of one semi-autogenous grinding (SAG) mill and one ball mill, will grind the ore prior to flotation. An intermediate crushing stage consisting of one pebble cone crusher will crush oversized product from the grinding circuit for recirculation to the SAG mill. A single vibrating screen will be utilized to classify the SAG mill discharge and the oversize that will be crushed. A hydrocyclone cluster will classify the ball mill discharge and the underflow of the vibrating screen. Underflow from the hydrocyclone cluster the oversize ball mill product will be recycled to the ball mill feed while the overflow the undersize product will gravity flow to the conditioning tank at the start of the flotation circuit.

The flotation circuit will consist of conventional rougher, scavenger and cleaner cells to produce a high-grade nickel concentrate and final tailings. One bank of rougher cells, one bank of scavenger cells, and five banks of cleaner cells will be utilized throughout the flotation circuit. The final flotation concentrate will be thickened in an indoor conventional concentrate thickener and stored in a stock tank. Concentrate from the stock tank will be dried for shipment in a horizontal plate filter press. The filter press will dewater the concentrate to an 8.6% moisture content. A bagging machine will bag the final concentrate in 2 t bags for shipping.

A high rate tailings thickener will clarify the final tailings from the flotation circuit and distribute the tailings underflow to the tailings management area. Flocculants will be used in each thickener to assist in settling and generating a precipitate from solution. Reagents including potassium amyl xanthate (PAX) and sodium hexametaphosphate (SHMP or Calgon) will be added to the ore in the grinding stage to enhance the flotation performance downstream. Methyl isobutyl carbinol (MIBC) and depramin C (CMC) will also be added to the cleaner flotation to aid in concentrate quality.

Flotation optimization will be provided by on-stream samplers, particle size analyzers and an on-line x-ray analyzer. The samplers and analyzers will be used to monitor performance of the flotation process to optimize concentrate grade and nickel recoveries. An assay and metallurgical laboratory will be incorporated into the mill building to perform laboratory tests.

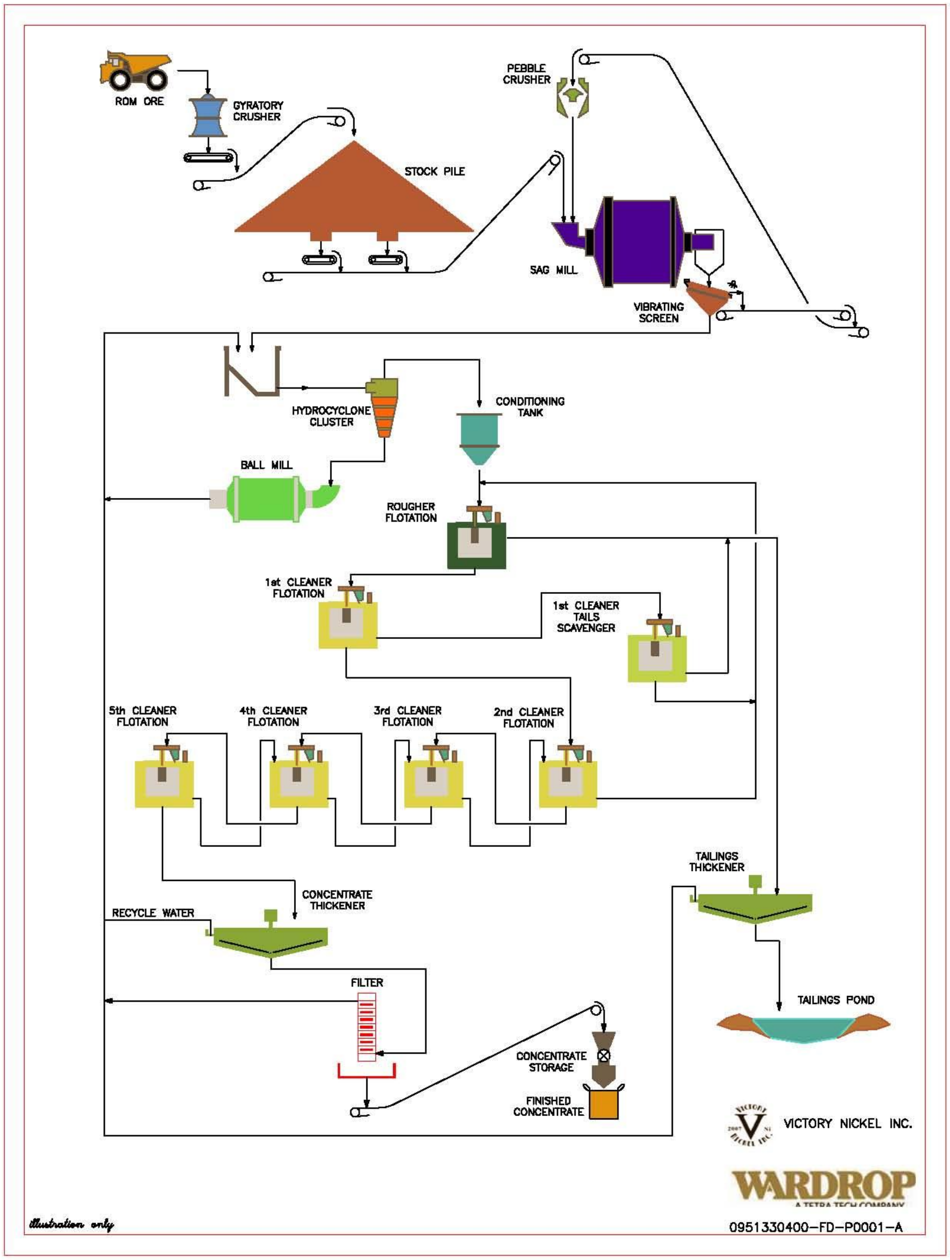


Figure 3-3 Simplified Flowsheet

3.1.2.2 Frac Sand Processing Plant

The Preliminary Economic Assessment (PEA) identified a sandstone horizon averaging nine metres thick above the unconformity of the main nickel bearing serpentinite. This sandstone layer must be removed to access the mineralization within the proposed open pit mine reported in the PEA study. The sandstone unit which is comprised of small, round, uniformly sized silica sand particles is amenable for use as hydraulic fractionating sand or frac sand in the oil and gas industry.

The sandstone is not expected to require drilling and blasting to be removed, but will require additional backhoe cleanup due to the expected undulating contact at the top of the basement rocks. The backhoe will windrow the sand so that a front-end loader can easily load the material while minimizing the loss of sand due to the loaders large bucket size. The sand is then hauled to a stockpile location, separate from the waste dumps, prior to processing. The sand is released each time a mining stage passes through the bedrock contact in Years 1, 2 and 3 (Table 3-8). The insitu sand would be processed at a feed rate of 1.5 Mt/a, producing different grades of frac sand at a rate of 1.15 Mt of marketable sand annually.

Table 3-8 Final Pit Sand Resource by Year

Phase	Sand (tonnes)	Year
Starter Pit	5,288,864	1
Phase I	2,091,628	2
Phase II	7,466,065	3
Total	**14,846,557**	

4. ENVIRONMENTAL STUDIES

4.1 Geotechnical Considerations and Surficial Geology

The geotechnical design is based on a production rate of 10,000 tonnes per day for Nickel and 1.5 million tonnes per year of frac sand.

The site is challenging from a geotechnical standpoint not only in terms of the foundation considerations involved but also because of serious lack of natural construction material particularly in the critical initial stages of the development of the mine. Geotechnical factors impact in a significant manner almost every aspect of the project, including the layout of the components of the mine, the design, construction and operational methodology of the open pit, the tailings disposal facility, the various mine waste dumps (including dumps for overburden stripping), site roads and drainage, and foundation and earthworks for the plant site.

The challenging geotechnical conditions have required widespread studies, analyses and optimization of planning even at this feasibility stage in order to minimize the overall costs.

The soil conditions at the site are dominated by a surface cover of muskeg/peat underlain by various thicknesses of clay and then bedrock. There is an exposure of bedrock to the immediate west of the site. The site is generally waterlogged. Detailed descriptions and characterization of the soil conditions encountered, design criteria and considerations, stability and seepage analyses, tailings deposition strategy, water handling and management, borrow sources and other relevant information are given in the feasibility study report. The field investigation procedures and the results obtained from the field and laboratory testing with all supporting data as well as preliminary geotechnical design drawings are presented in the feasibility study (Wardrop 2010).

The overall geotechnical database also includes information obtained from hydrogeological studies, installation of groundwater monitoring wells, a test pumping program relating to groundwater lowering around the open pit, evaluation of geochemical properties, a construction material search, quality testing of potential construction materials and geotechnical characterization of the tailings.

In general, the boreholes and test pits encountered peat (muskeg) with variable thicknesses ranging from 0.2 m to 4.0 m with an average thickness of approximately 1.6 m underlain by 0.5 to 21.3 m thick, low to high plasticity clay deposits and glacial till in places. These overburden deposits are underlain by limestone bedrock.

The consistency of the clay deposits is very soft to hard, and their shear strength varies with the depth. Typically the upper 2 m of soft to firm, but generally firm clay is followed by an approximately 3 m thick of firm to stiff, but predominantly stiff clay crust. Below this crust the clay deposit is soft to firm and somewhat weaker than the clay encountered at the upper 2 m.

The bedrock was cored in twenty-four locations. Recorded Rock Quality Designation (RQD) values suggest that the limestone bedrock is fair to excellent, but generally good quality.

A total of 96 groundwater monitoring wells was installed: 72 wells in the overburden and 24 in the bedrock. The groundwater level in the overburden across the site was found mostly within 1.0 metre below the ground surface, but in some boreholes was recorded at significantly greater depths, i.e. ranging from 5.7 m to 8.6 m.

The static groundwater level in the bedrock was generally encountered within the upper 1.5 m below the ground surface although in some areas was found either flowing at or above the ground surface. This suggests that the groundwater within the bedrock is confined under pressure and/or is in artesian conditions and is independent of that of the encountered within the overburden.

From a geotechnical engineering point of view, the containment structures were designed for a computed static factor of safety of 1.3 on completion of the construction, during normal operation and at closure, except the TWRMF, which was designed to a computed static factor of safety of 1.5 at closure. The pseudo-static (earthquake based) factor of safety is 1.05. In order to comply with these requirements on the relatively weak foundation soils, an optimized staged construction design approach was adopted. By using staged construction and allowing increasing the shear strength of the clay due to consolidation under the preceding stage, it was possible to obtain an increased height of dam or dumps. In order to achieve the same increased height of the dam or dumps in one stage, would have required excavating and installing shear keys through the clay extending to the bedrock which would have been expensive, difficult to implement and would not have been favorable from an environmental standpoint. The results of design calculations revealed that the maximum heights of the embankments for the TWRMF and Rock Dump can be achieved in three stages, while the overburden containment can be built in two stages. A two-year waiting period was considered to be necessary between successive construction stages.

The required storage capacities for the TWRMF, rock dumps and overburden containments were determined based on the production schedule. A number of different strategies for storage of the tailings were examined in a preliminary fashion in order to establish the most suitable approach for the site conditions and characteristics of the tailings. The option selected was one of total containment behind a lined rock fill dam.

The design of the dam consists of a rock fill section with a geosynthetic liner on the upstream side. The native clay forms an effective lining to the base of the TWRMF. Upstream and downstream slopes of the dam will be 2H:1V and 17.5º (±3.2H:1V) respectively. This latter slope is required for environmental reasons. Surface seepage will be collected in a collection pond through a peripheral drain system. Decant facilities will consist of barge mounted reclaim pumps. Design and construction planning have been coordinated to make maximum use of suitable rock fill from the open pit from the outset. Rock fill for TWRMF dam construction will be available from the open pit in the first year of operation. The TWRMF dam crest had been preliminarily established at 253.4 m, 256.4 m and 259.9 m for the three consecutive construction stages respectively. This incudes 1 m of freeboard. There is a possibility of optimization of the final height of the dam that may result in a reduction of the plan area.

With the use of geosynthetic lining on the upstream face of the TWRMF dam and considering the low permeability of the native clay, it is expected that seepage quantities would be small. A very preliminary seepage analysis (strictly theoretical) indicates that the total seepage flow from the TWRMF will be in the order of about 40 to 60 m^3/day. In any area within the pond, where the clay overburden is less than 2 m thick or does not exist, a low permeability blanket consisting of compacted clay fill up to 2 m thick is required to cover the exposed bedrock surface and/or shallow overburden area. .

4.1.1 Soil Classifications

A total of five main soil strata were identified within the overburden on the site comprising:

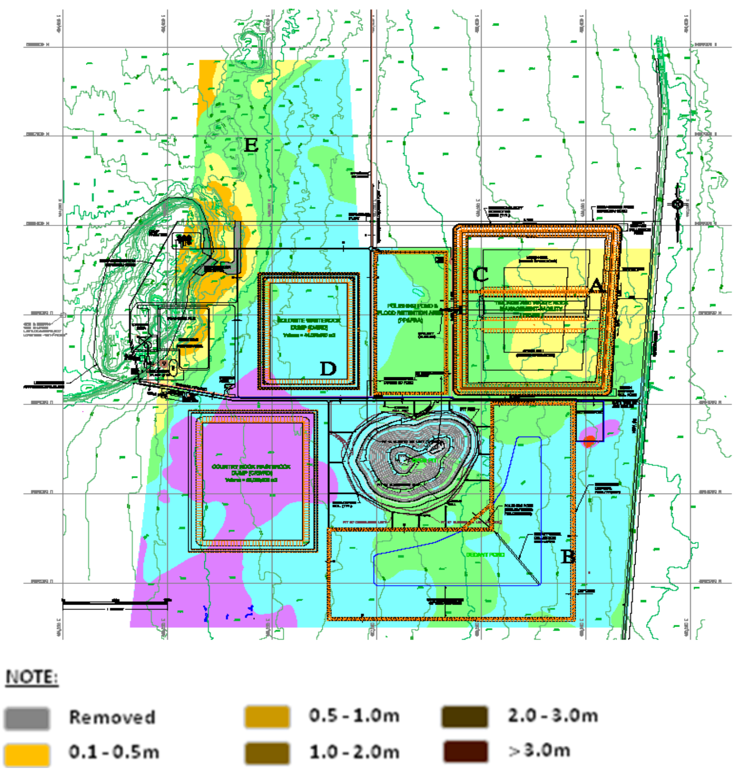
- peat
- low plasticity clay (CL)
- intermedliate plasticity clay (CI)
- high plasticity clay (CH)
- glacial till.

The overburden is underlain by a dolomite bedrock. The dolomite is fine grained, massive to stratified and varies in colour from creamy white to tan brown to bluish grey. The thickness of this unit ranges from 42 to 62 m from north to south, respectively. The uppermost 24 m is stratified and contains horizontal clay/organic beds of approximately 1 to 5 mm in thickness and occurring at intervals ranging from few millimeters to a meter.

The Quaternary surface cover typically compromises up to 4 m of peat that is generally underlain by up to 20 m of low permeability glacial lacustrine clays. The clays are dark brown to grey and carbonate rich. Muskeg is formed by an accumulation of sphagnum moss, leaves, and decayed matter.

The underlying clay and sporadic till was deposited from former glacial Lake Agassiz. Lake Agassiz once stretched across portions of Saskatchewan, Manitoba and western Ontario, impounded by retreating and transgressing Laurentian ice sheets. Lake Agassiz finally drained into the Arctic Ocean about 7400 BP. In found locally below the clay. The deposit contains silt and some sand and gravel with glacial till found locally below the clay and peat. Overburden Isopaches are given in Figure 4-1.

Peat Isopaches



Overburden Isopaches

Figure 4-1 Peat and Overburden Isopaches

4.2 Climate

The Minago Project area is located at approximately 250 m above sea level (MSL) in north-central Manitoba, approximately 100 kilometers north of Grand Rapids, which is on the western shores of Lake Winnipeg. The region is characterized by warm, wet summers and cold, dry winters. Temperatures range from 23.5 °C in July to -24.4 °C in January. Annual precipitation is approximately 473.7 millimeters (mm), of which 77% falls as rain. The majority of this rainfall occurs between June and September, with a smaller amount falling in early spring and late fall. Little rain is recorded for November to March when almost all precipitation falls as snow (Canadian Climate Normals 1971-2000, Grand Rapids Hydro Climate Station).

The seasonal air temperature cycles are considerably comparable between the Grand Rapids Hydro, The Pas Airport, and Norway House climate stations. For all three stations the coldest months are January and February, the warmest is July with seasonal temperature variations being similar. This considered plausible, given their relative proximity, similar geography and elevations. At approximately 250 m (MSL), the Minago Project site is at an elevation between that of The Pas (270 m (MSL)) and Grand Rapids (223 m (MSL)) and Norway House (224 m (MSL)).

Because differences in temperature among the three above mentioned stations are inconsequential and given their proximity to the Minago project, the air temperatures at the Grand Rapids station, where more copious data are available, were used in this analysis.

At Grand Rapids Hydro station from 2003 to 2007 the average mean monthly temperature for January was –17.42 °C and for July was 19.04 °C. The average minimum temperature in January was -24°C, and the average maximum in July was 24.6 °C.

Over the period of record available for Grand Rapids (40 years) and The Pas Airport (60 years) there has been a slight trend toward increasing precipitation and less extreme winter temperatures. Grand Rapids Hydro shows a gradual and minor increase in temperature over time, whereas recent increases in temperature at The Pas Airport seem to balance out over the 60 year observation period. The snow pack at The Pas Airport has notably decreased over the period of record, while the frequency and magnitude of extreme precipitation events appear to have increased over time.

The Minago project is located in a region historically exhibiting low seismicity and extensive evaluation extending beyond an examination of historic earthquakes is not considered necessary.

The following design information is provided by the Meteorological Service of Canada for a location defined as Grand Rapids/Wabowden Midpoint provides a summary of the climatic design data for the Minago location.

In 2007, Victory Nickel installed a weather station at Minago (Figure 4-2).

Figure 4-2 Weather Station at 'Minago

4.2.1 Design Temperatures

The annual temperature data for the Minago Project area is summarized in Table 4-1:

Table 4-1 Annual Temperature Data

Winter Design Temperature:	(January 97.5 Percentile)	-36°C
	(January 99 Percentile)	-38°C
Summer Design Temperature:	(July Dry 97.5 Percentile)	28°C
	(July Wet 97.5 Percentile)	21°C
Degree Days less than 18 degree centigrade		6,900

4.2.2 Precipitation

The annual precipitation data is summarized Table 4-2:

Table 4-2 Annual Precipitation Data

Annual Total Precipitation	490 mm
Annual Rain	350 mm
Rain 1/50 year return period 24 hours..........................	84 mm
Rain 1/50 year return period 15 minutes	16 mm

4.2.3 Wind Conditions

The site wind conditions are given in Table 4-3:

Table 4-3 Site Wind Conditions

Hourly wind pressure for 1/10 year return period	0.32 kPa
Hourly wind pressure for 1/30 year return period	0.40 kPa
Hourly wind pressure for 1/50 year return period	0.45 kPa
Hourly wind pressure for 1/100 year return period	0.51 kPa
Moisture Index	0.61

4.3 Hydrogeology and Groundwater Quality

Initial hydro geological assessment was conducted in early 2007 with a goal to determine the underground flow regime and hydraulic conductivity of the various geological units that will be affected by mining. The assessment found that the principle stratigraphic units were overburden (peat and clay; OB), shallow limestone (SLS), limestone (LS), sandstone (SS), and granite (GR). Limestone at Minago is approximately 55 m (180 ft) thick and consists of shallow limestone that has an upper zone of water bearing fractures (up to 40 m depth) and deep limestone underlying this zone. Underlying the limestone is approximately 10 m (30 ft) of sandstone, followed by some shale and weathered granite of the Precambrian Shield. The Ordovician limestone and sandstone were found to have significant groundwater producing potential.

The preliminary hydro geological program was followed by a comprehensive hydro geological characterization of the site in the summer of 2008. That program involved pumping of four high capacity dewatering wells located along the perimeter of the proposed open pit mine and monitoring the hydro geologic response in these wells and in 24 observation wells. Results of the long duration pumping test program were used to develop a conceptual hydro geological model of the Site in the upper 75 m of the subsurface and a groundwater flow model of the proposed open pit area.

Based on Golder Associates' (2008b) hydro geological model, the current dewatering design consists of 12 dewatering wells located at a distance of approximately 300 m to 400 m along the crest of the ultimate pit, and pumping simultaneously from the limestone and sandstone units. The total pumping rate for the wellfield is predicted to be approximately 40,000 m3/day (7,300 USgpm), and the average pumping rate for an individual well is estimated at about 3,300 m3/day (600 USgpm). The associated drawdown cone, defined using a 1 m drawdown contour, is predicted to extend laterally in the limestone to a distance of approximately 5,000 m to 6,000 m from the proposed open pit. The results of this analysis suggest that the actual dewatering rate for the entire wellfield could vary from 25,000 m3/day (4,600 USgpm) to 90,000 m3/day (16,500 USgpm).

The recommended dewatering well design includes the following:

1. Each well will be drilled 10 m into the weathered granite unit.
2. A sump will be placed in the bottom 5 m of the well.
3. A well screen will be placed above the sump in at least 5 m of limestone.
4. The well casing in the limestone will be slotted throughout most of its length.
5. The well annulus in limestone will be gravel filled to allow free downward drainage.
6. The pump will be installed in the sump in the bottom 5 m of each well.

The above design will allow well pumping to the extent that drawdown in the well will be near the bottom of the screen to effectively create a seepage face in the well screen/slotted casing that intersects the sandstone/limestone contact.

Several groundwater samples have been collected from the Minago Property. Groundwater samples were collected as part of the initial hydro geological program in 2007, after the installation of pumping wells in March 2008, and at the end of the long-term pump test in August 2008. All groundwater samples were collected in a representative manner and according to standard groundwater sampling protocols to minimize sample contamination. Based on the groundwater quality results, groundwater quality from the limestone and sandstone formations exceed the CCME freshwater aquatic life standards for total aluminum, total iron, zinc, total fluoride, and dissolved oxygen.

4.3.1 Site Map and Catchment Area

The Minago Project watershed settings are given in Figure 4-3. Essentially the main watershed include Oakley Creek, William River, Hargrave River and the Minago River.

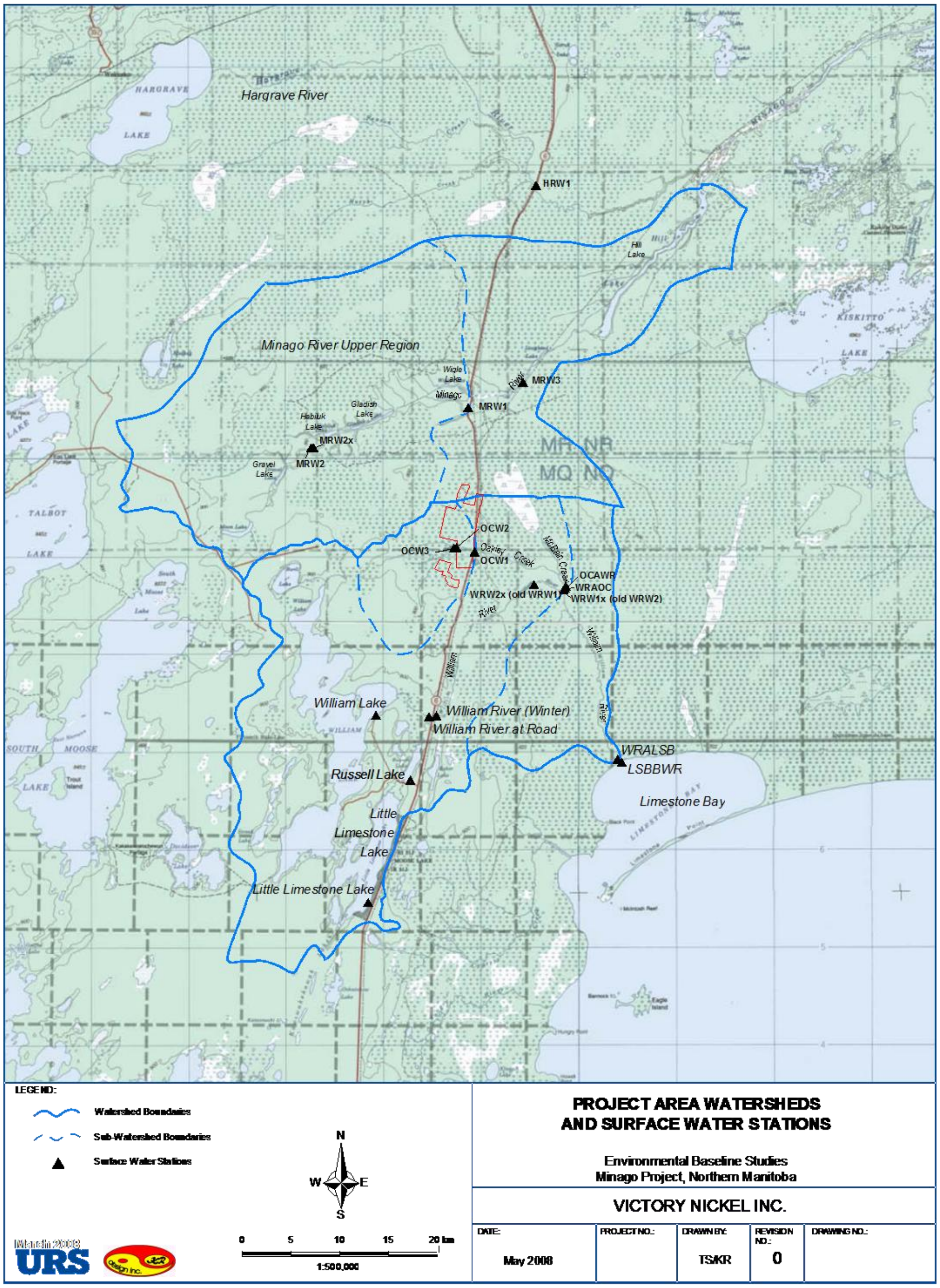


Figure 4-3 Site Map and Catchment Area

4.4 Hydrology and Surface Water

This Baseline Hydrologic Study was commissioned to determine the long term climatic and hydrometric characteristics of the area encompassing the proposed Minago Project development. Water quality sampling was initiated in the project area in 2006, while climate and hydrometric data collection started in 2007.

Regional temperature and precipitation data are available from seven climate stations located in northern Manitoba. Regional evaporation estimates, relative humidity, wind and radiation are also respectively available at one or more of these stations. Regional precipitation data is supplemented by a national database of snow survey and snow water equivalent information that is current up to 2004.

Data from eight regional hydrometric stations was available from the Water Survey of Canada and River and lake ice information was available from the Canadian Ice Database. This hydrology and surface water information with the data from the three regional sediment sampling stations formed the database.

January and July are typically the coldest and warmest months of the year, with mean daily air temperatures of approximately -22 ºC and 18 ºC, respectively. The average annual precipitation at the project site is estimated to be 510 mm after accounting for rainfall and snowfall undercatch. Average annual rainfall is 369 mm, with monthly rainfall averages greater than 10 mm from April to October. Average annual snowfall is 141 mm snow water equivalent (SWE), with monthly snowfall averages greater than 10 mm from October to April. The 24-hour rainfall amount with a 10-year return period is estimated to be 79 mm.

Observations at the project site indicate that wind occurs more frequently from the east and west directions. Based on the available data, the average wind speed at the site is about 20 km/hr. The west wind occurs most frequently, although the mean speed of the north-westerly wind is the highest (24 km/hr). The 100-year hourly wind speed was estimated to be 97 km/hr.

Annual lake evaporation at the project site is estimated at 566 mm, mostly occurring over the April to October period. Annual loss of snowpack to sublimation and redistribution is estimated at 39% (or approximately 55 mm). Estimates of the basin combined evapotranspiration/infiltration losses are 343 mm for the Oakley Creek and Minago River watersheds, and 353 mm for the Hargrave and William River watersheds.

The ice regime in the Minago area was characterized on the basis of regional observations. Mean ice thickness varies over a narrow range between 0.8 and 0.9 m. Occurrence of ice may be as early as mid-October. Complete freeze cover is observed by the end of October or early November. Deterioration of the ice cover is observed by late April and would likely coincide with the freshet.

The mean annual watershed runoff is estimated to be 117 mm for the Oakley Creek and Hargrave, Minago and William River watersheds. Runoff typically peaks in May. For the spring freshet period occurring between April and May, the 10-year return period annual flood peak discharges are estimated to be 8.3 and 16.3 m3/s for the Oakley Creek basin and the Minago

River, respectively; and 18.4 and 42.6 m3/s for the William River and Hargrave River, respectively.

The annual sediment yield from the Oakley Creek and Minago River watersheds is estimated to be 0.0001 mm or less. The sediment yield estimated from the Hargrave and William River watersheds is between 0.0005 and 0.0009 mm per year. The low yield at Oakley Creek and Minago River are indicative of lower land erosion in their watersheds compared to the watersheds of the Hargrave and William Rivers.

The increase in annual temperature, over a 100-year period ending in 2100, is projected to be +4.3 ºC based on the available regional climate change projections. Higher increases are expected over the winter period, with lower increases in the summer. Precipitation is also projected to rise by an average of +15% over this period.

The results of this hydrologic baseline study provide the basis for the preliminary planning and design of water management infrastructure at the project site. The study can also be used to support the surface water assessment component of an environmental impact statement for the project. The climate and hydrometric characteristics described for the project area are based on long-term regional information. The available site data at the Minago project site fits within the regional variability in climate and hydrologic conditions.

The baseline hydrologic condition presented in the Study should be periodically updated as additional data is collected from these monitoring programs. Climate and hydrometric characteristics presented in this report might be subject to adjustments in future updates due to potential effect from climate change. This update could support adjustment of the water management practice at the project site, as required.

Based on VNI’s commitment to the follow-up program and implementation of mitigation measures, no significant adverse residual project effects on heritage resources are expected. On this basis the likelihood of the conclusions of this report occurring as predicted is high.

The hydrological data from the studies were used to model site water management for the purpose of developing the Water Management Plan.

4.4.1 Site Area Surface Water

Surface water quality in watercourses surrounding the Minago Project was assessed from May to October 2006, from May to August 2007, and from September 2007 to May 2008. The water quality monitoring concentrated in Oakley Creek, Minago River, William River, and Hargrave River. One-time assessments of surface water quality were also completed for William Lake, Little Limestone Lake, Russell Lake, and two locations near the confluence of William River and Limestone Bay on Lake Winnipeg.

Overall, the water quality was good in the vicinity of the Minago Project with only some parameters exceeding Manitoba and/or CCME (Canadian Council of Ministers of the Environment) limits for the protection of freshwater aquatic life. The most common exceedances of Manitoba water quality guidelines occurred for aluminum and iron (many exceedances) followed by Nitrite-N (13 exceedances), copper (2 exceedances), Total Dissolved Solids (1 exceedance), and selenium and silver (1 exceedance each). The 2002 Metal Mining Effluent Regulations (MMER) was only exceeded for Total Suspended Solids (TSS). These results indicate that the background concentrations do exceed existing guidelines for a limited number of parameters.

4.5 Environmental Resources and Uses

4.5.1 Vegetation

Due to a regional gentle relief, large treed bogs are often observed within the Minago Property area, covering up to 30 % of the regional landscape and representing, both spatially and ecologically, one of the most important ecosystems in the area. Black spruce is by far the most abundant vascular species especially in badly drained environments where it creates the Sphagnum-spruce forest. This species is also abundant on better drained soils with the jack pine, a species which is frequently dominating xeric environments. Sites that are well drained consist mostly of low-elevated plateaus (above 265 m a.s.l.) covered by limestone, tills and fluvio-glacial sands. These plateaus are usually colonized by the open conifer forest. However, none of the areas potentially impacted by the Minago Project are located on such plateaus, but are all covered with Sphagnum-spruce stands sand treed bogs colonizing depressions filled with marine clay and silt, being covered by peat deposit which can be up to 4 m thick. Therefore, overall, the Project area contains vegetation consisting of mostly evergreen trees (primarily black spruce and tamarack) of intermediate (>3-15 m) to dwarf (3 m) heights. There is a relatively low level of vegetative biodiversity and there are not any vegetation types unique to the area or region. No rare, threatened, or endangered plant species were found. Projects effects on vegetation are linked with site clearing (about 1,300 ha) and to mitigate those effects, an Erosion and Sediment Control Plan as well as a progressive Site Reclamation Plan (as areas are abandoned and revegetated) will be implemented.

4.5.2 Wildlife

Wildlife surveys were conducted in the spring of 2007 and in the winter of 2008 and aadditional opportunistic observation of wildlife were conducted from May 6-9, 2008. The spring 2007 wildlife survey consisted of a qualitative presence/absence terrestrial survey at the proposed Minago Mine Project site and opportunistic observations made throughout an eight-day fisheries and wildlife field survey. The 2008 winter wildlife survey consisted of an aerial survey of a 16 by 18 km2 area surrounding the Minago Mine Project site, terrestrial transects, and helicopter transects along winter roads. The main objective of wildlife assessment program was to document the presence of large and small mammal species as well as of bird species. The Minago Mine Project area is not heavily utilized by all wildlife species with the exception of shore birds, sharp-tailed grouse, small forest carnivores and black bear, beaver, and amphibians (and likely the red-sided garter snake). None of the project area habitat is particularly critical to the survival of these species in the project vicinity. With the exception of the long-tailed weasel (Mustela frenata), northern raccoon (Procyon lotor), Arctic fox (Alopex lagopus), American badger (Taxidea taxus), and bobcat (Lynx rufus), the range of all species of furbearers native to Manitoba generally occurs throughout the Minago Project area.

Small forest carnivores, such as marten and ermine, were observed in moderate abundance. Other carnivores, such as lynx and fisher, utilize Minago Project area as habitat. However, prey species typically utilized by these species, such as showshoe hare and red squirrel are either limited in distribution or rare within the Minago Project area, requiring these species to utilize alternative prey species, such as voles, sharp-tailed grouse, and lemmings. Although shorebirds are probably a normal resident of the Minago Project area bog and fen habitat, their numbers are probably elevated due to the presence of the peat soil that has been converted into muck along the drill site access roads.

With rare exceptions, such as grouse, the birds that occur in the Minago Project vicinity are migratory and most occur at the Minago Project site only during their nesting seasons. None of the birds occurring in the Minago Project area have special status other than that conferred by the various treaties and conventions between Canada, the U.S., Japan, Mexico, and the former Soviet Union for the protection of migratory birds. Also, special status is conferred for the hunting seasons which are established by federal, provincial, and First Nations resource management agencies.

As timber harvest operations in central Manitoba create suitable early seral stage habitat, white-tail deer are likely to occur occasionally in the Minago Project area as they continue to invade more northern habitats in the boreal forest of Manitoba. This may eventually lead to the spread of meningeal worm through the moose and caribou populations, causing declines of population.

Moose populations in the Minago Project vicinity are concentrated north, south, and west of the Minago Project area. There is currently some summer and winter utilization of riparian habitat along Oakley Creek, bog habitat between the Moose Lake Winter Road and Oakley Creek, and bog and post-fire shrub habitat along the western edge of the Minago Project area. Although moose do enter the Minago Project area, they do not seem to make much use of it or utilize it as a migration route. Moose have been documented to forage most heavily on riparian willow, particularly where wildfire has stimulated willow production in burned black spruce stands.

One wildlife species of concern has been documented to occur in the vicinity of the Minago project area. The boreal population of woodland caribou (Rangifer tarandus caribou) is listed as "threatened" by the Committee on the Status of endangered Wildlife in Canada (COSEWIC) in the Species at Risk Act. Manitoba's boreal woodland caribou populations were listed as "threatened" in The Manitoba Endangered Species Act in June, 2006. However, the listed as "threatened", was not documented in the project area or the vicinity during any of the 2007 and 2008 wildlife surveys conducted for this project. There are two woodland caribou herds in the project vicinity: the Wabowden and William Lake herds. There are approximately 25-40 caribou in the William Lake herd and 200-225 caribou in the Wabowden herd (Manitoba Conservation, 2005). The William Lake herd has a low conservation concern rating, while the Wabowden herd has been assigned a medium conservation concern (Manitoba Conservation, 2005), based on the presence of industrial forestry in the Wabowden region north of the project vicinity.

At Minago, the habitat is of limited value to woodland caribou because treed islands of black spruce do not occur within open muskegs. Furthermore any individual caribou migrating south from the Wabowden herd will encounter a large area of burned-over land to the north and west of the project area land occupied by moose, a species with which they are competitive. In addition, the moose population may have increased the wolf densities since the primary forage in these areas is shrub habitat, rather than the niche forage of lichens which is utilized by the woodland caribou.

Any woodland caribou entering the project area at this time and for the foreseeable future are likely to be stray individuals from the main bodies of the two herds and the project area is not likely to provide critical habitat for either herd.

4.5.3 Fisheries

In 2006, 2007 and 2008, Wardrop, URS, and Roche undertook a number of fisheries assessment programs as detailed in the following sections.

Fish habitat and abundance assessments were undertaken by Wardrop (2007) in May and August 2006, by URS (2008b) in May/June 2007, and by Roche Consulting Engineers (Roche) in May 2008. Wardrop undertook fisheries assessments at three stations on Oakley Creek and at one station on Minago River. URS assessed fish habitat and abundances on Oakley Creek, Minago River, and William River at three stations per watercourse. Fish samples were also collected for baseline measurements of metal concentrations in fish. Roche's work included the installation of 2 or 3 bait traps in Oakley Creek, Minago River, and William River, as well as one bait trap and one experimental net each in Cross Lake, Hill Lake, and Limestone Bay on Lake Winnipeg. Roche also collected tissue samples in order to evaluate total metal content for 20 individuals (13 predators and 7 prey).

4.5.3.1 Fish Community

On May 16, 2006, Wardrop captured a total of 90 fish in the Oakley Creek. Brook stickleback (Culaea inconstans) were the dominant species followed by pearl dace (Margariscus margarita) and white sucker (Catostomus commersoni). Two adult white suckers were captured and released. Adult suckers (Catostomus spp.) were observed in deeper pools of Oakley Creek as far upstream as OCW-2 on May17, 2006.

Wardrop (2007) captured fish (on 22-23 August 2006) at all sites surveyed (OCW-1, OCW-2, OCW-3 and MRW-1). Forty-nine fish were captured at OCW-1 and species richness increased from three species in May to six in August 2006. Central mudminnow (Umbra limi) dominated the catch followed by brook stickleback, pearl dace, white sucker, blacknose shiner (Notropis heterolepis) and johnny darter (Etheostoma nigrum). At OCW-2, a total of 49 fish were captured with central mudminnow being the dominant species followed by brook stickleback and pearl dace. At OCW-3, a total of 17 fish were captured with the catch being dominated by brook stickleback followed by central mudminnow and pearl dace.

At MRW-1, a total of 56 fish were captured, with johnny darter being the dominant species followed by central mudminnow, white sucker, Iowa darter (Ethiostoma exile), and longnose sucker (Catostomus catostomus) (Wardrop, 2007).

Overall, species diversity was greatest at OCW-1 in August 2006, with six species from five families captured (Umbridae, Cyprinidae, Catostomidae, Gasterosteidae, and Percidae). Five species were captured at MRW-1, representing three families (Umbridae, Catostomidae, and Percidae). Three species, representing three families (Umbridae, Cyprinidae, Gasterosteidae) were captured at OCW-3 in August, 2006 (Wardrop, 2007).

In 2007, URS (2008b) found that lake-run white suckers (Catostomus commersoni) were abundant throughout the distance of Oakley Creek (URS, 2008b). Large lake-run white suckers were not observed in the mainstem of William River and Minago River. Dwarf white suckers were captured in both the Oakley Creek and in the tributary of the Minago River at sample location MRF2-2007.

Other than white suckers, the only other lake-run fish captured were emerald shiners (Notropis atherinoides) collected at sample locations WRF1 and WRF2 and a single rainbow smelt (Osmerus mordax) collected at sample location WRF2.

Following is a list of species collected at the 2007 fish sampling locations by URS:

- OCF1: central mudminnow (Umbra limi), brook stickleback (Culaea inconstans), and white sucker (Catostomus commersoni; both lake-run and dwarf resident)
- OCF2-2007: brook stickleback (Culaea inconstans), white sucker (both lake-run and dwarf resident), and pearl dace (Margriscus margrita)
- OCF3: central mudminnow, brook stickleback, and lake-run white sucker
- MRF1: central mudminnow and pearl dace
- MRF2-2007: central mudminnow and dwarf white sucker
- MRF3: pearl dace and Iowa darter (Etheostoma exile)
- WRF1: central mudminnow, brook stickleback, emerald shiner (Notropis atherinoides), and Johnny darter (Etheostoa nigrum)
- WRF2: brook stickleback, Johnny darter, emerald shiner, and rainbow smelt (Osmerus mordax)
- WRF3: Johnny darter and blacknosed shiner (Notropis heterolepis).

It should be noted that the spawning migrations of walleye (Sander vitreus) and northern pike (Exox lucius) from Lake Winnipeg (Oakley Creek and the William River) and Lake Hill (Minago River) were over before URS began sampling in May/June 2007.

During the 2008 fisheries program, Roche caught a total of 1,184 fish using experimental nets installed in Cross Lake, Hill Lake, and Limestone Bay of Lake Winnipeg between May 6 and 9, 2008 (Roche, 2008a). Rainbow smelts (Osmerus mardax) represented 86.8 % of all fish caught at station LBF1 and 86.99% of the overall May 2008 catch. Northern pikes (Esox lucius) were the second most abundant species, representing 9.5 % of the overall catch. Northern pikes (Esox lucius) represented 73.3% of the non Rainbow smelt species caught.

During the 2008 fishing program, only three brook sticklebacks (Culaea inconstans) and four pearl daces (Margariscus margarita) were caught using bait traps. These species were all caught at station OCF2-2008.

4.5.3.2 Fish Tissue Metal Concentrations

Fish tissue analyses were conducted in 2007. All species examined during the 2007 fisheries program exhibited concentrations of aluminum (Al), barium (Ba), manganese (Mn), and zinc (Zn) within the effects range of these elements and these levels of concentrations were found in all three watersheds sampled. Only Al and Zn concentrations in examined specimens exceeded published threshold levels. None of the concentrations measured exceeded the 2007 Canadian Food Inspection Guidelines for Chemical Contaminants and Toxins in Fish and Fish Products. All examined fish tissue samples were relatively small with a maximum weight of 45.4 g.

The concentrations did not significantly increase as sample locations moved downstream. It is likely that in most cases, concentrations of the four elements (Al, Ba, Mn, and Zn) exceeding thresholds for sub-lethal effects may be due to ingestion of stream sediments. The four metals are frequently found in fine stream sediments and might have been ingested by small fish while foraging.

In the 2008 fisheries program by Roche, tissue samples were collected in order to evaluate total metal content (As, Pb, Se, Ni, and Hg) in 20 specimens. Tissue samples were collected from four walleyes (Stizostedion vitreum), seven northern pikes (Esox lucius), three white suckers (Catostomus commersoni), four longnose suckers (Catostomus catostomus), and two yellow perch (Perca flavescens). One of the northern pike specimens weighed 4.5 kg, which is more than the average for this species (1 to 2 kg) (Roche, 2008a). The smallest fish sampled weighed 0.22 kg (yellow perch). Northern pike, walleye, and perch are predators while suckers are prey.

None of the analyzed tissue samples exceeded the 2007 Canadian Food Inspection Guidelines for Chemical Contaminants and Toxins in Fish and Fish Products criteria for arsenic and lead. In fact, metal concentrations for arsenic, selenium, and lead were always below the detection limit. However, 25% of all sample fish showed mercury concentrations above the 2007 Canadian Food Inspection Guidelines for Chemical Contaminants and Toxins in Fish and Fish Products (Roche, 2008a). Measured mercury concentrations varied from 0.06 to 1.6 mg/kg. These exceedances were essentially observed for northern pike (40 %) and walleye (60 %).

The elevated mercury concentrations may be explained by the trophic level of northern pike and walleye. Mercury bioaccumulation along the food chain occurs and highest contamination levels are often found in predators at the top of the food chain. It is also important to note that the highest mercury concentration (1.6 mg/kg) was observed for the northern pike specimen weighing 4.5 kg and measuring nearly 1 m. This individual was assumed to have been older than the other sampled fish and might therefore have accumulated more mercury over a longer period of time and also has eaten bigger and thus more contaminated fish (Roche, 2008a).

5. MINE WASTE MANAGEMENT

The project will produce waste, overburden material, ultramafic waste rock and tailings. Waste rock will consist of dolomite and country rock (granite), overburden will consist of peat and clay material. The tailings and ultramafic rock will be co-disposed in the TWRMF.

During the operation of the open pit, a total of 268.695 Mt of waste rock will be mined out of which 111.03 Mt will be limestone and 157.67 Mt will be basement rock. Basement rock will consist of two types: 122.01 Mt of granite (non-acid generating) and 35.66 Mt of ultramafic (potentially acid-generating and selenium containing). A summary of projected material quantities that will be mined from the Open Pit until closure is given in Table 5-1.

Waste rock will be deposited in three areas (as given Table 5-2). Dolomitic waste rock will be deposited in the 191 ha Dolomite Waste Rock Dump, granitic waste rock will be deposited in the 301.4 ha Country Rock Waste Rock Dump, and ultramafic waste rock will be co-disposed with the tailings in the 219.7 ha Tailings and Ultramafic Waste Rock Management Facility (TWRMF). All of the waste rock disposal areas will be located close to the open pit to minimize haulage costs and to optimize utilization of the site.

Limestone will be used in the construction of roads, containment berms, the basement layer for the ultramafic waste rock and causeways inside the Tailings and Ultramafic Waste Rock Management Facility (TWRMF), and for the site preparation of a Crusher Pad and a Ore Stockpile Pad; excess limestone will be deposited in the Dolomite Waste Rock Dump (Dolomite WRD).

5.1 Waste Rock Dump

Design Criteria and Considerations for the Waste Rock Dumps

The key design objective is to construct non-reactive waste rock dumps in the proximity of the open pit within compact footprints to the maximum heights governed by geotechnical analyses to minimize operational costs. As the dolomitic and Country Rock waste rock is inert, no special environmental protection measures are necessary (Wardrop, 2009b).

Tables 5-2 and 5-3 summarize the basic design criteria and parameters adopted for the waste rock dumps.

Waste Rock Dump Designs

The design of the waste rock dumps focuses on minimizing dump footprints and maximizing their heights through staged construction and in accordance with the results of engineering analyses and the waste production schedule. With both dumps containing non-acid generating (NAG) waste rock, there will not be a need for a seepage collection system and the storm water can report directly to the natural environment.

The locations of Country Rock Waste Rock Dump (CRWRD) and Dolomite Waste Rock Dump (DWRD) were selected to be on muskeg/peat covered weak overburden clay characterized by average thicknesses of 15 m and 10 m, respectively.

Table 5-1 Yearly Waste Rock Placement Schedule

Product	Year												TOTAL
	2012	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**kt**
Dolomite (Limestone) kt	42,655	43,179	15,183	10,015	0	0	0	0	0	0	0	0	**111,032**
Granite kt	0	1,744	20,890	20,440	35,711	24,459	9,784	4,944	3,832	199	0	0	**122,005**
Ultramafic kt	0	861	7,941	5,524	5,667	5,732	4,382	3,026	2,297	229	0	0	**35,659**
TOTAL kt	**42,655**	**45,784**	**44,014**	**35,979**	**41,379**	**30,192**	**14,166**	**7,970**	**6,128**	**428**	**0**	**0**	**268,695**

Source: adapted from Wardrop, 2009b

Table 5-2 Design Basis for Rock Dumps

Item	Value
Life of the Open Pit mine	10 years
Total Waste Rock	268,696,000 t
Total Dolomite Waste Rock	111,032,000 t
Total Country Rock Waste Rock	122,005,000 t
Country Rock Waste Rock Specific Gravity	2.07 t/m³
Dolomite Waste Rock Specific Gravity	2.79 t/m³
Swelling	30%
Total Required Volume for Country Rock Waste Rock Dump	~ 59,000,000 m³
Total Required Dolomite for Construction of Mine Infrastructure (TWRMF, roads, dykes, etc.)	10,743,600 m³
Total Required Volume for Dolomite Waste Rock Dump	41,000,000m³

Source: Wardrop, 2009b

Table 5-3 Basic Engineering Design Parameters for Rock Dumps

Item	Target
1. Geotechnical Slope Stability: • Waste Dump	
• Construction (in stages)	• Static F.O.S 1.3, pseudo static F.O.S 1.05
• Normal Operation	• Same as above
• Closure	• Static F.O.S. 1.3, pseudo static F.O.S 1.05
2. Seismicity: • Operating Design Basis Earthquake	• 1: 475 year return
• Closure Earthquake	• 1: 2,475 year return
3. Max Dump Height	• Dependent on the results of engineering analyses in support of staged construction.

Source: Wardrop, 2009b

5.1.1 Country Rock Waste Rock Dump (CRWRD)

The Country Rock Waste Rock Dump (CRWRD) is designed for storing 59 Mm^3 of inert granitic waste rock. The dump will be founded on existing overburden comprised of muskeg/peat and clay averaging approximately 15 m in thickness. This dump will measure 1,596 m by 1,240 m in plan and will be staged in ten (10) lifts of 4 m for an ultimate dump height of 40 m. The dump configuration includes a 20 m and a 43 m setback for the toes of the Stage 2 and Stage 3 lifts with subsequent lifts set-back to give a 2H:1V slope (Wardrop, 2009b).

To allow for sufficient time for consolidation of the soft clay layer, successive lifts of this waste rock dumps will be sequenced with sufficient time for consolidation. Assuming 4 m lifts and a repetitive placement operation, any subsequent lift may only be started after the current lift has been in place for sufficient time for consolidation to be effective. Stages 2 to 8 may be sequenced 6 months after the previous stage, Stage 9, 11 months after that and Stage 10 after 15 months.

Construction of the Country Rock WRD will commence with the grubbing of all trees.

5.1.2 Dolomite Waste Rock Dump (DWRD)

The Dolomitic Waste Rock Dump is designed for storing 41 Mm^3 of inert dolomite rock. This dump will be founded on existing overburden comprised of muskeg/peat and clay averaging approximately 10 m in thickness. The dump will measure 1,303 m by 974 m in plan and will be staged in ten (10) lifts for a maximum height of 40 m. The dump configuration will be formed with overall slopes of 2H:1V and setbacks of 8 m, 23 m and 6 m for the toes of Stage 2, Stage 3 and Stage 4 lifts, respectively (Wardrop, 2009b).

Successive lifts of this dump will be sequenced with a set period of time (as will be done for the Country Rock WRD) to allow for sufficient time for consolidation of the soft clay layer underlying the dump. Assuming 4 m lifts and a repetitive placement operation, all subsequent lifts may only be started after a consolidation period of 6 months (Wardrop, 2009b).

Construction of the Dolomite WRD will commence with the grubbing of all trees. after 11 and 15 months of placement of the last lift, respectively. Detailed slope stability results for Country Rock WRD and Dolomite WRD are presented elsewhere (Wardrop, 2009b).

Deposition Strategy for Waste Rock Dumps

The main construction issue in relation to the dumps is foundation preparation by pre-loading. This will be achieved by placing 2 consecutive 2 m thick waste rock lifts as a part of the Stage 1 lift. The start of the second lift will have to coincide with the end of the first lift placement, separated by 3 months (Wardrop, 2009b). The second lift will have to be completed by the end of 6 months. Spreading of waste rock will be progressive over the entire dump area in advance of the Stage 2 lift placement (Wardrop, 2009b).

From a construction standpoint, it is preferable to proceed with the preloading during the winter season. It is estimated that the preloading will need to remain in place for at least 90 days (~3 months). This estimate can be confirmed by test fills during the detailed design stage. The placement of the Stage 2 lift in both dumps should proceed by slow gradual advancement of another 4 m of waste rock over larger areas to promote finalization of consolidation of the muskeg and peat and gradual load transfer into underlying clays in accordance with the staged construction (Wardrop, 2009b).

5.1.3 Overburden Management

This section addresses the management of fine and organic overburden, which includes on-site clays and peat/muskeg. The management of dolomitic overburden will be presented in the Waste Rock Disposal Section.

Fine and organic overburden will be managed in several ways. The vast majority of peat and clay overburden that needs to be removed to gain access to the ore reserves and to built infrastructure will be stored in an Overburden Disposal Facility (ODF). Low permeability clays will be salvaged and stockpiled in sufficient quantities to enable the construction of low permeability liners where required. For example, a low permeability liner will be installed on the upstream side of the Tailings and Ultramafic Waste Rock Management Facility (TWRMF).

Dredging was selected as an overburden management option for the Minago Open Pit, because of logistical challenges, tight scheduling issues, and capital and operational costs related to safe disposal of mechanically excavated overburden (Wardrop, 2009b). Dredged material will be deposited in the ODF.

The ODF capacity will be approximately 15 Mm^3. The ODF will be capable of retaining a total of 11.2 Mt (~ 13.4 Mm^3) of overburden that will be discharged into the facility during an 8 months dredging period. scheduled. A further 1.6 Mm^3 of swelled peat and soft clay will be added. This material will originate from the downstream side of the dam foundation of the TWRMF and from runoff and seepage collection ditches.

The ODF will be located immediately south and east of the open pit as shown in Figure 1-2.

Overburden Disposal Facility (ODF) Design Criteria and Design Basis

The in situ material quantities that were used as the design basis for the ODF are detailed in Table 5-4. The design basis for the ODF assumes that the overburden materials will be comprised of 50% solids and 50% water by weight. The change in solids mass from 70% prior to the dredging to 50% at the point of disposal will be a result of the mixing and pumping of the slurry. After deposition, a certain portion of the initial water content will be released to bring the longer term ratio to 65% solids and 35% water (Wardrop, 2009b). The estimated total mass and volume of solids and water upon deposition in the ODF are presented in Table 5-5.

Table 5-4 In-situ Overburden Material Quantities

Item	Value
Effective Unit Weight	1.86 t/m³
Effective Moisture Content	52 %
Total Overburden Weight	11,200,000 t
Total Overburden Volume	6,021,000 m³
Effective Solids Content (By Weight)	66%
Effective Water Content (By Weight)	34%

Source: Wardrop, 2009b

Table 5-5 Design Basis Criteria for the ODF

Item	Value
In situ Solids Weight	
In situ Water Weight	
Solids Weight	7,347,000 t
Water Weight (at 50% water to 50% solids by weight)	7,347,000 t
Total Weight	14,694,000 t
Solids Volume	6,022,000 m³
Water Volume	7,347,000 m³
Total Volume	13,369,000 m³

Source: adapted from Wardrop, 2009b

ODF Design

The ODF will be surrounded by a perimeter dyke that will be approximately 4.5 m above the local topography and the dyke crest will be 12 m wide to accommodate construction traffic and facilitate feeder and discharge pipes (Wardrop, 2009b). Peat will be left in place in the dyke foundation.

The discharge of dredged peat and clay slurry will be through a number of discharge pipes spaced out along the ODF dyke crest. Carriage water that was used to transport the solids will be released from the ODF through a series of stop log weirs constructed in the perimeter dyke at the central apex of the ODF. The weirs will pass the water into a triangular collection pond contained by another dyke. The collected carriage water will then be reused for dredging operations. In addition, a 0.3 m perforated HDPE or ADS pipe will be installed in the ODF apex to enhance carriage water collection efficiency during and post the dredging operations (Wardrop, 2009b).

Dredging Operations

The peat and clay soils will be removed using a hydraulic dredging process utilizing a boom mounted rotating cutter attached to barge. The boom will have sufficient length and flexibility to cut the overburden material to vertically and horizontally control the cutter to accurately remove the overburden materials to the desired plan and profile (Wardrop, 2009b).

The selection of the cutter head size and number of dredge units will be identified in the detailed engineering design with input from dredging contactors. Preliminary discussions with a dredging contractor suggest that two 1 m diameter cutter units may be required for the Minago Project. Water will be added at the cutter head to facilitate the conveyance of the solids to the ODF. The water and solids slurry will be pumped through a pipeline system by booster pumps to the ODF and discharged within the operating cell of the ODF (Wardrop, 2009b).

During the dredging operation, the slurry is expected to be comprised of 20% solids and 80% water by weight. For the planned 8-month dredging period, the estimated dredging production will be approximately 25,000 m^3/day (46,500 tonnes/day) of *in situ* overburden (Wardrop, 2009b).

The disposal strategy will involve perimeter discharge of a peat and clay slurry starting along the western side of the southern leg of the ODF and continuing in parallel along the northern and southern sides. The same strategy will apply to the eastern ODF leg where the deposition will start at the northern side and will continue along the western and easterm sides. The dredged material is expected to form a beach at a 0.3 % slope and a 2 % subaqueous slope (Wardrop, 2009b). The beach will divert decant water towards the pervious dyke section. Decant water from the dredging operations will be collected in the decant water collection pond,.

The outboard pond dyke will be constructed out of coarse limestone rock fill that will be 4 m high, a 0.5 m of fine limestone rock fill on the upstream side, and a 0.3 m thick inboard clay liner to increase the dyke’s water holding capacity.

To effectively manage water release and to support continued dredging operations, a total of three 1.3 m in diameter corrugated metal pipe (CMP) will run through the dyke (laterals) and these will be connected to perforated standpipes installed within the pond (Wardrop, 2009b). Collected water will be returned to the dredging operations for continued dredge water demand. It is estimated that over the eight months dredging period, approximately 7.4 Mm^3 of make-up water will be required. To support the dredging operations and assuming a 15 percent water loss, the estimated make-up water demand will be approximately 35,000 m^3/day (Wardrop, 2009b).

Water pumped from the pit dewatering wells will be used for the dredging operations. The cone of depression created by the groundwater dewatering wells will provide under drainage for the overburden clays. This will be considered in geotechnical analyses for major site earth/rock fill structures.

The water level in the dredging pit will be drawn down at the end of the dredging period to assist in the de-watering of the dolomite (Wardrop, 2009b).

On closure, the ODF will be reshaped and revegetated and overflow will be directed to the ditch near Highway #6 that reports to Oakley Creek (Wardrop, 2009b).

Material Properties

Assumed foundation material properties (CL, CH and bedrock) were based on field and laboratory data. Assumed properties for peat, coarse and fine rockfill, and dredged peat and clay were based on previous experience and professional judgement

ODF Seepage Results

Seepage through the embankment was estimated using Seep/W for a one meter wide slice or rockfill material against the upstream perimeter of the dam. The computed seepage quantities for sections D1 and D2 were in the order of 50 m^3/day. The initial seepage rate is expected to be much higher until a seal is created by the discharged peat and clay (Wardrop, 2009b).

Construction Considerations

Peat Overburden

The in-situ peat is unsuitable for construction purposes, but it may have potential for use in site reclamation. If pre-loaded, the peat may be used as foundation material for structures that are not sensitive to settlements, such as waste rock dumps (Wardrop, 2009b). Pre-loading tests on the peat were not carried out for determination of consolidation characteristics. These tests will be conducted during the detailed engineering design phase.

Clay Overburden

The construction of water containment structures and dykes across the site will require low permeability materials. Site clays were assessed during the pre-feasibility and feasibility geotechnical investigations and the results of laboratory tests on selected clay samples may be summarized as follows (Wardrop, 2009b):

- The optimum moisture content ranged from 16.3% to 18.6% at standard Proctor maximum dry densities (SPMDD) ranging between 1,600 and 1,752 kg/m^3.
- Clay with natural moisture contents reasonably close to the optimum for compaction may be found within the uppermost 5 m of the deposit. The moisture content of the tested clays was typically well above the optimum at depths greater than 5 m. The natural moisture content of tested clay was generally higher than 20%.
- It was found that site areas with shallow thickness of overburden contained stiff clays that exhibited natural moisture contents close to the optimum for compaction.
- Clay properties may not be favourable for conventional rolled fill applications without additives such as lime and this needs to be factored into the designs. The use of such additives may be cost prohibitive (Wardrop, 2009b).
- Recovery of clays from perennially flooded terrain will pose formidable logistical challenges as the muskeg/peat is water logged. More specifically, these areas will require that the muskeg/peat are bermed off so that the upper stiff clay may be excavated in a "dry" condition. Also, clays may experience moisture uptake during excavation even if the borrow areas are bermed off (Wardrop, 2009b).

5.2 Tailings Waste Rock Management Facility

The layout of the Tailings and Waste Rock Storage Facility complete with associated appurtenances is given in Figure 1-.2. The facility will store 25.1 and 35.6 Mt of tailings and ultramafic waste rock, respectively.

The water balance studies performed by Wardrop shows that the facility will operate with a net water surplus. In order to minimize the amount of runoff from entering the TWRMF, Victory Nickel will install diversion ditches along the upland flank of the tailings impoundment. In addition, a seepage recovery ditch will also be installed to capture leakage through TWRMF.

Tailings supernatant waters will be discharged to the polishing pond before the water is discharged into the receiving environment. An emergency spillway will also be maintained during mining operations to allow discharge of water under severe storm conditions.

The tailings are non-acid generating (NAG). The ultramafic waste rock is potentially acid generating (PAG) and is expected to be disposed of under the planned closure scenario, with the tailings under a "wet" closure, to avoid ARD or ML from the ultramafic rock store in the TWRMF. A permanent water cover is proposed in order to keep the materials saturated. Tailings and ultramafic waste rock geochemical characterization data are covered elsewhere.

The tailings (NAG) and ultramafic rock (PAG) will be disposed of in the Tailings Waste Rock Storage Facility (TWRMF) to mitigate ARD. The wet closure option calls for maintaining a minimum of 1 to 2 metres of water cover.

TWRMF Description

The TWRMF consists of a tailings dam (storing tailings and ultramafic waste rock), a seepage recovery dam, seepage collection ditches, a spillway and a polishing pond. The general layout of the TWRMF is shown in Site Plan given in Figure 1-2. The TWRMF will have a capacity to store tailings and ultramafic waste rock in the order of magnitude of approximately 25 Mt and 36 Mt respectively. The estimated volume for the tailings and ultramafic waste rock is 40 million m^3.

5.2.1 Tailings and Ultramafic Waste Rock Management Facility and Polishing Pond

The Tailings and Ultramafic Waste Rock Management Facility (TWRMF) is a key component of the water and waste management system at Minago for tailings, liquid waste and ultramafic waste rock. The disposal of tailings and waste rock has been studied from a number of different perspectives. The selected alternative is tailings co-disposal with ultramafic waste rock behind a lined rockfill embankment dam. Muskeg and/or clay will be forming the base of the embanked repository. The remaining waste rock will be disposed of in the Dolomite Waste Rock Dump, if it is dolomite/limestone, or in the Country Rock Waste Rock Dump otherwise.

The TWRMF location within the project area (Figure 1-2) was selected to take into account factors such as the exclusion zones, the distance from the open pit and the favourable subsurface conditions, including shallow soft clay overburden (Wardrop, 2009b).

One key objective for the co-disposal is to initially induce invasion of tailings into the voids of end-dumped PAG/ML waste rock to encapsulate the PAG waste rock in tailings for the ultimate goal of providing acceptable seepage water quality from the facility. Other key objectives are to facilitate closure without long-term water treatment and to significantly lower CAPEX/OPEX and closure cost (Wardrop, 2009b).

Material in the TWRMF will be stored subaqueously whenever possible. Subaqueous disposal is practiced at many metal mines to keep oxidative rates at a minimum and to minimize metal leaching. Based on geochemical work done to date, Minago's mill tailings contain low sulphide levels and were deemed to be non acid generating (NAG) (URS, 2009i). Sulphide levels were less than or equal to 0.07 % in the Master tailings samples tested. However, ultramafic waste rock has been found to be potentially acid generating (PAG) (URS, 2009i).

The TWRMF will remain in place after all operations have ceased at the site. The TWRMF inflow will consist of:

1) mill tailings;
2) tailings and liquid waste from the Frac Sand Plant;
3) outflow from the sewage treatment system;
4) sludge from the potable water treatment plant; and
5) precipitation.

Outflows from the TWRMF include the TWRMF Decant, losses due to evaporation and sublimation, and seepage. Seepage will be captured by interceptor ditches surrounding the TWRMF and will be pumped back to the TWRMF. The seepage design criteria has tentatively been set at 250 m^3/day to satisfy walk-away requirements (Wardrop, 2009b). The TWRMF Decant will be discharged to the Polishing Pond (Figure 1-2) and will be regulated automatically by a control system.

5.2.2 TWRMF Design Criteria

The TWRMF design requires compliance with permitting requirements as well as dam design and water quality guidelines. The TWRMF dam design is controlled to a significant extent by the presence of weak peat and clay foundation soils and a sufficient separation of the dam from Highway 6. The TWRMF must accommodate a total of 27.4 Mt of nickel and frac sand tailings and 36 Mt PAG-waste rock over the course of 9 years and provide secure storage for the long-term.

The Design Basis and Basic Engineering Design Parameters are summarized in Tables 5-6 and 5-7, respectively. Additional Design Criteria for the TWRMF are as follows (Wardrop, 2009b):

- The rate for the construction of successive stages of the TWRMF Dam should be governed by foundation strength and consolidation characteristics as well as the mine waste production schedule.
- The cone of depression created by pit dewatering is predicted to extend laterally in the dolomite to a distance of approximately 5,000 m to 6,000 m from the proposed open pit. The cone of depression will provide under drainage for the overburden clays and should be considered in geotechnical analyses for the TWRMF dam.
- A designated decant pond should be located between the causeways.
- The tailings deposition plan should ensure minimal exposure of PAG waste rock to atmospheric conditions during operations, closure and post closure.
- The configuration of PAG waste rock within the facility should allow for 2 m tailings cover at the end of the tailings deposition.
- Based on experience, tailings deposition slopes of 0.5% sub-aerial and 2% subaqueous should be assumed in the design.

5.2.3 Deposition Plan for the TWRMF

Construction of the TWRMF dam will take place in 2011 and 2012. Concurrently disposed tailings and ultramafic waste rock will be fully contained behind a perimeter dam to be constructed as a part of a robust operation. Key elements of the concurrent disposal of tailings and ultramafic waste rock in the TWRMF are illustrated in Figure 5-1 and the deposition strategy is briefly described in the following paragraphs (Wardrop, 2009b):

- In order for the frac sand deposition to start and subsequently to support the initial phase of Ni-tailings deposition in 2014, a dolomite waste rock base will be constructed where the coarse PAG-waste rock rind will be placed and underneath the north and south causeways. The construction of the dolomite waste rock base will be completed during the last stages of the TWRMF dam construction in 2012.

Table 5-6 Design Basis for the TWRMF

Item	Value
Life of TWRMF	9 years
Total Nickel Tailings (tonnes)	24,847,889
Total Sand Tailings (tonnes)	2,571,804
Total Combined Tailings to TWRMF (tonnes)	27,419,693
Total PAG Waste Rock (tonnes)	35,660,000
Tailings Specific Gravity (Nickel)	2.6
Initial Tailings Void Ratio (Nickel)	1.0
Initial Tailings Density (Nickel)	1.3 t/m^3
Average Final Tailings Density (Nickel)	1.5 t/m^3
Tailings Pulp Density (solid weight) (Nickel)[1]	45%
Water in Tailings Voids (Nickel)	22%
Average Initial Tailings Density (Sand)	1.4 t/m^3
Average Final Tailings Density (Sand)	1.6 t/m^3
Tailings Pulp Density (solid weight) (Sand)	20%
Ultramafic Waste Specific Gravity	2.59
Ultramafic Waste Swelling	30%
Void Space in PAG Waste Rock	4,130,502 m^3
Void Space in Coarse PAG Waste Rock	3,304,402 m^3
Void Space in Fine PAG Waste Rock	826,100 m^3
Total Volume of Ni Tailings	16,565,259 m^3
Total Volume of Sand Tailings	1,607,378 m^3
Total Combined Tailings Volume	18,172,637 m^3
Total PAG Waste Rock (solids and voids)	17,898,842 m^3
Total Ni-Tailings Ingress into Voids of Coarse Ultramafic Waste Rock (at initial tailings density)[2]	2,478,301 m^3
Total Ni- and Frac-Sand Tailings ingress into Voids of Fine Ultramafic Waste Rock (at initial tailings density)[3]	413,050 m^3
Total Ni-Tailings Between the Ultramafic Waste Rock Rind and Central Causeway (at final tailings density)	15,376,725 m^3
Required TWRMF Storage	33,275,567 m^3
Required TWRMF Storage (with 15% contingency included)	38,300,000 m^3

Source: adapted from Wardrop, 2009b

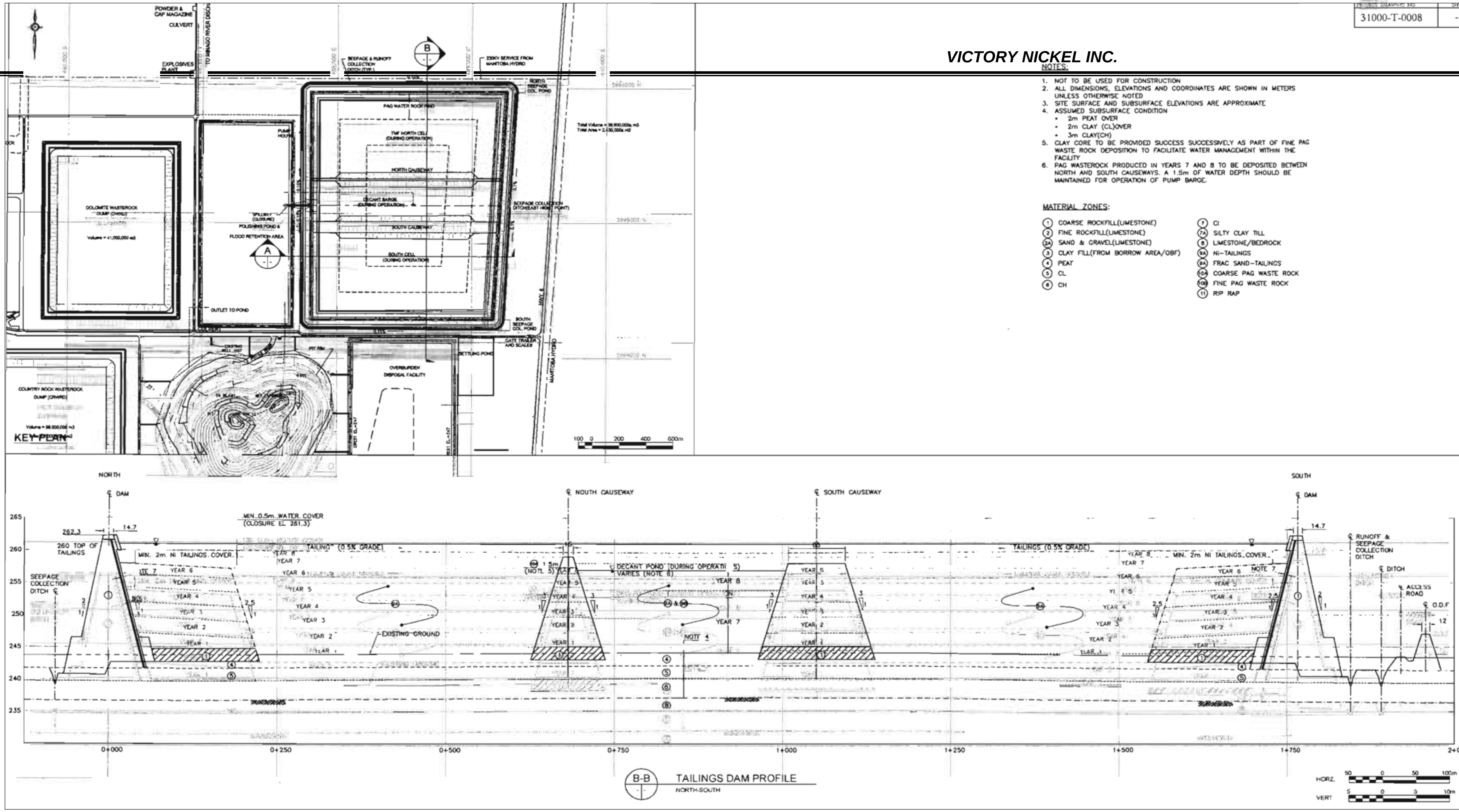
NOTES:

1. A 45% solids density is used in the feasibility study water balance. However, higher water-to-solids ratios to enhance transport into and through the rock fill may be considered in the detailed engineering.
2. Coarse ultramafic waste rock, represented by fractions larger than 0.2 m, is estimated to be 80% of total ultramafic waste rock. Infilling of voids within coarse ultramafic waste rock with tailings is estimated to be 75%. Ingressed tailings were assumed to remain at their initial density due to the relative incompressibility of the waste rock matrix.
3. Fine ultramafic waste, represented by fractions finer than 0.2 m, is estimated at 20% of total ultramafic waste. Infilling of voids within fine ultramafic waste rock with tailings is estimated to be on the order of 50%. Ingressed tailings are assumed to remain at their initial density due to the relative incompressibility of the waste rock matrix.

Table 5-7 Basic Engineering Design Parameters for the TWRMF

Item	Target	Comments
1. Geotechnical Slope Stability		
• Construction (in stages)	• Static F.O.S. 1.3, pseudo static F.O.S 1.05.	
• Normal Operating	• Same as above.	
• Closure	• Static F.O.S. 1.5, pseudo static F.O.S 1.05.	
2. Seepage	• Limit on Contaminants of Concern (CoC) concentrations	• Analyses using SEEP/W targeting a total estimated seepage volume less than 250 m^3/day. • Low permeability barrier to be provided on the upstream face of the containment structure to reduce seepage through the ultramafic waste rock – tailing composite. • Seepage from the TWRMF to be collected via collection ditches and ponds.
3. Hydrotechnical • Construction Diversion Peak Flow	• 1:20 yr - 24 hr rainfall	• All peak flows are estimated from catchment times of concentration and storm. Seepage to be collected via collection ditches reporting to the overall water management system.
• Operation peak flow	• 1:200 yr – 24 hr rainfall	
• Closure Spillway and Diversion peak flow	• 1:1,000 yr – 24 hr rainfall	• Determine wave run-up in the freeboard.
• Freeboard	• 1.0 m on the top of Closure Spillway wet section for 1:200 year runoff	
• Closure Flood	• 1:1,000 yr – 24 hr rainfall	
• Runoff Coefficient	• 1	
4. Decant System (if applicable) • Water Storage	• Minimum five days retention or 1.5 m of water level at all times, whichever is higher	
5. Closure Cover	• A minimum of 0.5 m of water on the top of final tailings at the containment structure.at all times.	• Runoff (dry year), seepage, infiltration and evaporation to ensure a minimum thickness water cover.
6. Seismicity • Operating Design Basis Earthquake	• 1: 475 year return	
• Closure Earthquake	• 1:2,475 year return	

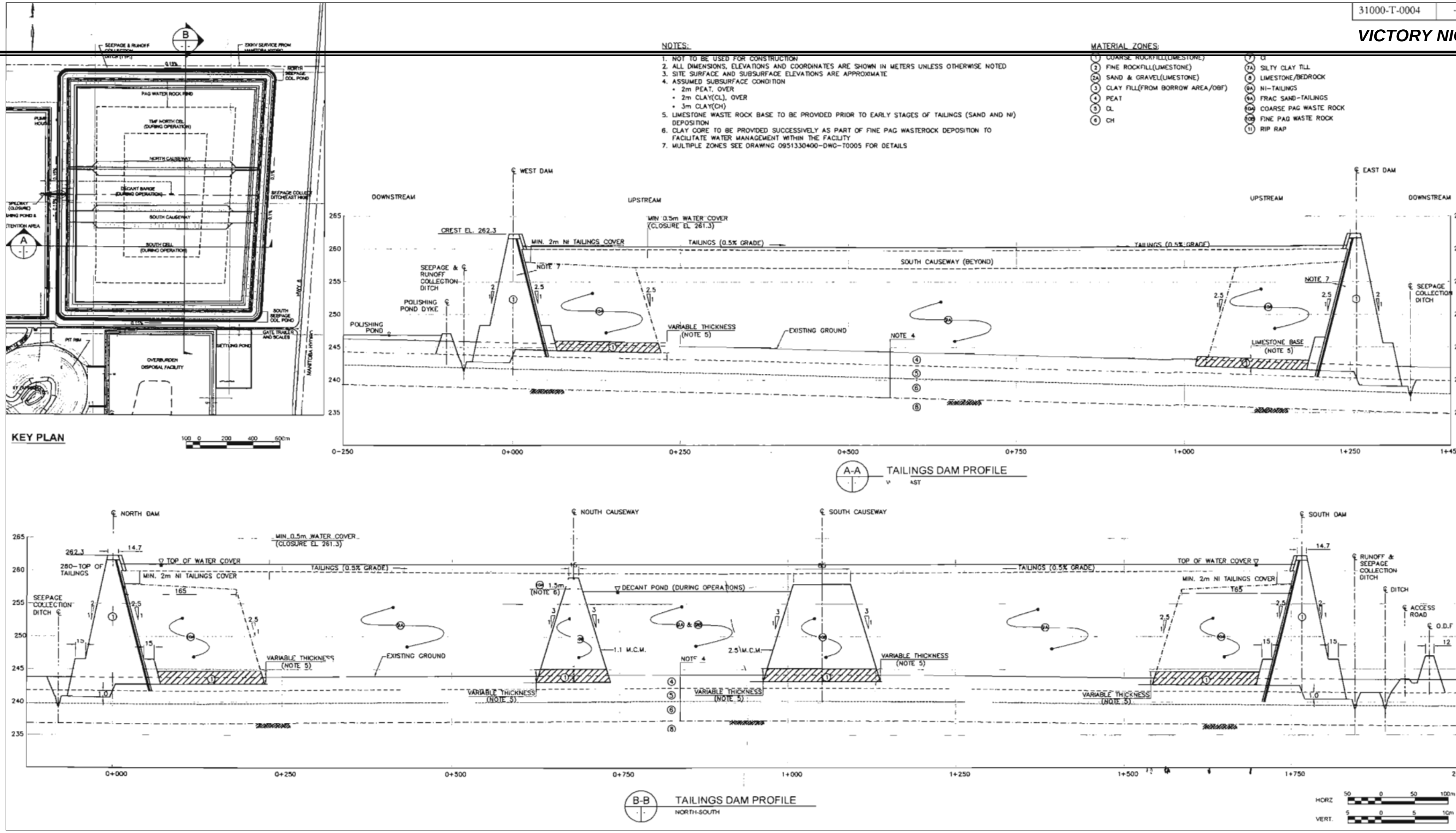
Source: Wardrop, 2009b



Source: adapted from Wardrop's drawing 0951330400-T0008 (Wardrop, 2009b)

Figure 5-1 Deposition Plan and Profiles of theTailings and Ultramafic Waste Rock Management Facility

- The retaining structure construction will be carried out in lifts corresponding to yearly ultramafic waste rock production. A 1 m clay liner will be provided between the rind and the upstream face of the dam. The clay liner in between the waste rock rind and the dam will ensure full containment by minimizing seepage reporting to the downstream environment as per design criteria. The TWRMF plan and profile is given in Figure 5-2.
- The clay cutoff trench within the north causeway will facilitate intermittent flooding and dewatering in both of the cells (north and south cells). Maximizing PAG waste rock saturation during waste rock placement will minimize oxidation and reduce their ARD/ML potential.
- The coarse ultramafic waste rock (estimated at 80% of total PAG-waste rock production) will be deposited in a rind to be constructed immediately upstream of the dam. The rind construction will be carried out in lifts corresponding to the yearly PAG waste rock production.
- The fine ultramafic waste rock (estimated at 20% of total PAG-waste rock production) will be deposited in the north and south causeways. The north causeway will have a clay cutoff trench built in stages, also in accordance with the yearly waste rock production schedule.
- Ultramafic waste rock will be placed simultaneously in both the northern and southern cells and flooding will closely follow advancement of the ultramafic waste rock placement. Dewatering of the north cell will take place prior to the start of tailings deposition in order promote hydraulic gradients and thereby increase invasion of Ni-tailings into the void space of the ultramafic waste rock. Tailings deposition in the northern cell will take approximately 6 months. Dewatering of the southern cell will precede Ni-tailings placement and it will take another 6 months to complete the deposition in the southern cell.
- Ni-tailings deposition will be carried out from the dam crest by running feeder pipes from the main tailings supply pipe at the dam crest and down the upstream dam slope. The feeder pipes will eventually distribute tailings over the rockfill through perforated spreader pipes. Ripping of the uppermost PAG-waste rock surface might be done as an expedient to open up the uppermost fines in order to promote tailings ingress into the waste rock void space.
- Ultramafic waste rock placement and tailings deposition will alternate in the same fashion for 6 years. During this time, a decant pond will be created between the north and south causeways from which water will be pumped to the Polishing Pond (Figure 1-2). In 2019 and 2020, coarse ultramafic waste rock will be deposited in the area between the north and south causeways. A minimum of 1.5 m of decant water above the waste rock will be maintained to facilitate free flow and prevent potential blockage during operations of barge mounted pumps. An alternative arrangement may be pumping from perforated decant towers installed within the rockfill placed in causeways. This alternative will be examined more closely in the detailed design stage.



Source: adapted from Wardrop's drawing 0951330400-DWG-T0004 (Wardrop, 2009b

Figure 5-2 Tailings and Ultramafic Waste Rock Management Facility (TWRMF) Dam Plan and Profile

- In 2019 and 2020, the ultramafic waste rock in the rind will receive a minimum of 2 m of Ni-tainings cover by peripheral discharging from the dam crest. It is estimated that the slopes for the tailings beach and the subaqueous tailings will be 0.3% and 2%, respectively.
- The frac sand tailings deposition will be carried out from the top of causeways until the Ni-tailings deposition ceases. Thereafter, sand tailings will also be deposited from the dam crest through the main tailings supply pipe system.
- After Ni-tailings deposition will have ceased, frac sand tailings will be deposited as a final layer on top of the Ni-tailings. Frac sand tailings will be produced approximately 2 years longer than the Ni-tailings. Frac sand tailings have low metal concentrations and will leave the top surface of the TWRMF in an inert condition. On top of the Frac sand tailings, a minimum of 0.5 m of water cover will be provided on closure.

Concurrent disposal of tailings and ultramafic waste rock will ensure total encapsulation of PAG-waste rock on closure and the water cover will ensure subaqueous disposal, both of which will minimize ARD/ML concerns.

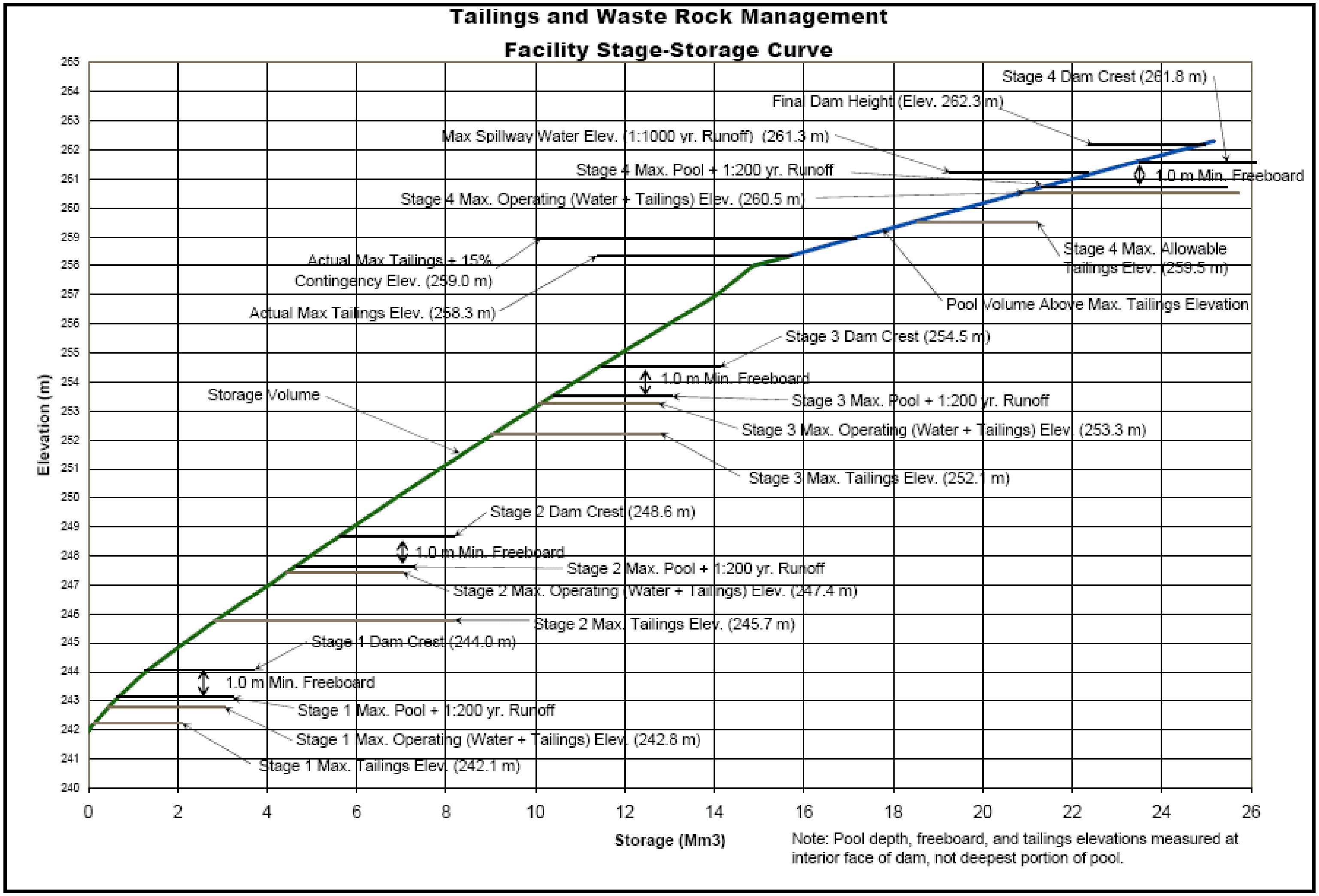
Decant from the TWRMF will be discharged to the Polishing Pond to address concerns regarding the resuspension of tailings due to wind and wave action on the water cover. Suspended solids will settle out in the Polishing Pond prior to water discharge from that facility to the receiving environment.

Figure 5-3 shows stage storage curve with critical design elevations for the TWRMF based on estimates given in Minago's Feasibility Study (Wardrop, 2009b).

5.2.4 TWRMF Dam Section Design

The dam will be located in an area where the geotechnical profile lends itself to a higher containment structure with a small footprint. Also, the geotechnical profile will allow for construction staging to meet the mine production schedule. To bound uncertainties related to extrapolation of confirmed shallow overburden characteristics in the southeastern part of the TWRMF, a deeper overburden was assumed to underlie the rest of the TWRMF in the geotechnical analyses considered in this report. Final confirmation of the TWRMF foundation will be part of a detailed design geotechnical investigation. The plan and profile of the TWRMF is shown in Figure 4-5 with typical dam sections illustrated in Figure 5-2.

The TWRMF dam was designed as an earth/rockfill structure varying in settled height from approximately 19 m to 21 m above the local topography. Peat will be left in place within the upstream part of the dam foundation and removed along with a 1.0 m of soft underlying clay within



Source: Wardrop, 2009b

Figure 5-3 TWRMF Stage Storage Curve

the downstream part. The upstream and downstream dam slopes of the rockfill dam will be 2.5H:1V and 2H:1V, respectively (Wardrop, 2009b).

Based on stability analyses, the dam will be constructed in four (4) stages to meet the consolidation requirements. The construction schedule will be planned so that the end of previous stage coincides with the start of the subsequent stage. The heights of dam fill will be up to 4.5 m and 6 m for Stages 1 and 2 and Stages 3 and 4, respectively. Stabilizing berms (4.5 m high and 15 m wide downstream and upstream) will be required prior to the start of the Stage 2 lift.

The construction of the dam will take two years from the start in “2012” (Year -1) to completion at the end of “2013” (Year +1). The dam shell will be constructed of coarse rockfill (Zone 1 material) comprising an estimated 800 mm minus dolomite waste rock originating from the open pit. The upstream side of this zone will support a 0.5 m thick zone of fine rockfill (Zone 2 material) comprised of minus 75 mm dolomite waste rock and finally a 0.5 m sand and gravel zone (Zone 2A material). The dam will have an upstream clay lining with a nominal thickness of 1 m placed over the Zone 2A in four sequences as briefly described below.

Sequence 1: The clay liner will extend through peat to be keyed in the native clay. The clay liner (Zone 3) will be provided in a feather-edge like gap between the top of Zone 2A on the dam upstream slope and Zone 1 within the upstream stabilizing berm. This will coincide with the completion of about 1.2 m thick lifts within the upstream stabilizing berm constructed ahead of the start of the Stage 2 lift within the main dam structure (Wardrop, 2009b).

Sequence 2: The clay liner (Zone 3) will be provided in a feather-edge like gap as depicted on Detail 1 between the top of Zone 2A on the dam upstream slope and Zone 10A within PAG-waste rockfill rind. This will coincide with the completion of about 50% of yearly lift thicknesses within Zone 10A (PAG-waste rock rind) (Wardrop, 2009b).

Sequence 3: A 1.0 m clay (Zone 3) liner above the PAG rockfill rind will be placed over Zone 2A at the dam upstream slope ahead of tailings discharge (Wardrop, 2009b).

Sequence 4: Extention of the clay (Zone 3) liner to the dam crest will be placed ahead of the water cover implementation. The thickness of the Zone 3 in this last stage will increase as dictated by a 3H:1V upstream slope. The clay liner in this uppermost zone will be protected with a 0.5 m thick fine rockfill (Zone 2), which in turn will be covered by a 1.0 m of rip rap (Zone 11) to protect the dam crest from the ice scour action. In initial stages, material for Zone 3 will be obtained from local borrow pits containing stiff clays. Subsequently, Zone 3 material may be obtained from the ODF, if it meets design specifications (Wardrop, 2009b).

A 0.3 m thick pavement surface composed of Zone 2 material will be provided on the dam crest. Appropriate safety berms composed of Zone 2 material will also be provided on the crest (Wardrop, 2009b).

Dam Stability and Settlement Analyses

Dam stability and settlement analyses were carried out in support of developing a dam design section that satisfies design basis and criteria outlined in Tables 5-6 and 5-7

Methods of Analysis

Coupled analyses using Sigma/W and Slope/W, components of GeoStudio 2007, were used in the dam stability and settlement analyses. Sigma/W uses finite element methods to solve both stress-deformation and seepage dissipation equations simultaneously. Pore water pressures generated during lift placement were calculated with Sigma/W and then incorporated into Slope/W for stability analysis. Slope/W was used to locate failures with the least factor of safety within defined search limits (Wardrop, 2009b).

In the modelling, initial pore pressure conditions were specified with an initial water table at the ground surface. Zero pressure boundary conditions were applied to the bottom of the bedrock to model dewatering wells pumping water out of the bedrock layer.

Sigma/W modelling of the dam's section assumed that the first lift will be placed on the first day, and that 6 months will pass thereafter for consolidation. Slope stability analyses were performed assuming that 10 days had passed since the lift had been placed and at the end of 182 days. All four lifts were modeled assuming no waste rock or tailings had been placed on the upstream side of the TWRMF until construction was completed (Wardrop, 2009b).

Another analysis was performed that simulated conditions six months after the completion of the facility, assuming that the waste rock and tailings had been placed at the same time. The total computed construction time of the facility was assumed to be 2 years (Wardrop, 2009b).

A small buttress with a height of 4.5 m and a width of 15 m was incorporated into the design on both the upstream and the downstream sides of the TWRMF. Construction of these buttresses was assumed to coincide with the time of placement of the Stage 2 lift to enhance stability (Wardrop, 2009b).

Pseudo static analyses were completed to simulate earthquake conditions using 0.03 g (50% of the Peak Ground Acceleration (PGA) for a 1:2,475-year return period), which is consistent with generally accepted practices adopted by the United States Army Corps of Engineers (Hynes-Griffin and Franklin, 1984).

Assumed Material Properties

Assumed material properties for the foundation materials (CL, CH and bedrock) were based on field and laboratory data. The properties of the waste rock (dolomite and PAG/ML (ultramafic), coarse and fine rockfill material were estimated based on previous experience and professional judgement (Wardrop, 2009).

Results of Dam Stability and Settlement Analyses

5.2.5 Geotechnical Construction Considerations for the TWRMF

All peat/muskeg and the soft clay layer underneath the peat must be removed from the downstream part TWRMF dam foundation and the runoff/seepage collection ditch (Wardrop, 2009b). The muskeg/peat excavated from the downstream part of the TWRMF dam foundation will be disposed of in the Overburden Disposal Facility (ODF). The muskeg/peat removal will require prior excavation of a system of drainage ditches reporting to the collection ditch that will coincide with the future runoff/seepage collection ditch located immediately east of the eastern side of the future TWRMF dam.

The system of drainage ditches will excavated in the winter as the frozen top of the muskeg will facilitate movement of construction equipment. The rate/depth of frost penetration may also be accelerated by snow removal in the construction area (Wardrop, 2009b).

Coarse Rockfill (Zone 1)

Dolomite waste rock from the open pit will be the source of coarse rockfill (Zone 1 material) for the construction of the TWRMF dam and dolomite rockfill base for the ultramafic waste rock rind and north and south causeways construction. Grading requirements for the coarse rock material are shown in Table 5-8.

Fine Rockfill (Zone 2)

Filter criteria were used to determine the rockfill (Zone 2 material) gradations presented in Table 5-9. The Zone 2 material will be obtained by primary and secondary crushing of Zone 1 dolomite waste rock.

Table 5-8 Gradation Requirements – Coarse Rockfill (Zone 1)

Dimension or U.S. Standard Sieve Size (mm)	% Passing by Weight
810	100
450	60-100
200	37-100
130	25-60
75	10-45
25	0-15
#4	0

Source: Wardrop, 2009b

Sand and Gravel (Zone 2A)

There are no known natural sources of sand and gravel within economic distances for the Minago project. Therefore, Zone 2A material may have to be obtained by further crushing some of the Zone 2 dolomite rockfill.

Table 5-9 Gradation Requirements – Fine Rockfill (Zone 2

Dimension or U.S. Standard Sieve Size (mm)	% Passing by Weight
75	100
50	90-100
30	60-100
25	54-100
19	46-60
#4	10-22
#8	0-7
#16	0

Source: Wardrop, 2009b

Clay (Zone 3)

Clay (Zone 3 material) that will be used in the upstream TWRMF dam liner and in cut-off trenches will be initially obtained from local borrow sources within the uppermost “drier” clay. This may be replaced with clay deposited in the ODF, if it is of suitable quality.

5.2.6 TWRMF Associated Facilities

Runoff Diversion Berm

Surface water runoff will be diverted away from the TWRMF by the construction of a runoff diversion berm along its western and eastern sides. Diverting surface water will decrease the amount of water entering the system. The diversion berm will be constructed using peat and clay from the excavaton of the runoff collection system.

Runoff and Seepage Collection System

The runoff and seepage collection system will collect seepage and precipitation that falls on and near the TWRMF dam. Runoff will be collected in ditches built around the entire perimeter of the TWRMF and directed to two existing ponds, located to the northeast and southeast of the dam. Water reporting to the ponds will be pumped back to the TWRMF.

The western and eastern sides of the TWRMF will have ditch inverts sloped at 0.10%. The flow divide will be at the mid point of the western and eastern sides of the facility from where the water will be diverted north and south. The northern and southern ditches will slope at 0.15% and report to the southern and northern collection ponds (Wardrop, 2009b).

The base of eastern and western ditches will be 1.5 m wide and this will increase to 2.5 m for northern and southern ditches. Ditches will be have side slopes of 2.5H:1V and 4H:1V in native clays and peat, respectively. There will be a 0.5 m setback at the peat and clay interface. All of the ditches will be designed to have freeboard within peat without erosion protection for the design ditch invert slopes (Wardrop, 2009b).

5.2.7 TWRMF Dam Classification

Dam classification in accordance with the Canadian Dam Association Dam Safety Guidelines 2007 (CDA) is based on the evaluation of the consequences of dam failure in terms of risk to population, loss of life, and environmental, cultural, and economic losses. The TWRMF dam can be classified as “Significant Dam Class” and the selection of the hydrology, hydrotechnical and seismic design criteria presented in previous sections were selected in accordance with the CDA criteria considering the following:

- Dam is located in an unpopulated area of Manitoba, relatively far away from urban settlements.

- During the life of the mine, only personnel required for the operation of the mine will be temporarily resident near the mine.
- The temporary housing to accommodate the personnel of the mine and the infrastructure for the processing of the ore will be located at a distance of approximately 2 km from the TWRMF dam.
- Co-disposal of rockfill and tailings provides additional reinforcement of the dam structure which minimizes potential of a dam breach resulting in uncontrolled discharge of tailings towards to the open pit (to the southwest) or Highway 6 (to the east) of the TWRMF.

Polishing Pond

Water in the Polishing Pond will be contained by a perimeter dyke. The dyke is designed as an earth/rock fill structure varying in height from 4.0 m to 6.0 m above the local topography. The upstream and downstream embankment slopes will be 3H:1V and 2H:1V, respectively. The dyke is scheduled to be raised in 2011 prior to the end of the dredging operations to receive water from the open pit dewatering coinciding with the last phase of the dredging operations.

The main rock fill zone (Zone 1) of the Polishing Pond dyke will be composed of 800 mm minus coarse rock, supporting a 0.5 m thick zone of 75 mm minus fine rock fill, which in turn, will support Geotextile 1200R and a Bentofix liner (Wardrop, 2009b). A 0.5 m clay cover over the Bentofix will be provided for confinement and frost protection. The geotextile at the base of the dyke along with the fine rock fill is designed to prevent migration of fines from the foundation soils into the coarse rock fill. A 0.3 m thick pavement surface, composed of fine rock fill, will be provided over the crest of the embankment (Wardrop, 2009b).

An anchor trench around the upstream toe of the Polishing Pond dyke will be extended approximately 0.5 m into the native clay to ensure full containment of the stored water. The Bentofix liner will be anchored into the trench and backfilled with locally available clay. Dewatering of the cut-off trench may be required to facilitate the installation of the Bentofix liner under dry conditions (Wardrop, 2009b). The dyke embankment will be constructed using rockfill originating from the neighboring limestone bluff located about 2 km west of the Polishing Pond.

6. TAILINGS AND SITE WATER MANAGEMENT SYSTEMS

6.1 Tailings Management System

The Tailings Management Facility (TWRMF) is a key component of the water and waste management system at Minago for liquid waste and tailings. The TWRMF will serve as repository for nickel mill and Frac Sand Plant tailings.

The management system for the Tailings Management Facility (TWRMF) includes the tailings impoundment and its ancillary facilities including a tailings dam, diversion ditches, collection ditches, a spillway and a seepage recovery system.

Minago tailings will be stored subaqueously. Submerging tailings containing sulphide minerals, or "subaqueous disposal", is practiced at many metal mines to keep oxidative rates at a minimum and to minimize metal leaching. Based on geochemical work done to date, Minago's nickel tailings will contain low sulphide levels and were deemed to not become acid generating (URS, 2008a). Sulphide levels were less than or equal to 0.07 % in the Master tailings samples tested.

Tailings slurry will be conveyed to the TWRMF by a high-density polyethylene (HDPE) delivery pipeline. The slurry will then be fed into the dam by spigot deposition. In so doing, beaches of sand-sized tailings will be deposited near the edge of the dam surface, with silt-clay particles settling out at a distance from the spigotting points.

During operations, water storage in the TWRMF will be minimized as much as possible and continuous discharge from the TWRMF will ensure that contaminants will not build up in the water retained by the TWRMF. The design of the facility will include several baffles and/or barriers to encourage the settlement of suspended solids and to ensure that TWRMF decant has a low suspended solids concentration.

The overall operation of the TWRMF during the operational phase, temporary suspension state (TSS), state of inactivity (SI), closure and post closure stages will be reviewed periodically by a competent person to ensure that the tailings management components are functioning as per design criteria and intent. In addition, prior to decommissioning, a comprehensive plan for decommissioning of the TWRMF will be developed and submitted to the Manitoba Government for review and approval and all subsequent decommissioning activities will be carried out according to the approved plan.

6.2 Site Water Management

This Section presents the general site water management, the description and discussion of a water balance model that was developed for the Minago Project based on the mine site layout as shown in Figure 6-1; metallurgical, hydrological, hydrogeological, and geochemical conditions; and related environmental baseline study results obtained to date. The goal is to manage and control site waters to ensure compliance with applicable regulations.

The water management components presented in this Section include:

- twelve dewatering wells to dewater the open pit area;
- a water treatment plant to produce potable water;
- a sewage treatment system (extended aeration system) for the disposal and treatment of on-site grey water and sewage;
- mill and Frac Sand Plant tailings and effluents that will be discharged into a Tailings and Ultramafic Waste Rock Management Facility (TWRMF);
- a Tailings and Ultramafic Waste Rock Management Facility (TWRMF) that will temporarily store tailings and the ultramafic waste rock permanently and effluents from various site operations;
- waste rock dump seepages that will be discharged to the receiving environment or into the TWRMF depending on their water quality;
- overburden dump runoff that will be discharged directly into the receiving environment (if it meets discharge requirements);
- an open pit dewatering system that will ensure safe working conditions in and around the open pit;
- a Polishing Pond and flood retention area to serve as holding pond for water that will either be recycled to site operations or discharged to the receiving environment (if it meets discharge water standards);
- a site drainage system to prevent flooding of site operations;
- site wide water management pumping systems; and
- discharge pipelines to Minago River and Oakley Creek to discharge excess water from the Polishing Pond to the receiving environment.

Among the sources of water that need to be managed are the pit dewatering well water, TWRMF supernatant, and precipitation (rainfall and snowfall). Primary losses of precipitation include sublimation, evaporation, and retention as pore water in sediments and soils. Seepage losses to groundwater (e.g. from the TWRMF), which should increase due to dewatering, will likely be very small due to the thick layer of clay that is underlying the muskeg.

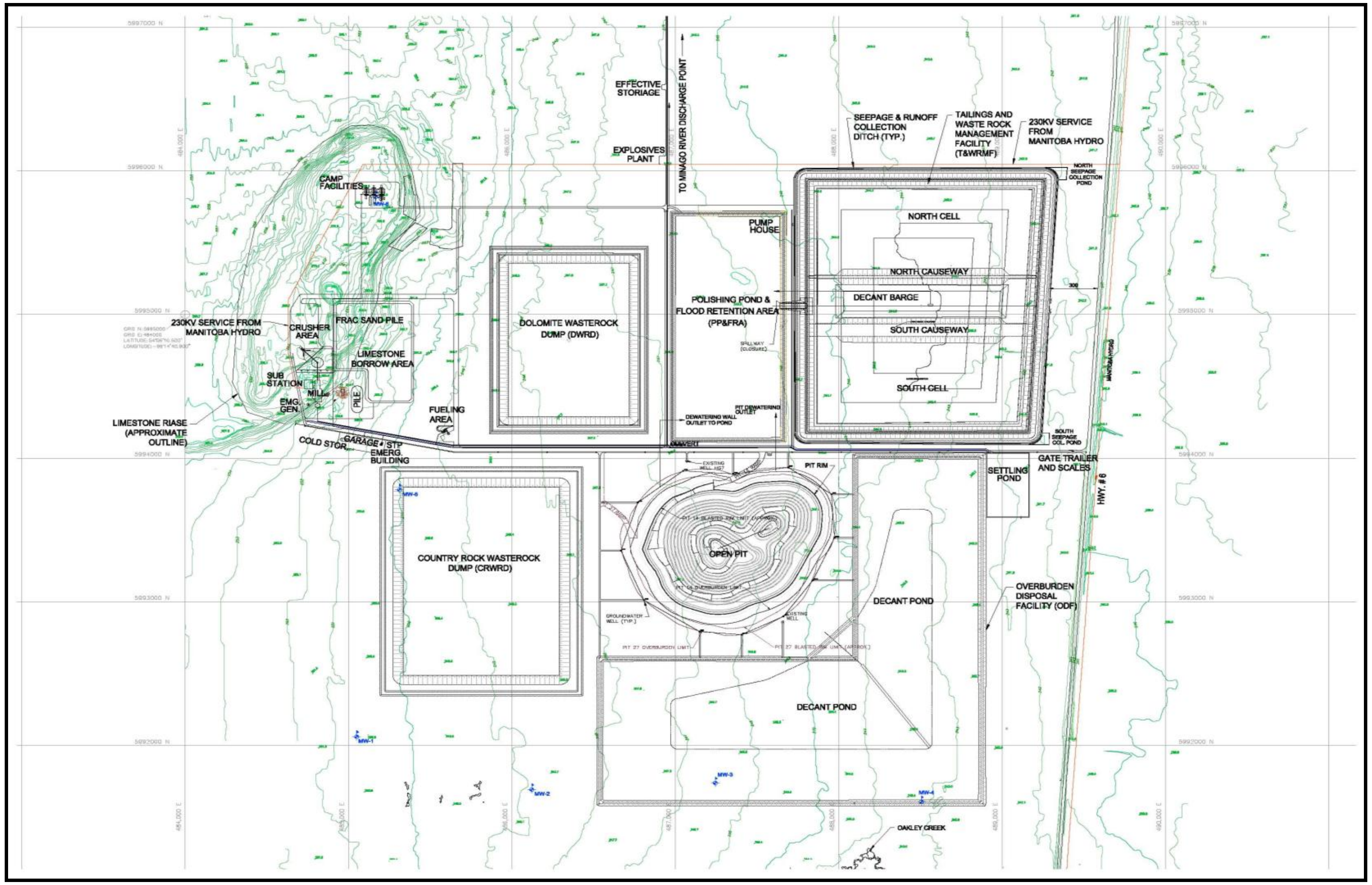


Figure 6-1 Layout of the Mine Site

The vertical hydraulic conductivity (K_V) of the overburden clay, which is an aquitard overlying the limestone, was estimated to range from 4×10^{-9} m/s to 6×10^{-9} m/s and the horizontal hydraulic conductivity, K_H, was estimated to range from 6×10^{-6} m/s to 6×10^{-9} m/s, with a geometric mean of 4×10^{-8} m/s (Golder Associates, 2008b). These hydraulic conductivities are indicative of an anisotropy ratio (K_H/K_V) of 10 (Golder Associates, 2008b).

The Minago Project water management system will be maintained to provide the following aspects:

- meet the MMER Water Quality standards;
- recovery and removal of as much supernatant water as predictable from within the Tailings Management Facility (TWRMF); and
- discharge of water to the environment only upon verification of acceptable quality.

6.2.1 General Description of the Site Water Management System

Water at Minago will be managed to ensure safe working conditions and minimum impacts to the local and regional surface and groundwater flow regimes and the aquatic environment. As water will be managed to suit site activities, the discussion of the site water management system was broken down into the following seven scenarios:

- Water Management during Construction;
- Water Management during Nickel and Frac Sand Plants Operations (Year 1 through Year 8);
- Water Management during Frac Sand Plant Operations (Years 9 and 10);
- Water Management during Closure;
- Water Management during Post Closure;
- Water Management during Temporary Suspension; and
- Water Management during the State of Inactivity.

Closure involves decommissioning of processing facilities and buildings and infrastructure that are no longer needed. The closure period is a transition stage between the operational and the post closure periods.

The post closure period refers to the period after all decommissioning activities of mining facilities and infrastructure have been completed and the site is in its final, post mining state.

"Temporary suspension" means that advanced exploration, mining or mine production activities have been suspended due to factors such as low metal prices and mine related factors such as ground control problems or labour disputes. Temporary suspension does not occur under normal operating conditions. The site will be monitored continuously during the Temporary Suspension (TS) of operations and dewatering of the open pit will continue as it did during operations. TS may become a "State of Inactivity", if the TS is extended indefinitely.

The "State of Inactivity" implies that mine production and mine operations at the mine site have been suspended indefinitely. The State of Inactivity also does not occur under normal operating conditions. The State of Inactivity (SI) may turn into a state of permanent closure, if prevailing conditions for the resumption of operations are not favourable. During the State of Inactivity, mine dewatering will be reduced significantly and only a minimal crew will be assigned to the site to monitor and ensure safety on site.

6.2.1.1 Water Management System during Construction

To facilitate the description of the water management model during construction, key components are illustrated with boxes in a schematic water balance diagram, given in Figure 6-2, and flow(s) in and out of each box are numbered (Q1 through Q24). All flows in the schematic water balance diagram are from left to right.

Following is a description of the water management model during construction, depicted in Figure 6-2:

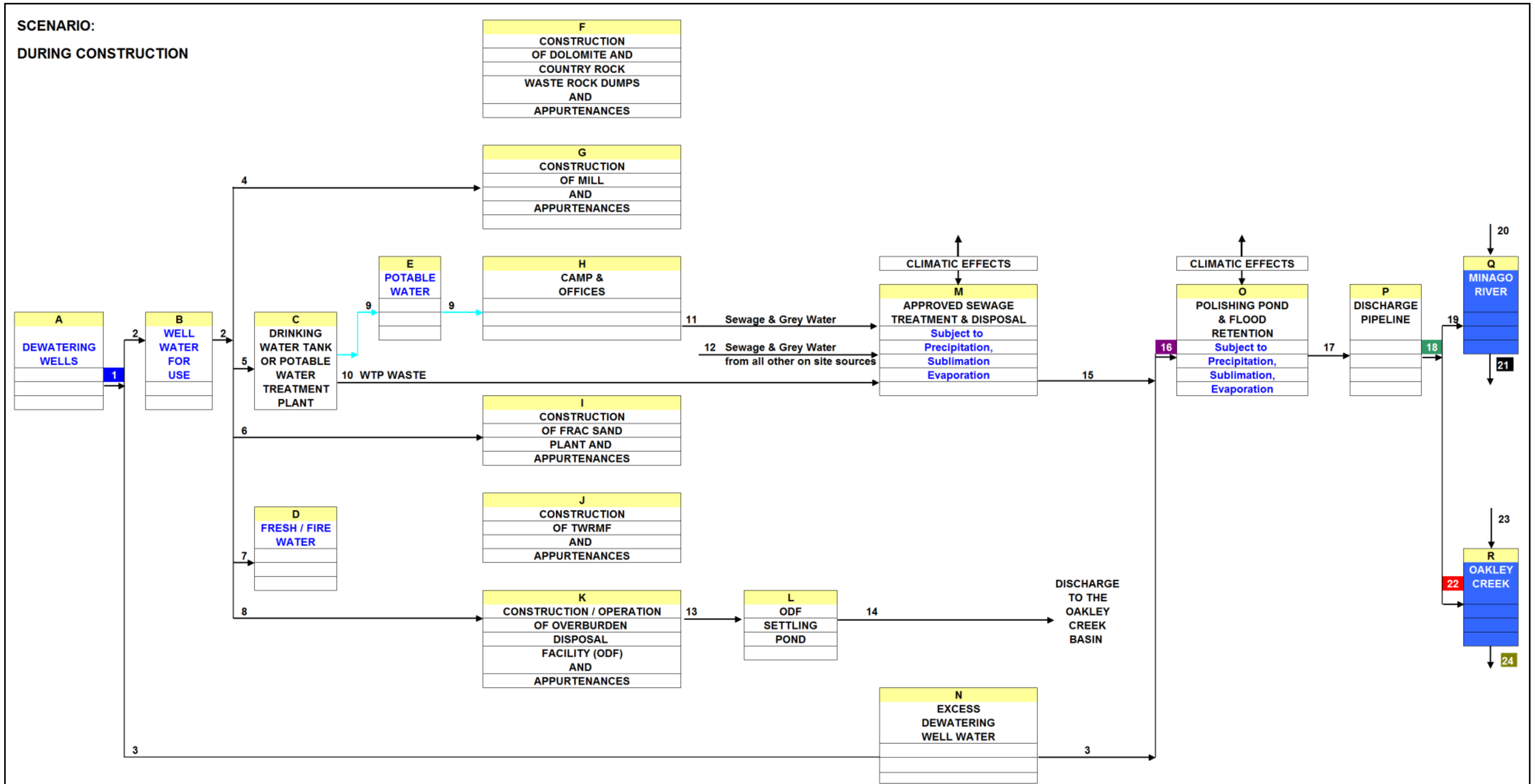
- **Dewatering Well Water (Flow Q1):**

  To allow ore extraction, the open pit area needs will be dewatered. Dewatering will start during the construction phase. Based on pumping tests conducted by GAIA in 2008, a dewatering well system has been designed, which is detailed in Section 7.6. The design consists of 12 dewatering wells located at a distance of approximately 300 m to 400 m along the crest of the ultimate open pit, pumping simultaneously from the limestone and sandstone geological units. The total pumping rate for the wellfield is predicted to be approximately 40,000 m^3/day (7,300 USgpm), and the average pumping rate for an individual well is estimated to be about 3,300 m^3/day (600 USgpm) (Golder Associates, 2008b). The associated drawdown cone, defined using a 1 m drawdown contour, is predicted to extend laterally in the limestone to a distance of approximately 5,000 to 6,000 m from the proposed open pit. Based on sensitivity analyses, the actual dewatering rate for the entire wellfield could vary from 25,000 m^3/day (4,600 USgpm) to 90,000 m^3/day (16,500 USgpm) (Golder Associates, 2008b).

  In the Minago water balance model, presented towards the end of this section, a dewatering rate of 40,000 m^3/day was assumed (32,000 m^3/day originating from the dewatering wells and 8,000 m^3/day from dewatering of the Open Pit).

- **Process Water and Dewatering Well Water (Flows Q2, Q3, Q4, Q5, Q6, Q7, and Q8):**

  Water from the dewatering wells will be used as process water (Q2) for construction activities of the mill complex and appurtenances (Q4), as input to the potable water treatment plant (Q5), as input to the Frac Sand Plant construction site (Q6), as fire water (Q7), and for the construction of the Overburden Disposal Facility (ODF) and dredging of overburden (Q8).



DEWATERING WELLS	Q1 = Q2+Q3
WELL WATER FOR USE	Q2 = Q4 + Q5 + Q6 + Q7 + Q8
POLISING POND DISCHARGE WATER	Q18
MINAGO RIVER DOWNSTREAM	Q21 = Q19+Q20
OAKLEY CREEK DOWNSTREAM	Q24 = Q22+Q23

Figure 6-2 Water Management System during Construction

- **Potable Water / Grey Water / Sewage (Flows Q9, Q10, Q11, Q12 and Q15):**

  A water treatment plant to produce potable water will be operated at the Minago site to produce sufficient potable water for the camp (Q9), all other on-site personnel and any other processes that require potable water. Sludge from the potable water treatment plant (Q10) will be disposed of in an approved sewage treatment system.

  All on-site grey water and sewage (Q11 and Q12) will be collected and discharged to an approved sewage treatment system. Outflow from the sewage treatment system (Q15) will be discharged to the Polishing Pond.

  The sewage treatment system will be subject to the climatic effects of precipitation, sublimation, and evaporation.

- **ODF Settling Pond (Flows Q13 and Q14):**

  Construction of the Overburden Disposal Facility may require some dewatering well water and dredging of the overburden (Q13), while underway, will require almost all of the dewatering water (~35,000 m^3/day) (Wardrop, 2010). Discharge of ODF seepage will be released to the environment via an ODF Settling Pond (Q14). Only water meeting the discharge criteria will be discharged to the Oakley Creek basin for ultimate discharge to Oakley Creek.

- **Polishing Pond (PP) (Flows Q3, Q15, Q16, and Q17):**

  Storm water, outflow from the approved sewage treatment system (Q15) and excess dewatering well water (Q3) will be discharged to the Polishing Pond. This water containment will ensure that quality standards are met prior to discharge. Water contained in the Polishing Pond will be discharged to the receiving environment via a discharge pipeline system (Q18), to the Minago River (Q19) and the Oakley Creek (Q22).

  The Polishing Pond will be used as water storage, final settling pond, and flood retention area. The Polishing Pond will be approximately 75 ha in area with a gross storage capacity of approximately million m^3. The Polishing Pond will be subject to the climatic effects of precipitation, sublimation, and evaporation.

- **Discharge System to Minago River (year round) (Flow Q19):**

  Discharge to the Minago River (Q19) willl occur year round at rates that will be adjusted seasonally to ensure that the discharged flows will not impact the flow regime nor the flora and fauna in Minago River negatively.

  In the water balance model, it was assumed that 70% of all water to be discharged from the Polishing Pond will be directed towards Minago River during the non-winter months (May to October). In the winter months (Nov. – Apr.), 65% of all excess Polishing Pond water will be discharged to the Minago River and 35% will be stored in the Polishing Pond for discharge during the subsequent freshet (May).

- **Discharge System to Oakley Creek (Summer) (Flow Q22):**

It was assumed that Oakley Creek will be completely frozen during the winter months and therefore no discharges are planned to Oakley Creek in the winter months. Discharge to Oakley Creek (Q22) will occur from May to October. Discharges to Oakley Creek will be adjusted seasonally to ensure that the discharged water will not impact the flow regime nor the flora and fauna in Oakley Creek negatively. It was assumed that 30% of excess Polishing Pond water will be discharged to Oakley Creek during non-winter months.

6.2.1.2 Water Management System during Operations

The operational period at Minago will consist of two distinct periods. In Year 1 through Year 8, both the Nickel Processing Plant and the Frac Sand Plant will be operating. In Year 9 and Year 10, the Nickel Processing Plant will be decommissioned based on current projections of nickel resources, but the Frac Sand Plant will be operating.

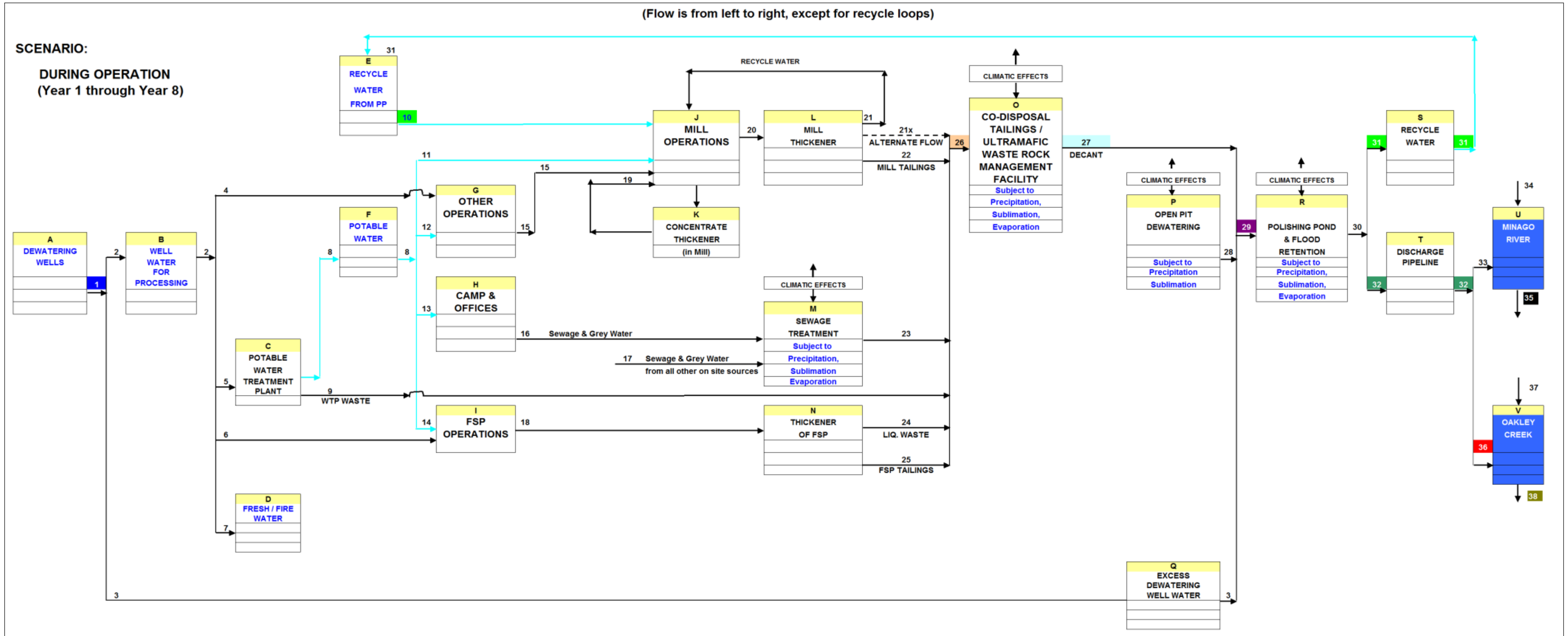
To facilitate the description of the water management model, key components are illustrated with boxes in the schematic water balance diagram (Figure 6-3) and flow(s) in and out of each box are numbered (Q1 through Q38). All flows in the schematic water balance diagram are from left to right (which is the typical flow direction) except for flows in recycle loops, which flow from right to left.

Following is a description of the water management model during the Year 1 through Year 8:

- **Dewatering Well Water (Flow Q1):**

  To allow ore extraction, the open pit area needs will be dewatered. Based on pumping tests conducted by GAIA in 2008, a dewatering well system has been designed as detailed elsewhere. The design consists of 12 dewatering wells located at a distance of approximately 300 m to 400 m along the crest of the ultimate open pit, pumping simultaneously from the limestone and sandstone geological units. The total pumping rate for the wellfield is predicted to be approximately 40,000 m^3/day (7,300 USgpm), and the average pumping rate for an individual well is estimated to be about 3,300 m^3/day (600 USgpm) (Golder Associates, 2008b). The associated drawdown cone, defined using a 1 m drawdown contour, is predicted to extend laterally in the limestone to a distance of approximately 5,000 to 6,000 m from the proposed open pit. Based on sensitivity analyses, the actual dewatering rate for the entire wellfield could vary from 25,000 m^3/day (4,600 USgpm) to 90,000 m^3/day (16,500 USgpm) (Golder Associates, 2008b).

  In the Minago water balance model, presented towards the end of this section, a dewatering rate of 40,000 m^3/day was assumed (32,000 m^3/day originating from the dewatering wells and 8,000 m^3/day from dewatering of the Open Pit).



SYSTEM OF LINEAR EQUATIONS (FOR FLOWS)

DEWATERING WELLS	Q1 = Q2+Q3
PROCESS WATER	Q2 = Q4 + Q5 + Q6 + Q7
RECYCLED WATER FROM FINAL POLISHING POND	Q10 = Q31
TMF INFLOW	Q26 = Q9+Q21x+Q22+Q23+Q24+Q25
TMF DECANT	Q27
POLISHING POND INFLOW	Q29 = Q3+Q27+Q28
DISCHARGED WATER	Q32
MINAGO RIVER DOWNSTREAM	Q35 = Q33+Q34
OAKLEY CREEK DOWNSTREAM	Q38 = Q36+Q37

Figure 6-3 Water Management System during the Nickel and Frac Sand Plants Operations (in Years 1 through 8)

- **Process Water and Dewatering Well Water (Flows Q2, Q3, Q4, Q5, Q6, and Q7):**

  Water from the dewatering wells will be used as process water (Q2) in the industrial complex (Q4), as input to the potable water treatment plant (Q5), as input to the Frac Sand Plant (Q6), and as fire water (Q7). Any excess dewatering well water not required for processing purposes (Q3) will be discharged to the Polishing Pond.

- **Potable Water / Grey Water / Sewage (Flows Q8, Q9, Q11, Q12, Q13, Q14, Q16, Q17, and Q23):**

  A water treatment plant to produce potable water will be operated at the Minago site to produce sufficient potable water (Q8) for the camp and offices (Q13), all other on-site personnel (Q11, Q12, and Q14), and any other processes that require potable water. Sludge from the potable water treatment plant (Q9) will be disposed of in the TWRMF.

  All on-site grey water and sewage (Q16 and Q17) will be collected and discharged to an extended aeration treatment system. Outflow from the sewage treatment system (Q23) will be discharged to the TWRMF.

  The sewage treatment system will be subject to the climatic effects of precipitation, sublimation, and evaporation.

- **Mill complex (Flows Q10, Q11, Q15, Q19, Q20, Q21, Q21x, and Q22):**

  Milling operations at Minago will be located on the north western side of the site and north of the access road (Figure 6-1). Schematically, the mill complex is illustrated with 'Mill Operations', 'Concentrate Thickener in Mill', and 'Mill Thickener' in Figure 6-3.

  The mill complex has the following inflows:

  1) Recycle water from the Polishing Pond (Q10);
  2) Potable water (Q11);
  3) primary crusher products and crushed ore from the Other Operations area (as well as water used for dust suppression) (Q15);
  4) recovered water from the concentrate thickener (Q19); and
  5) Recycle water from the mill thickener (Q21).

  Outflows from the mill complex are nickel concentrate that will be shipped for sale and tailings slurry (Q22) that will be discharged to the Tailings and Ultramafic Waste Rock Management Facility (TWRMF). If the quality of the mill recycle water does not meet the process water quality standards for the mill, a portion of the recycle water from the Mill Thickener (Q21x) may also be discharged into the TWRMF. However, the redirection of the recycle water from the Mill Thickener is not expected under normal operating conditions.

- **Frac Sand Plant (Flows Q6, Q14, Q18, Q24 and Q25):**

  The Frac Sand Plant will receive process water (Q6) consisting of dewatering well water and potable water (Q14). Liquid waste from the Frac Sand Plant (Q18) will be directed towards the thickener of the Frac Sand Plant.

  Frac Sand Plant tailings (Q25) and related liquid waste (Q24) from the Frac Sand Plant will be discharged to the TWRMF.

- **Other Operations (Flow Q15):**

  The term 'Other Operations' in the context of this site water management plan refers to the primary crusher, crushed ore tunnel, maintenance building, fueling area, and substation. The main outflow of the Other Operations Area (Q15) will be crushed ore that will be directed towards the mill complex. Grey water and sewage from the Other Operations Area will be discharged to the sewage treatment system. Hydrocarbons and other potentially deleterious substances in the Other Operations Area will be handled, stored and disposed of in an appropriate manner in compliance with all applicable regulations and guidelines and will not be discharged to the TWRMF.

- **Tailings and Ultramafic Waste Rock Management Facility (Flows Q9, Q21x, Q22, Q23, Q24, and Q25):**

  The Tailings and Ultramafic Waste Rock Management Facility (TWRMF) is a key component of the water and waste management system at Minago for liquid waste, tailings and ultramafic waste rock management. The TWRMF will serve as repository for mill and Frac Sand Plant tailings and ultramafic waste rock.

  Tailings and ultramafic waste rock will be disposed concurrently in the TWRMF and will be stored subaqueously. Key elements of the concurrent disposal of tailings and ultramafic waste rock are detailed elsewhere.

  Submerging tailings containing sulphide minerals, or "subaqueous disposal", is practiced at many metal mines to keep oxidative rates at a minimum and to minimize metal leaching. Based on geochemical work done to date, Minago's mill tailings contain low sulphide levels and were deemed to be non acid generating (NAG) (URS, 2009i). Sulphide levels were less than or equal to 0.07 % in the Master tailings samples tested. However, the Precambiran ultamafic waste rock is potentially acid generating (URS, 2008i).

  The TWRMF will remain in place after all operations have ceased at the site. The TWRMF inflow (Q26) will consist of:

  6) alternate flow from the mill thickener (only if warranted) (Q21x);
  7) mill tailings (Q22);
  8) sludge from the potable water treatment plant (Q9);
  9) liquid waste from the Frac Sand Plant (Q24);
  10) tailings from the Frac Sand Plant (Q25); and
  11) outflow from the sewage treatment system (Q23).

The TWRMF will also be subject to the climatic effects of precipitation, evaporation and sublimation.

Outflows from the TWRMF include the TWRMF Decant (Q27) and losses due to evaporation and sublimation, and seepage. Seepage will be captured by interceptor ditches surrounding the TWRMF and will be pumped back to the TWRMF. The flow volume of the TWRMF Decant will be regulated automatically by a control system.

During the operational phase, deposited waste will be kept under a nominal 0.5 m thick water cover. The design of the facility will include several baffles and/or barriers to encourage the settlement of suspended solids and to ensure that the TWRMF decant has a low suspended solids concentration.

The TWRMF will provide 38 million m^3 of storage with a maximum water surface area of approximately 219.7 ha (Wardrop, 2010).

- **Open Pit Dewatering (Flow Q28):**

During the mining phase, the open pit will be dewatered to ensure safe and dry working conditions in the pit. Open pit dewatering (Q28) will be subject to the climatic effects of precipitation and sublimation.

The excess open pit dewatering water will be pumped to the Polishing Pond.

- **Polishing Pond (PP) (Flows Q3, Q27, Q28, Q29, Q30, Q31, Q32, Q33 and Q36):**

The Polishing Pond will be used as water storage, final settling pond, and flood retention area. The Polishing Pond will be approximately 75 ha in area with a gross storage capacity of approximately million m^3. This water containment structure will ensure that quality standards are met prior to discharge. Water contained in the Polishing Pond will be pumped to the Minago River watershed, the Oakley Creek watershed and to the process water tank as reclaim water.

The Polishing Pond will receive decant water from the TWRMF (Q27), dewatering water from the Open Pit (Q28), excess groundwater from the twelve (12) mine dewatering wells (Q3), and precipitation. Under normal operating conditions, when meeting water quality standards, water retained by the Polishing Pond (Q30) will either be recycled to the milling process (Q31 = Q10) or discharged to the receiving environment via a discharge pipeline system (Q32), which discharges water to the Minago River (Q33) and the Oakley Creek (Q36).

Storm water from the waste rock dumps, the TWRMF and the in-pit dewatering system will also be channelled into a Polishing Pond.

The Polishing Pond will also be subject to the climatic effects of precipitation, evaporation and sublimation.

- **Discharge System to Minago River (year round) (Flow Q33):**

Discharge to the Minago River (Q33) will occur year round at rates that will be adjusted seasonally to ensure that the discharged flows will not impact the flow regime nor the flora and fauna in the Minago River negatively.

In the water balance model, it was assumed that 70% of all excess Polishing Pond water will be directed towards the Minago River during the non-winter months (May to October) and that 65% of it will be discharged to the Minago River during the winter months (November to April).

- **Discharge System to Oakley Creek (Summer) (Flow Q36):**

  It was assumed that Oakley Creek will be completely frozen during the winter months and therefore no discharges are planned to Oakley Creek in the winter months (Nov. – Apr.). Discharge to the Oakley Creek (Q36) will occur from May to October. Discharges to the Oakley Creek will be adjusted seasonally to ensure that the discharged water will not impact the flow regime nor the flora and fauna in the Oakley Creek negatively. It was assumed that 30% of the excess Polishing Pond water will be discharged to the Oakley Creek during non-winter months (May – Oct.).

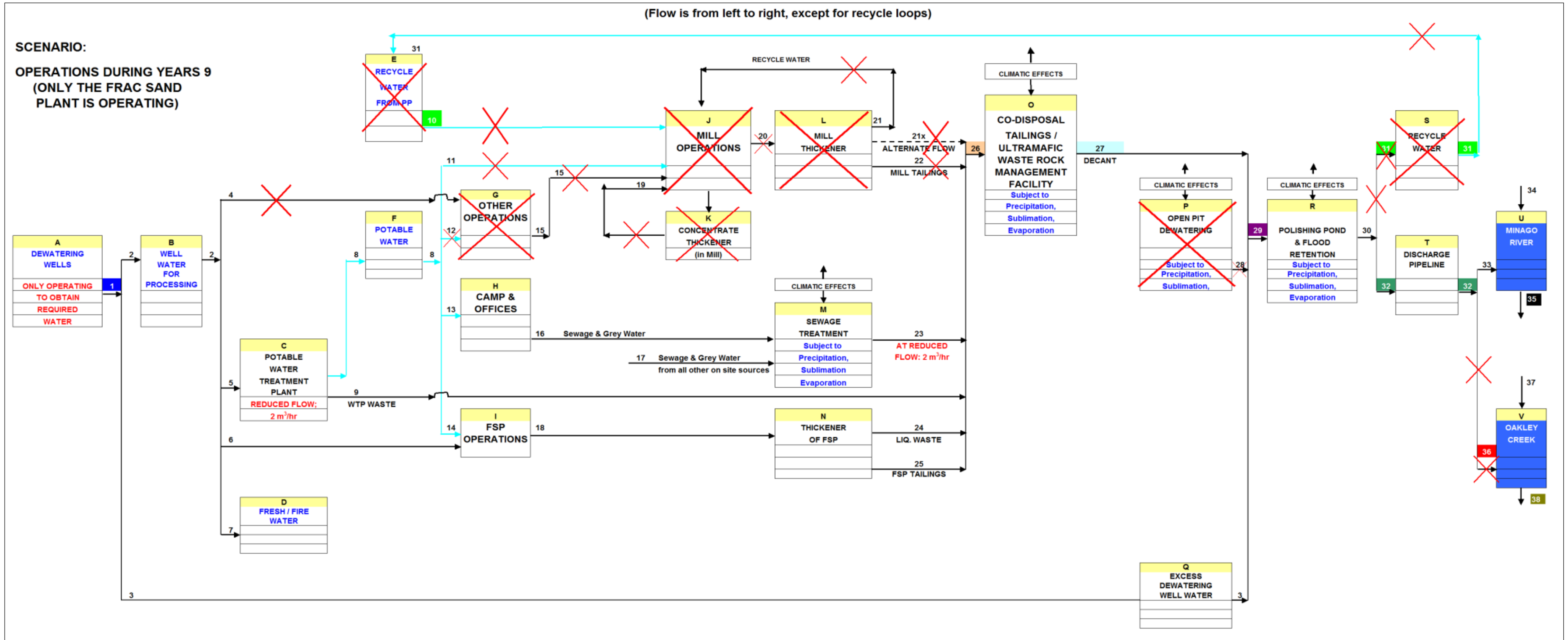
- **Key Input Parameters and Considerations for Nickel and Frac Sand Plant Operations (Year 1 through Year 8) (Figure 6-3):**

  1. The Nickel Processing Plant and the Frac Sand Plant and related appurtenances will be operating.
  2. All twelve dewatering wells will be running and the Open Pit will be dewatered.
  3. Tailings and ultramafic waste rock will be concurrently disposed in a Tailings and Waste Rock Management Facility (TWRMF).
  4. Only the deposited Ni tailings will leach at the maximum leaching rate measured during kinetic testing in the subaqueous leach column surface water.
  5. Voids in freshly deposited tailings will represent 22% of the tailings stream. Voids remaining in the ultramafic waste rock after concurrent disposal with tailings were assumed to represent 6.9% of the total volume of the waste rock and its voids (Wardop, 2010). All voids were assumed to be filled with water of the same quality as the supernatant of the TWRMF. This porewater was assumed to be unavailable for discharge from the TWRMF.
  6. On-site daily potable water consumption per person was assumed to be ~ 300 L.
  7. The TWRMF will have a water cover with a nominal thickness of 0.5 m during the operational phase.
  8. Excess groundwater from the dewatering wells will be discharged to the Polishing Pond all year round.
  9. In the winter months (Nov. to Apr.), 65% of the Polishing Pond water will be discharged to the Minago River and 35% will be stored in the Polishing Pond. During the remainder of

the year (May to October), 70% of the Polishing Pond water will be discharged to the Minago River and 30% will be discharged to the Oakley Creek.

6.2.1.3 Water Management System during Frac Sand Plant Operations in Year 9 and 10

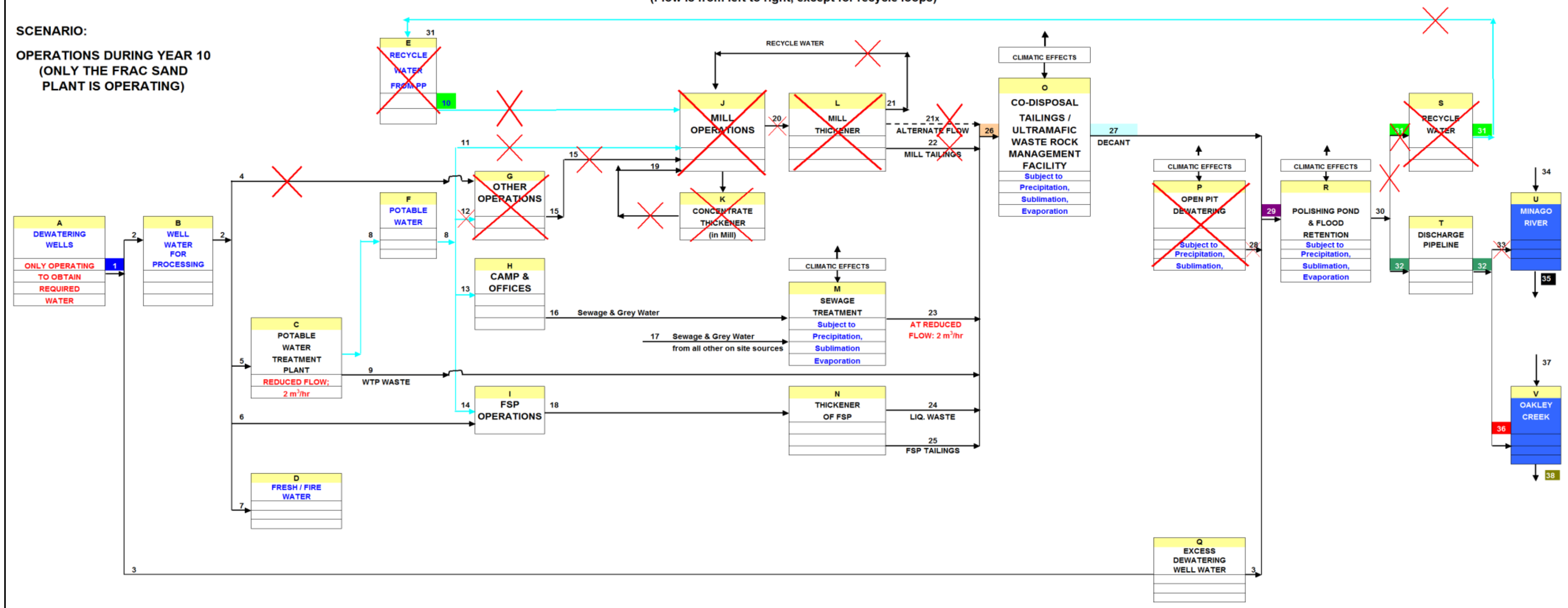
In Year 9 and Year 10, the Nickel Processing Plant will be decommissioned based on current projections of nickel resources, but the Frac Sand Plant will be operating as before. Accordingly, the extent of the water management system will be scaled back significantly. Less water will be needed for operations; and therefore, the mine dewatering program will be scaled down significantly. No water will be required nor discharged from the Nickel Processing Plant complex during these years. The Open Pit dewatering will cease. These changes in the water management program compared to the Year 1 through Year 8 water management program are illustrated in Figures 6-4 and 6-5. Figure 6-4 shows conditions in Year 9 and Figure 6-5 illustrates conditions in Year 10.



SYSTEM OF LINEAR EQUATIONS (FOR FLOWS)

DEWATERING WELLS	Q1 = Q2+Q3
PROCESS WATER	Q2 = Q4 + Q5 + Q6 + Q7
RECYCLED WATER FROM FINAL POLISHING POND	Q10 = Q31
TMF INFLOW	Q26 = Q9+Q21x+Q22+Q23+Q24+Q25
TMF DECANT	Q27
POLISHING POND INFLOW	Q29 = Q3+Q27+Q28
DISCHARGED WATER	Q32
MINAGO RIVER DOWNSTREAM	Q35 = Q33+Q34
OAKLEY CREEK DOWNSTREAM	Q38 = Q36+Q37

Figure 6-4 Water Management System during Frac Sand Plant Operations in Year 9



SYSTEM OF LINEAR EQUATIONS (FOR FLOWS)

DEWATERING WELLS	Q1 = Q2+Q3
PROCESS WATER	Q2 = Q4 + Q5 + Q6 + Q7
RECYCLED WATER FROM FINAL POLISHING POND	Q10 = Q31
TMF INFLOW	Q26 = Q9+Q21x+Q22+Q23+Q24+Q25
TMF DECANT	Q27
POLISHING POND INFLOW	Q29 = Q3+Q27+Q28
DISCHARGED WATER	Q32
MINAGO RIVER DOWNSTREAM	Q35 = Q33+Q34
OAKLEY CREEK DOWNSTREAM	Q38 = Q36+Q37

Figure 6-5 Water Management System during Frac Sand Plant Operations in Year 10

In Figure 6-4, all components that will not be active in the water management system (i.e., for which flows will be zero) are shown as crossed out. All other flows and water balance components will remain the same as they will have been during the Year 1 through Year 8 operations.

Following is a short list of the flow conditions with respect to "zero" flows in Year 9 and Year 10:

- Dewatering Well Water (Flow Q1 => only one well will be operating);
- Process Water and Dewatering Well Water (Flows Q2, Q3, Q4=0, Q5, Q6, and Q7);
- Potable Water / Grey Water / Sewage (Flows Q8, Q9, Q11=0, Q12=0, Q14, Q16, Q17, Q23);
- Mill complex: It will be closed (Flows Q10=0, Q11=0, Q15=0, Q19=0, Q20=0, Q21=0, Q21x=0, and Q22=0);
- Frac Sand Plant (Flows Q6, Q14, Q18, Q24 and Q25);
- Other Operations (Flow Q15=0);
- Tailings and Ultramafic Waste Rock Management Facility (Flows Q9, Q21x=0, Q22=0, Q23, Q24, and Q25);
- Open Pit Dewatering (Flow Q28=0);
- Polishing Pond (PP) (Flows Q3, Q27, Q28=0, Q29, Q30, Q31=Q10=0, Q32, Q33 and Q36=0);
- Discharge System to the Minago River (year round) (Flow Q33):

  Year 9: In the Year 9 water balance model, it was assumed that 100% of all water to be discharged from the Polishing Pond will be directed towards Minago River (Q33) year round to achieve a staged reduction of discharges. The discharge will range from 1% to 5% of the average seasonal flows in the Minago River, as detailed lateron in this Section.

  Year 10: There will be no Polishing Pond discharges to Minago River (Q33=0) in Year 10.

- Discharge System to the Oakley Creek (Summer)(Flow Q36):

  It was assumed that Oakley Creek will be completely frozen during the winter months and therefore no discharges are planned to Oakley Creek in the winter months (Nov. to Apr.).

  Year 9: In the Year 9 water balance model, it was assumed that 0% of the Polishing Pond discharges will be directed towards the Oakley Creek (Q36).

  Year 10: In Year 10, there will be no discharge to Oakley Creek in the winter months (Nov. to Apr.), but 100% of the Polishing Pond discharges will be directed towards Oakley Creek for the remainder of the year.

- **Key Input Parameters and Considerations for Frac Sand Plant Operation in Year 9 (Figure 6-4):**

  1. The Frac Sand Plant will operate and frac sand tailings will be deposited in the TWRMF.
  2. All operations will have ceased at the Nickel Processing Plant and related facilities and no more Ni tailings nor waste rock will be created or disposed.

3. Only the deposited Ni tailings will leach at the maximum leaching rate measured during kinetic testing in the subaqueous leach column surface water.
4. The TWRMF will have a water cover of a nominal thickness of 0.5 m.
5. Dewatering pumps will be restricted to pump only sufficient water for frac sand processing and other site operations.
6. All of the Polishing Pond water will be discharged to the Minago River year round and discharge will be staged to prepare the aquatic habitat for complete withdrawal of discharges from the Polishing Pond.

- **Key Input Parameters and Considerations for Frac Sand Plant Operation in Year 10 (Figure 6-5):**

  All assumptions are as for Year 9 except for the discharge of Polishing Pond water. All of the Polishing Pond water will be stored in the winter months (Nov. to April) and discharged to the Oakley Creek watershed during the remainder of the year (May to October).

6.3 Minago Water Balance Model

A Water Balance Model (WBM) was developed to estimate average elemental concentrations in flows that will be part of the working mine. The water balance was developed based on expected baseline inputs and outputs. Inputs and outputs are related to three main aspects including dewatering well water and its uses and discharges (chemistry and flow); mining and milling processes to produce concentrate and saleable products out of the ore (chemistry and flow); and climatic conditions (rainfall, snowfall, sublimation, and evaporation). Key considerations of the water balance model are summarized below, first in general terms and then in detail.

As for the general description of the water management system, the water balance model is described for the following seven scenarios in this document:

- water balance during Construction (illustrated in Figure 6-1);
- water balance during Nickel and Frac Sand Plants Operations (in Years 1 through 8) (illustrated in Figure 6-3);
- water balance during Frac Sand Plant Operations (in Years 9 and 10) (illustrated in Figure 6-4);
- water balance during Closure (illustrated in Figures 6-1 and 6-2);
- water balance during Post Closure (illustrated in Figure 8-1).
- water balance during Temporary Suspension (illustrated in Figure 5-1); and
- water balance during the State of Inactivity (illustrated in Figure 5-2).

6.3.1 General Description of Inputs and Outputs of the Water Balance Model

The primary water inputs of the water balance model are due to dewatering wells that enable mining in the open pit by lowering the water table. In the water balance model, it was assumed that approximately 32,000 m^3/day will be pumped from 12 dewatering wells that surround the open pit and 8,000 m^3/day will be pumped from the Open Pit (Golder Associates, 2008b). Dewatering well water will be used for processing in the mill and Frac Sand Plant and to create potable water. However, the vast majority (approximately 84%) of the dewatering well water will be discharged unused to the Polishing Pond for subsequent discharge to the receiving environment (Minago River or Oakley Creek) during the mine operations and the State of Temporary Suspension, should it occur.

Another major input into the water balance model are precipitation and associated climatic effects (evaporation, sublimation, etc). All large storage areas (including the waste rock dumps, the Tailings and Ultramafic Waste Rock Management Facility (TWRMF), the Open pit, the Polishing Pond, and the sewage treatment system) will be subject to climatic effects.

Assumptions used to characterize climatic effects for the Minago Project are as follows:

- **Precipitation**

  The precipitation at Minago was assumed to be 510 mm consisting of 369 mm (72%) of rain and 141 mm (28%) of snow (Golder Associates, 2009). It was assumed that 40 mm (10.8%) of the rain falls in the month of May and 329 mm (89.2%) in the period of June to October (Golder Associates, 2009).

- **Snow Storage**

  Snow sublimation and redistribution has a notable impact on the amount of water in the snowpack and therefore affects the water balance of site facilities and related watersheds. Sublimation can occur directly from snowpack surfaces or during blowing snow events with overall rates dependent on humidity and wind speed (Essery et al., 1999; Déry and Yau, 2002). Snow sublimation is highly dependent on the thermal balance of the snowpack. Golder Associates (2009) projected an average snow sublimation rate of 39% of the average annual snowfall for the Minago Project.

- **Snowmelt**

  In the water balance model, snowmelt was assumed to occur in the month of May.

- **Lake Evaporation and Evapotranspiration**

  Evaporation is the process by which water is transferred from land and water to the atmosphere. Transpiration is the evaporation of water from the vascular system of plants to the atmosphere. The combination of both processes is termed evapotranspiration and is a function of the type of surface (open water, leaf or leaf canopy, bare soil, etc.), the availability of water, and the net energy input into the system.

  The seasonal distribution of evaporation is affected primarily by solar radiation and vegetation cover (or lack of it). During the snowmelt period, evaporation is relatively small compared with the large supply of melt water within a thinly thawed active layer (Woo and Steer, 1983). Typically, evaporation is greatest following snowmelt and decreases through the summer period. Evaporation decreases as the latitude increases. Evaporation losses from lakes are greater than evapotranspiration losses from an equivalent terrestrial area.

  Lake evaporation in the vicinity of the proposed project site is expected to be 500 mm or more (EMRC, 1995), while evapotranspiration is estimated to range between 350 and 400 mm (EMRC, 1995). The majority of the water balance components at Minago will not be subjected to transpirational effects as they will be bare “brown” fields.

In the Minago water balance model, it was assumed that the evaporation from the Tailings and Ultramafic Waste Rock Management Facility (TWRMF), the Polishing Pond, and the sewage treatment system will be 50% of the lake evaporation estimated for large lakes in the vicinity of the Minago Project. Evaporation was assumed to be 56 mm in May, 218.35 mm in the period from June to October (over a period of 154 days), and 0 mm in the winter months (November to April). Evaporation losses were assumed to be negligible for the waste rock dumps (due to the coarseness of the material leading to negligible water storage on the surface) and the open pit due to the continuous removal (pumping) of water that infiltrates the open pit during operations.

- **Ice Regime**

The mean ice thickness in the vicinity of the Minago Project is expected to be between 0.75 and 1 m in lakes and rivers (Allen, 1977). The freeze-over window is expected to be early to mid November, while the ice-free date is typically in mid April (Allen, 1977).

Based on March, 2008, field measurements, Oakley Creek was found to be completely frozen near Highway #6 (at monitoring station OCW1) during the field monitoring program. As such, it is proposed not to discharge any water to Oakley Creek in the winter months.

Outputs

Discharges to Minago River and Oakley Creek watersheds are the major “output” of the water balance model. All other clean, potable, grey, and processing waters will be managed internally at the Minago Project.

6.3.1.1 Detailed Assumptions of the Water Balance Model

Key assumptions and considerations of the Minago water balance model are presented below. These key assumptions include climatic conditions and the stages of Operations, Closure and Post Closure as well as Temporary Suspension, the State of Inactivity. Based on the stated assumptions, elemental concentrations and flowrates were estimated for combined flows that will have a bearing on the receiving environment.

- **Key Climatic Assumptions**

Key climatic parameters used for the water balance model are given in Table 6-1.

Table 6-1 Climatic Parameters and Considerations used for the Minago Water Balance Model

PRECIPITATION:		
Average annual precipitation:	**510 mm**	Source: Golder Associates (2009)
72% falls as rain:	369 mm	Source: Golder Associates (2009)
28% falls as snow:	141 mm	Source: Golder Associates (2009)
Snow Sublimation:		
39% of annual snow fall:	54.99 mm	Source: Golder Associates (2009)
Water equivalent remaining in the spring:	= 141-54.99 mm = 86.01 mm	Source: Golder Associates (2009)
Water Balance Model Assumptions:		
- It was assumed that 40 mm of rain falls in May (31 days).		Source: Golder Associates (2009)
- It was assumed that 141 mm of snow falls between November and April (180 days). It was assumed that 86.01 mm water equivalent remains of the snow precipitation in the spring.		Source: Golder Associates (2009)
- It was assumed that 329 mm of rain falls in June, July, August, September, October (2.1364 mm/day over 154 days)		Source: Golder Associates (2009)
LAKE EVAPORATION:		
Average annual lake evaporation:	566.0 mm	Source: Golder Associates (2009)
in April:	17.6 mm	Source: Golder Associates (2009)
in May:	112.0 mm	Source: Golder Associates (2009)
in period from June to October:	436.7 mm	Source: Golder Associates (2009)

Water Balance Model Assumptions:

It was assumed that water evaporates from the sewage treatment system, TWRMF, and Polishing Pond at 50% of the lake evaporation measured for big lakes in the vicinity of the Minago Project. For the 50% evaporation model, it was assumed that 56 mm evaporate in the month of May (1.80645 mm/day over 31 days) and 218.35 mm (1.4179 mm/day over 154 days) evaporate in June, July, August, September and October.

- **Key Input Parameters and Considerations for the Calculation of Flowrates:**

  Key assumptions for flowrate calculations are detailed in Table 6-2. Efforts were made to use flowrates that are representative of anticipated site conditions. All flowrates not detailed in Table 6-2 were based on material flowsheets developed by Wardrop Engineering Inc. (Wardrop) and others and are presented as part of the presentation of modeling results.

- **Key Input Parameters and Considerations for the Calculation of Elemental Concentrations:**

  Key assumptions for contaminant loadings and element concentrations in the water balance flows are summarized in Table 6-3. Efforts were made to use concentrations that are representative of anticipated site and geochemical conditions.

- **Key Input Parameters and Considerations for Flowrates in Minago River and Oakley Creek:**

  Key assumptions for flowrates in Minago River and Oakley Creek are summarized in Table 6-4.

- **Assumed Weekly Metal Leaching Rates for the Minago Tailings**

  The metal leaching rates assumed for Minago tailings are detailed in Table 6-5 and correspond to 10% of surface water loadings measured for the subaqeous column in kinetic tests that were run for 54 weeks (URS, 2009). Steady State was assumed after week 11 (URS, 2008i).

- **Assumed Areal Extent of Site Faciltiies:**

  The areal extent of site facilities that was used in the water balance model are detailed in Table 6-6.

- **Input Data – Material Flow Rates and Conditions for the TWRMF:**

  Assumed material flow rates and conditions for the TWRMF are detailed in Table 6-7.

Table 6-2 Key Input Parameters and Considerations for Flowrate Calculations in the Minago Water Balance Model

Flowrates Qi (i = 1 to 38)		Mathematical Formulae to determine Qi (i = 1 - 38)
UNIT EVAPORATION (1 Unit = 1 ha)	UNIT LAKE EVAPORATION	= Q-Unit-Evapo
UNIT PRECIPITATION (1 Unit = 1 ha)		
Q1	FLOW FROM DEWATERING WELLS	
Q2	WELL WATER FOR PROCESSING	
Q3	EXCESS WATER FROM DEWATERING WELLS	
Q4	GROUNDWATER TO OTHER OPERATIONS	
Q5	GROUNDWATER TO WATER TREATMENT	as per Feasibility Study
Q6	GROUNDWATER TO FRAC SAND PLANT	
Q7	GROUNDWATER FOR FIRE FIGHTING	
Q8	POTABLE WATER	
Q9	WATER TREATMENT PLANT WASTE	
Q10	RECYCLE WATER FROM PIOLISHING POND	= Q32
Q11	POTABLE WATER TO MILL	
Q12	POTABLE WATER TO OTHER OPERATIONS	
Q13	POTABLE WATER TO OFFICES & CAMP	
Q14	POTABLE WATER TO FRAC SAND PLANT	
Q15	FLOW FROM OPERATIONS TO MILL	
Q16	SEWAGE & GREY WATER FROM CAMP AND OFFICES	
Q17	SEWAGE & GREY WATER FROM ALL OTHER ON SITE SOURCES	as per Feasibility Study
Q18	FLOW FROM FSP OPERATIONS TO FSP THICKENER	
Q19	FLOW FROM CONCENTRATE THICKENER IN MILL TO MILL	
Q20	FLOW FROM MILL TO MILL THICKENER	
Q21	RECYCLE WATER FROM MILL THICKENER	
Q21x	ATERNATE FLOW FOR RECYCLE WATER FROM MILL THICKENER	
Q22	MILL TAILINGS SLURRY	
Q23	SEWAGE TREATMENT OUTFLOW	
Q24	LIQ. WASTE FROM FSP	
Q25	SLURRY FROM FRAC SAND PLANT (FSP)	
Q26	TWRMF INFLOW	= Q9 + Q21x + Q22 + Q23 + Q24 + Q25
Q - Liquid Precipitation on TWRMF	Available Precipitation on TWRMF	= AREA*Q-Unit-PPT
Q - Evaporation from TWRMF	Evaporation from TWRMF	= AREA*(Q-Evapo from TWRMF)
Q - Retained Water in Tailings Voids	Retained Water in Tailings Voids	= 22% Retained Water in Voids; assumed tailings density = 1.5 tonnes/m^3
Q - TWRMF Supernatant	TWRMF Supernatant	= Q26+(Q-Remaining Supernatant)+Q-PPT on TWRMF-(Q-Evapo from TWRMF) - (Q-Retained Water in Voids)
Q27	TWRMF DECANT	= TWRMF Supernatant minus 0.5 m water during Operations
Q - Pit Dewatering	OPEN PIT DEWATERING	= 8000 m^3/day during Operations;= 0 m^3/day thereafter
Q - Precipitation on Pit	Precipitation minus Sublimation on Open Pit	= AREA*Q-Unit-PPT
Q28	TOTAL OPEN PIT DEWATERING	= (Q-Pit Dewatering)+(Q-PPT on Pit)
Q29	POLISHING POND INFLOW	= (Q3+Q27+Q28) during Operations
Q - Precipitation on Polising Pond	Precipitation minus Sublimation ON POLISHING POND	= AREA*Q-Unit-PPT
Q - Evaporation from Polishing Pond	EVAPORATION FROM POLISHING POND	= AREA*Q-Unit-Evapo
Q30	POLISHING POND OUTFLOW	= Q29 + (Q-PPT on Polishing Pond) - (Q-Evapo from Polishing Pond)
Q31	RECYCLE FROM FINAL POLISHING POND	as per Feasibility Study
Q32	FLOW TO DISCHARGE PIPELINE	as per Feasibility Study
Q33	DISCHARGE TO MINAGO	= 65% of Q32 during winter and 70% of Q32 otherwise during Operations
Q34	MINAGO UPSTREAM	as per Hydrologic Study
Q35	MINAGO DOWNSTREAM	= Q33+Q34
Q36	DISCHARGE TO OAKLEY CREEK	= 0% of Q32 during winter; 30% of Q32 otherwise during Operations
Q37	OAKLEY CREEK UPSTREAM	as per Hydologic Study
Q38	OAKLEY CREEK DOWNSTREAM	= Q36+Q37

Table 6-3 Key Input Parameters and Considerations for Calculations of Elemental Concentrations in the Minago Water Balance Model

Concentration Ci (in Flow Qi)	Mathematical Formulae to determine Ci (i = 1 to 38)
UNIT EVAPORATION	
UNIT PPT (U-PPT)	= CCME Mean Detection Limits
C1	= Aug-2008 Groundwater Quality (Dissolved Metals)
C2	= Aug-2008 Groundwater Quality (Dissolved Metals)
C3	= Aug-2008 Groundwater Quality (Dissolved Metals)
C4	= Aug-2008 Groundwater Quality (Dissolved Metals)
C5	= Aug-2008 Groundwater Quality (Dissolved Metals)
C6	= Aug-2008 Groundwater Quality (Dissolved Metals)
C7	= Aug-2008 Groundwater Quality (Dissolved Metals)
C8	= CCME Mean Detection Limits
C9	not assumed
C10	= C32
C11	= CCME Mean Detection Limits
C12	= CCME Mean Detection Limits
C13	= CCME Mean Detection Limits
C14	= CCME Mean Detection Limits
C15	Internal Nickel Processing Plant Water Quality
C16	not assumed
C17	not assumed
C18	Internal FSP Water Quality
C19	} Internal Mill Water Quality (C19–C21x)
C20	
C21	
C21x	
C22	= Measured Concentration SGS Lakefield Nov. 7, 2008 Results
C23	= CCME Mean Detection Limits
C24	= Measured Dissolved Concentration for FSP Overflow
C25	= Measured Dissolved Concentration for FSP Underflow
C26	= {C9 +Q21x*C21x + Q22*C22 + Q23*C23 + Q24*C24 + Q25*C25} / Q26
C - PPT on TWRMF	= CCME Mean Detection Limits
C - Evapo from TWRMF	
C - Tailings Leachate	= {Mass of Tailings [tonnes]* Leaching Rate of Tailings [mg/kg/period]} / Q-TWRMF Supernatant [m^3/period]
C-TWRMF Supernatant	= {Q26*C26 + (Q-TWRMF Supernatant Remaining)*(C-TWRMF Supernatant Remaining) + (Q-PPT on TWRMF)*(C-PPT on TWRMF) + (Q-Tailings Leachate)*(C-Tailings Leachate) } / Q-TWRMF Supernatant
C27	= C-TWRMF Supernatant
C-Pit Dewatering	= Aug-2008 Groundwater Quality (Dissolved Metals)
C-PPT on Pit	= CCME Mean Detection Limits
C28	= {(Q-Pit Dewatering)*(C-Pit Dewatering) + (Q-PPT on Pit)*(C-PPT on Pit)} / Q28
C29	= {Q3*C3 + Q27*C27 + Q28*C28} / Q29 during Operations
C-PPT on PP	= CCME Mean Detection Limits
C-Evapo from PP	
C30	= {Q29*C29 + (Q-PPT on Polishing Pond)*(C-PPT on Polishing Pond)} / Q30
C31	= C30
C32	= C30
C33	= C30
C34	= AVERAGE 2006-2008 MINAGO RIVER WATER QUALITY (Dissolved Metals at MRW2)
C35	= {Q33*C33 + Q34*C34} / Q35
C36	= C30
C37	= AVERAGE 2006-2008 OAKLEY CK WATER QUALITY (Dissolved Metals at OCW2)
C38	= {Q36*C36 + Q37*C37} / Q38

Table 6-4 Estimated Flowrates in Minago River and Oakley Creek

Time Period / **Stream**	**May** m^3/s	**June to October** m^3/s	**November to April** m^3/s
Minago River	10	1.9	0.8
Oakley Creek	4	0.5	0

Table 6-5 Weekly Metal Leaching Rates Assumed for Minago Tailings

10% of Subaqueous Leach Column Surface Water Loading as given in URS Geochemical Memo, dated March 4, 2010				
ELEMENT	Unit	Minimum	Average	Maximum
Aluminum (Al)	mg/kg/wk	2.000E-06	2.120E-05	1.440E-04
Antimony (Sb)	mg/kg/wk	6.080E-07	9.290E-07	1.180E-06
Arsenic (As)	mg/kg/wk	2.000E-07	1.304E-06	6.400E-06
Cadmium (Cd)	mg/kg/wk	1.600E-08	7.450E-08	7.680E-07
Chromium (Cr)	mg/kg/wk	3.200E-07	1.210E-06	2.000E-06
Cobalt (Co)	mg/kg/wk	6.400E-08	6.030E-07	1.240E-06
Copper (Cu)	mg/kg/wk	1.800E-06	8.010E-06	2.240E-05
Iron (Fe)	mg/kg/wk	3.200E-06	1.570E-05	6.200E-05
Lead (Pb)	mg/kg/wk	9.280E-08	1.621E-06	1.630E-05
Molybdenum (Mo)	mg/kg/wk	6.000E-06	1.180E-05	1.960E-05
Nickel (Ni)	mg/kg/wk	1.800E-05	4.020E-05	8.420E-05
Selenium (Se)	mg/kg/wk	4.000E-07	8.720E-07	2.180E-06
Zinc (Zn)	mg/kg/wk	4.160E-06	1.300E-05	7.680E-05

Table 6-6 Areal Extent of Site Facilities

Designated Area	**Area (ha)**
Pit Area	190.0
Tailings and Ultramafic Waste Rock Management Facility (TWRMF)	219.7
Polishing Pond	75.0

Table 6-7 Input Data - Material Flow Rates and Conditions for the Tailings and Ultramafic Waste Rock Management Facility (TWRMF)

			Ultramafic WR in TWRMF (kT)	Ni Tailings in TWRMF (kT)	Water Cover Height	Discharge to Minago River from Discharge Pipeline	Discharge to Oakley Creek from Discharge Pipeline
Mill & Frac Sand Plant Operating	Year 1	Nov.-Apr.	8,802	1,806.364	0.5 m	65%	0%
		May	8,802	1,806.364	0.5 m	70%	30%
		Jun.-Oct.	8,802	1,806.364	0.5 m	70%	30%
	Year 2	Nov.-Apr.	14,326	5,360.918	0.5 m	65%	0%
		May	14,326	5,360.918	0.5 m	70%	30%
		Jun.-Oct.	14,326	5,360.918	0.5 m	70%	30%
	Year 3	Nov.-Apr.	19,993	8,915.472	0.5 m	65%	0%
		May	19,993	8,915.472	0.5 m	70%	30%
		Jun.-Oct.	19,993	8,915.472	0.5 m	70%	30%
	Year 4	Nov.-Apr.	25,725	12,470.026	0.5 m	65%	0%
		May	25,725	12,470.026	0.5 m	70%	30%
		Jun.-Oct.	25,725	12,470.026	0.5 m	70%	30%
	Year 5	Nov.-Apr.	30,107	16,024.580	0.5 m	65%	0%
		May	30,107	16,024.580	0.5 m	70%	30%
		Jun.-Oct.	30,107	16,024.580	0.5 m	70%	30%
	Year 6	Nov.-Apr.	33,133	19,579.134	0.5 m	65%	0%
		May	33,133	19,579.134	0.5 m	70%	30%
		Jun.-Oct.	33,133	19,579.134	0.5 m	70%	30%
	Year 7	Nov.-Apr.	35,430	23,133.688	0.5 m	65%	0%
		May	35,430	23,133.688	0.5 m	70%	30%
		Jun.-Oct.	35,430	23,133.688	0.5 m	70%	30%
	Year 8	Nov.-Apr.	35,659	24,847.808	0.5 m	65%	0%
		May	35,659	24,847.808	0.5 m	70%	30%
		Jun.-Oct.	35,659	24,847.808	0.5 m	70%	30%

Table 6-7 (Cont.'d) Input Data - Material Flow Rates and Conditions for the Tailings and Ultramafic Waste Rock Management Facility (TWRMF)

			Ultramafic WR in TWRMF (kT)	Ni Tailings in TWRMF (kT)	Water Cover Height	Discharge to Minago River from Discharge Pipeline	Discharge to Oakley Creek from Discharge Pipeline	Discharge to Oakley Creek via the Oakley Creek Basin	Comments
Frac Sand Plant Operating	Year 9	Nov.-Apr.	35,659	24,847.808	0.5 m	100%	0%	0%	Staging of
		May	35,659	24,847.808	0.5 m	100%	0%	0%	Discharge to Minago River
		Jun.-Oct.	35,659	24,847.808	0.5 m	100%	0%	0%	for Fisheries Habitat Conditioning
	Year 10	Nov.-Apr.	35,659	24,847.808	0.5 m	0%	0%	0%	No Discharge; Excess water will be stored in the Polishing Pond
		May	35,659	24,847.808	0.5 m	0%	100%	0%	
		Jun.-Oct.	35,659	24,847.808	0.5 m	0%	100%	0%	
Closure	Year 11	Nov.-Apr.	35,659	24,847.808	1.5 m	0%	0%	100%	Excess water from the Polishing
		May	35,659	24,847.808	1.5 m	0%	0%	100%	Pond will be discharged to the
		Jun.-Oct.	35,659	24,847.808	1.5 m	0%	0%	100%	Oakley Creek Basin
	Year 12	Nov.-Apr.	35,659	24,847.808	1.5 m	0%	0%	100%	Excess water from the Polishing
		May	35,659	24,847.808	1.5 m	0%	0%	100%	Pond will be discharged to the
		Jun.-Oct.	35,659	24,847.808	1.5 m	0%	0%	100%	Oakley Creek Basin
Post Closure	Year 13	Nov.-Apr.	35,659	24,847.808	1.5 m	0%	0%	100%	Excess water from the Polishing
		May	35,659	24,847.808	1.5 m	0%	0%	100%	Pond will be discharged to the
		Jun.-Oct.	35,659	24,847.808	1.5 m	0%	0%	100%	Oakley Creek Basin
Temporary Suspension (TS)	After Year 4	Nov.-Apr.	25,725	12,470.026	0.5 m	65%	0%	0%	
		May	25,725	12,470.026	0.5 m	70%	30%	0%	
		Jun.-Oct.	25,725	12,470.026	0.5 m	70%	30%	0%	
State of Inactivity (SI)	After one year of TS	Nov.-Apr.	25,725	12,470.026	0.5 m	0%	0%	0%	No Discharge; Excess water will be stored in the Polishing Pond
		May	25,725	12,470.026	0.5 m	0%	100%	0%	
		Jun.-Oct.	25,725	12,470.026	0.5 m	0%	100%	0%	

6.3.2 Results of the Minago Water Balance Model

Following are key results of the water balance model based on the assumptions outlined above. As for the general description of the water management, the water balance model results are presented for the following seven mine development phases: Construction, Operations, Closure, Post Closure, Temporary Suspension, and the State of Inactivity. Following the presentation of results, Contaminants of Concern respective to the water quality of the discharged water will be summarizedWater balance models for all mine development phases were developed for three periods of the year: May, June to October, and November to April. These periods were chosen to represent average conditions during the freshet, summer, and winter.

Contaminant loadings and estimated elemental concentrations in the various flows of the Minago water balance model, presented below, are listed against the Metal Mining Effluent Regulations (Environment Canada, 2002a) and the Canadian Guidelines for the Protection of Aquatic Life (CCME, 2007). They are also summarized against the Manitoba Water Quality Standards, Objectives and Guidelines (Tier II and Tier III Freshwater Quality) (Williamson, 2002). These guideline limits are presented in Table 6-8. Parametric concentrations were estimated for aluminum (Al), antimony (Sb), arsenic (As), cadmium (Cd), chromium (Cr), cobalt (Co), copper (Cu), iron (Fe), lead (Pb), molybdenum (Mo), nickel (Ni), selenium (Se), and zinc (Zn).

The Metal Mining Effluent Regulations (MMER) were registered on June 6, 2002, under subsections 34(2), 36(5), and 38(9) of the *Fisheries Act* and replaced the MMLER and the associated *Metal Mining Liquid Effluent Guidelines* (Environment Canada, 2002a). The MMER prescribe authorized concentration limits for deleterious substances in mine effluents that discharge to waters frequented by fish. The MMER apply to all Canadian metal mines (except placer mines) that exceed an effluent flowrate of 50 m^3 per day. The MMER apply to effluent from all final discharge points (FDPs) at a mine site. A FDP is defined in the Regulations as a point beyond which the mine no longer exercises control over the quality of the effluent. The regulated MMER parameters are arsenic, copper, cyanide, lead, nickel, zinc, total suspended solids (TSS), Radium 226, and pH.

Canadian Water Quality Guidelines for the Protection of Aquatic Life define acceptable levels for substances or conditions that affect water quality such as toxic chemicals, temperature and acidity. As long as conditions are within the levels established by the guidelines, one would not expect to see negative effects in the environment (CCME, 2007). These guidelines are based on toxicity data for the most sensitive species of plants and animals found in Canadian waters and act as science-based benchmarks.

Table 6-8 Guideline Limits used for Interpreting Water Balance Results

Water Quality Parameter	Metal Mining Liquid Effluents (2002)		Manitoba Water Quality Standards, Objectives, and Guidelines (Williamson, 2002)		Canadian Water Quality Guidelines for the Protection of Aquatic Life
	Monthly Mean	Grab Sample	TIER II Water Quality Objectives assuming hardness = 150 mg/L $CaCO_3$	Freshwater	(CCME, 2007)
Aluminum (Al)				0.005 - 0.1	0.005
Antimony (Sb)					
Aresenic (As)	0.5	1	0.15 mg/L (4-Day, 3-Year) [A]	Tier II	0.005
Cadmium (Cd)			0.00302 [B]	Tier II	0.000017 $10^{\{0.86[\log(hardness)]-3.2\}}$
Chromium (Cr)			0.10331 [C]	Tier II	
Cobalt (Co)					
Copper (Cu)	0.3	0.6	0.01266 [D]	Tier II	0.002
Iron (Fe)				0.3	0.3
Lead (Pb)	0.2	0.4	0.0039 [E]	Tier II	0.001
Molybdenum (Mo)				0.073	
Nickel (Ni)	0.5	1	0.07329 [F]	Tier II	0.025
Selenium (Se)				0.001	0.001
Zinc (Zn)	0.5	1	0.16657 [G]	Tier II	0.03

Tier II Water Quality Limits for arsenic, cadmium, chromium, copper, lead, nickel, and zinc are hardness dependent as follows:

A Arsenic limits: 0.15 mg/L for averaging duration 4 days (4-Day, 3-Year or 7Q10 Design Flow);
0.34 mg/L for averaging duration 1 hr (1-Day, 3-Year or 1Q10 Design Flow)

B Cadmium limits: [e{0.7852[ln(Hardness)]-2.715}]×[1.101672-{ln(Hardness)(0.041838)}] for 4 days averaging duration.
[e{1.128[ln(Hardness)]-3.6867}]×[1.136672-{ln(Hardness)(0.041838)}] for 1 hour averaging duration.

C Chromium limits: Chromium III: [e{0.8190[ln(Hardness)]+0.6848}]×[0.860] for 4 days averaging duration.
Chromium III: [e{0.8190[ln(Hardness)]+3.7256}]×[0.316] for 1 hour averaging duration.
Chromium VI: 0.011 mg/L for averaging duration 4 days (4-Day, 3-Year or 7Q10 Design Flow);
0.016 mg/L for averaging duration 1 hr (1-Day, 3-Year or 1Q10 Design Flow)

D Copper limits: [e{0.8545[ln(Hardness)]-1.702}]×[0.960] for 4 Days hour averaging duration.
[e{0.9422[ln(Hardness)]-1.700}]×[0.960] for 1 hour averaging duration.

E Lead limits: [e{1.273[ln(Hardness)]-4,705}]×[1.46203 -{ln(Hardness)(0.145712)}] for 4 Days averaging duration.
[e{1.273[ln(Hardness)]-1.460}]×[1.46203 -{ln(Hardness)(0.145712)}] for 1 hour averaging duration.

F Nickel limits: [e{0.8460[ln(Hardness)]+0.0584}]×[0.997] for 4 Days averaging duration.
[e{0.8460[ln(Hardness)]+2.255}]×[0.998] for 1 hour averaging duration.

G Zinc limits: [e{0.8473[ln(Hardness)]+0.884}]×[0.976] for 4 Days averaging duration.
[e{0.8473[ln(Hardness)]+0.884}]×[0.978] for 1 hour averaging duration.

The Manitoba Tier II Water Quality Objectives are defined for a limited number of common pollutants (such as dissolved metals and nutrients) are routinely controlled through licencing under the Manitoba Environment Act. Manitoba Tier II Water Quality Objectives typically form the basis for the water quality base approach when additional restrictions need to be developed to protect important uses of ground or surface waters (Williamson, 2002).

It should be noted that water quality guideline limits for heavy metals (such as cadmium, chromium, copper, lead, nickel and zinc) depend on hardness. Therefore, results presented below are listed in terms of applicable equations to determine the guideline limits based on hardness as well as for a hardness of 150 mg/L $CaCO_3$. The hardness level of 150 mg/L $CaCO_3$ was chosen as comparison for results obtained with the Minago water balance model based on water quality results obtained to date. For these results, listed in Table 6-9, the average hardness was 192.2 mg/L $CaCO_3$, the median hardness was 193 mg/L $CaCO_3$, and the weighted average hardness was 173.1 mg/L $CaCO_3$.

Table 6-9 Hardness Levels Measured at Minago

	Number of Samples	Minimum (mg/L$CaCO_3$)	Average (mg/L$CaCO_3$)	Maximum (mg/L$CaCO_3$)
Frac Sand Plant Overflow	2		171.5	194
Frac Sand Plant Underflow	2		167	192
Sub-aqueous Col. Pore Water	53	145	232	358
Sub-aqueous Col. Surface Water	53	71.2	102.8	138
Groundwater Limestone	3	242	267	287
Groundwater Sandstone	3	165	196	257
Upstream Minago (MRW2)	7	169	192	213
Downstream Minago (MRW1)	14	87.2	149	256
Upstream Oakley Cr. (OCW2)	13	169	204.8	265
Process Water (Nov. 2008 SGS Lakefield Results)	1		240	
Total	151			
Minimum		**71.2**		
Average			**192.2**	
Maximum				**358.0**
Weighted Average			**173.1**	

6.3.2.1.1 Water Balance Modeling Results during Construction

Estimated flowrates during construction prior to the dredging operations are listed in Table 6-10 and the corresponding water management plan is illustrated in Figure 6-2

The Polishing Pond discharge to Minago River (Q19) in relation to the Minago River streamflow (Q20) will be 8% in May, 14% in the summer months (June to October) and 30% in the winter months (November to April). In absolute quantities, discharge to Minago River will range from 20,741 m^3/day to 69,360 m^3/day during construction. The Polishing Pond discharge to Oakley Creek (Q22) in relation to the Oakley Creek streamflow (Q23) will be 0% in the winter months (Nov. to Apr.), 9% in May, and 23% in the summer months (June to October). In absolute quantities, discharge to Oakley Creek will range from 0 m^3/day to 29,725 m^3/day during construction.

Table 6-11 presents projected parametric concentrations for the Polishing Pond outflow (Q17), Minago downstream (Q21), and Oakley Creek downstream (Q24). All projected Polishing Pond outflow concentrations meet the MMER levels and the projected water quality downstream of the mixing zones in the Minago River and the Oakley Creek meets the CCME (2007) and Manitoba Tier III Freshwater guidelines levels.

6.3.2.1.2 Water Balance Modeling Results during Operations

Year 1 through Year 8 Operations

Estimated flowrates during Year 1 through Year 8 operations are listed in Table 6-12and the corresponding water management plan is illustrated in Figure 6-3.

The Polishing Pond discharge to Minago River (Q33) in relation to the Minago River streamflow (Q34) will be 10% in May, 19% in the summer months (June to October) and 31% in the winter months (November to April). In absolute quantities, discharge to Minago River will range from 21,160 m^3/day to 90,035 m^3/day during Year 1 to Year 8 operations. The Polishing Pond discharge to Oakley Creek (Q36) in relation to the Oakley Creek streamflow (Q37) will be 0% in the winter months (Nov. to Apr.), 10% to 11% in May, and 31% in the summer months (June to October). In absolute quantities, discharge to Oakley Creek will range from 0 m^3/day to 37,715 m^3/day during operations.

Table 6-13 presents projected parametric concentrations for the Polishing Pond outflow (Q30), Minago downstream (Q35), and Oakley Creek downstream (Q38). Additional results for Q26 (TWRMF Inflow), Q27 (TWRMF Decant), and Q29 (Polishing Pond Inflow). All Polishing Pond outflow concentrations are projected to meet the MMER levels and the projected water quality downstream of the mixing zones in the Minago River and the Oakley Creek meets the CCME (2007) and Manitoba Tier III Freshwater guidelines levels. Table 6-14 gives projected effluent concentrations in site flows during Year 8 operations.

Table 6-10 Projected Flow Rates during Construction

FLOW		During Construction prior to Dredging		
		NOVEMBER TO APRIL	MAY	JUNE TO OCTOBER
		Minago River Flow 0.8 m^3/s; Oakley Creek Flow at 0 m^3/s	Minago River Flow 10 m^3/s; Oakley Creek Flow at 4 m^3/s	Minago River Flow 1.9 m^3/s; Oakley Creek Flow at 0.5 m^3/s
		m^3/day	m^3/day	m^3/day
UNIT EVAPORATION	UNIT LAKE EVAPORATION	0	18	14
UNIT PPT (U-PPT)	UNIT PRECIPITATION	0	41	21
Q1	FLOW FROM DEWATERING WELLS	31,999	31,999	31,999
Q2	WELL WATER FOR PROCESSING	90	90	90
Q3	EXCESS WATER FROM DEWATERING WELLS	31,909	31,909	31,909
Q4	GROUNDWATER TO MILL CONSTRUCTION	0	0	0
Q5	GROUNDWATER TO WATER TREATMENT	90	90	90
Q6	GROUNDWATER TO FSP CONSTRUCTION	0	0	0
Q7	GROUNDWATER FOR FIRE FIGHTING	0	0	0
Q9	POTABLE WATER	90	90	90
Q10	WATER TREATMENT PLANT WASTE	0	0	0
Q11	SEWAGE & GREY WATER FROM CAMP AND OFFICES	90	90	90
Q12	SEWAGE & GREY WATER FROM ALL OTHER ON SITE SOURCES	0	0	0
Q13	FLOW FROM THE ODF TO THE ODF SETTLING POND	0	0	0
Q14	DISCHARGE TO THE OAKLEY CREEK BASIN	0	0	0
Q15	SEWAGE TREATMENT OUTFLOW	0	635	97
Q16	POLISHING POND INFLOW	31,909	97,392	32,006
Q-PPT on Polishing Pond	PPT ON POLISHING POND	0	3,049	1,602
Q-Evapo from Polishing Pond	EVAPO FROM POLISHING POND	0	1,355	1,063
Q17	POLISHING POND OUTFLOW	31,909	99,086	32,545
Q18	DISCHARGE PIPELINE	20,741	99,086	32,545
Q19	DISCHARGE TO MINAGO	20,741	69,360	22,782
Q20	MINAGO UPSTREAM	69,120	864,000	164,160
Q21	MINAGO DOWNSTREAM	89,861	933,360	186,942
Q22	DISCHARGE TO OAKLEY CREEK	0	29,726	9,764
Q23	OAKLEY CREEK UPSTREAM	0	345,600	43,200
Q24	OAKLEY CREEK DOWNSTREAM	0	375,326	52,964
FLOW RATIOS:				
Q19 / Q20	RATIO OF DISCHARGE TO MINAGO TO FLOW IN MINAGO	30%	8%	14%
Q22 / Q23	RATIO OF DISCHARGE TO OAKLEY CK TO FLOW IN OAKLEY CK	0%	9%	23%

Table 6-11 Projected Effluent Concentrations in Site Flows during Construction prior to Dredging

SCENARIO:				ESTIMATED AVERAGE CONCENTRATION During Construction			REGULATIONS				
				Tailings only; max.tailings leaching rate	Tailings only; max.tailings leaching rate	Tailings only; max.tailings leaching rate	Metal Mining Liquid Effluents (2002)		Manitoba Water Quality Standards, Objectives, and Guidelines (Williamson, 2002)		Canadian Water Quality Guidelines for the Protection of Aquatic Life
			WATER QUALITY	NOVEMBER TO APRIL	MAY	JUNE TO OCTOBER			TIER II Water Quality Objectives		
FLOW			PARAM.	(mg/L)	(mg/L)	(mg/L)	Monthly Mean	Grab Sample	assuming hardness = 150 mg/L $CaCO_3$	Freshwater	(CCME, 2007)
Q17	POLISHING POND OUTFLOW	Al	RC17	0.009	0.009	0.009				0.005 - 0.1	0.005
Q17	POLISHING POND OUTFLOW	Sb	RC17	0.00003	0.00004	0.00005					
Q17	POLISHING POND OUTFLOW	As	RC17	0.001	0.001	0.001	0.5	1	0.15 mg/L (4-Day, 3-Year) [A]	Tier II	0.005
Q17	POLISHING POND OUTFLOW	Cd	RC17	0.00001	0.00001	0.00001			0.00302 [B]	Tier II	0.000017 or $10^{\{0.86[\log(hardness)]-3.2\}}$
Q17	POLISHING POND OUTFLOW	Cr	RC17	0.0010	0.0010	0.0010			0.10331 [C]	Tier II	
Q17	POLISHING POND OUTFLOW	Co	RC17	0.00008	0.00009	0.00010					
Q17	POLISHING POND OUTFLOW	Cu	RC17	0.0005	0.0005	0.0006	0.3	0.6	0.01266 [D]	Tier II	0.002
Q17	POLISHING POND OUTFLOW	Fe	RC17	0.005	0.006	0.006				0.3	0.3
Q17	POLISHING POND OUTFLOW	Pb	RC17	0.00003	0.00005	0.00006	0.2	0.4	0.0039 [E]	Tier II	0.001
Q17	POLISHING POND OUTFLOW	Mo	RC17	0.0007	0.0007	0.0007				0.073	
Q17	POLISHING POND OUTFLOW	Ni	RC17	0.001	0.001	0.001	0.5	1	0.07329 [F]	Tier II	0.025
Q17	POLISHING POND OUTFLOW	Se	RC17	0.0002	0.0002	0.0002				0.001	0.001
Q17	POLISHING POND OUTFLOW	Zn	RC17	0.005	0.005	0.005	0.5	1	0.16657 [G]	Tier II	0.03
Q21	MINAGO DOWNSTREAM	Al	RC21	0.011	0.012	0.012				0.005 - 0.1	0.005
Q21	MINAGO DOWNSTREAM	Sb	RC21	0.00004	0.00005	0.00005					
Q21	MINAGO DOWNSTREAM	As	RC21	0.0007	0.0006	0.0006	0.5	1	0.15 mg/L (4-Day, 3-Year) [A]	Tier II	0.005
Q21	MINAGO DOWNSTREAM	Cd	RC21	0.000014	0.000016	0.000015			0.00302 [B]	Tier II	0.000017 or $10^{\{0.86[\log(hardness)]-3.2\}}$
Q21	MINAGO DOWNSTREAM	Cr	RC21	0.00041	0.00029	0.00033			0.10331 [C]	Tier II	
Q21	MINAGO DOWNSTREAM	Co	RC21	0.00006	0.00005	0.00006					
Q21	MINAGO DOWNSTREAM	Cu	RC21	0.001	0.001	0.001	0.3	0.6	0.01266 [D]	Tier II	0.002
Q21	MINAGO DOWNSTREAM	Fe	RC21	0.054	0.065	0.062				0.3	0.3
Q21	MINAGO DOWNSTREAM	Pb	RC21	0.00005	0.00006	0.00006	0.2	0.4	0.0039 [E]	Tier II	0.001
Q21	MINAGO DOWNSTREAM	Mo	RC21	0.00025	0.00017	0.00020				0.073	
Q21	MINAGO DOWNSTREAM	Ni	RC21	0.001	0.001	0.001	0.5	1	0.07329 [F]	Tier II	0.025
Q21	MINAGO DOWNSTREAM	Se	RC21	0.00023	0.00024	0.00024				0.001	0.001
Q21	MINAGO DOWNSTREAM	Zn	RC21	0.002	0.001	0.001	0.5	1	0.16657 [G]	Tier II	0.03

Table 6-11 (Cont.'d) Projected Effluent Concentrations in Site Flows during Construction prior to Dredging

SCENARIO: FLOW			WATER QUALITY PARAM.	ESTIMATED AVERAGE CONCENTRATION During Construction: Tailings only; max.tailings leaching rate NOVEMBER TO APRIL (mg/L)	Tailings only; max.tailings leaching rate MAY (mg/L)	Tailings only; max.tailings leaching rate JUNE TO OCTOBER (mg/L)	REGULATIONS: Metal Mining Liquid Effluents (2002) Monthly Mean	Metal Mining Liquid Effluents (2002) Grab Sample	Manitoba Water Quality Standards, Objectives, and Guidelines (Williamson, 2002): TIER II Water Quality Objectives assuming hardness = 150 mg/L $CaCO_3$	Manitoba Water Quality Standards, Objectives, and Guidelines (Williamson, 2002): Freshwater	Canadian Water Quality Guidelines for the Protection of Aquatic Life (CCME, 2007)
Q24	OAKLEY CREEK DOWNSTREAM	Al	RC24	0.0000	0.0000	0.0000				0.005 - 0.1	0.005
Q24	OAKLEY CREEK DOWNSTREAM	Sb	RC24	0.000000	0.000000	0.000000					
Q24	OAKLEY CREEK DOWNSTREAM	As	RC24	0.0000	0.0000	0.0000	0.5	1	0.15 mg/L (4-Day, 3-Year) [A]	Tier II	0.005
Q24	OAKLEY CREEK DOWNSTREAM	Cd	RC24	0.000000	0.000000	0.000000			0.00302 [B]	Tier II	0.000017 or $10^{\{0.86[\log(hardness)]-3.2\}}$
Q24	OAKLEY CREEK DOWNSTREAM	Cr	RC24	0.0000	0.0000	0.0000			0.10331 [C]	Tier II	
Q24	OAKLEY CREEK DOWNSTREAM	Co	RC24	0.0000	0.0000	0.0000					
Q24	OAKLEY CREEK DOWNSTREAM	Cu	RC24	0.0000	0.0000	0.0000	0.3	0.6	0.01266 [D]	Tier II	0.002
Q24	OAKLEY CREEK DOWNSTREAM	Fe	RC24	0.0000	0.0000	0.0000				0.3	0.3
Q24	OAKLEY CREEK DOWNSTREAM	Pb	RC24	0.0000	0.0000	0.0000	0.2	0.4	0.0039 [E]	Tier II	0.001
Q24	OAKLEY CREEK DOWNSTREAM	Mo	RC24	0.0000	0.0000	0.0000				0.073	
Q24	OAKLEY CREEK DOWNSTREAM	Ni	RC24	0.0000	0.0000	0.0000	0.5	1	0.07329 [F]	Tier II	0.025
Q24	OAKLEY CREEK DOWNSTREAM	Se	RC24	0.0000	0.0000	0.0000				0.001	0.001
Q24	OAKLEY CREEK DOWNSTREAM	Zn	RC24	0.0000	0.0000	0.0000	0.5	1	0.16657 [G]	Tier II	0.03

Notes:
August 2008 groundwater chemistry was assumed in the modeling.

A Arsenic limits: 0.15 mg/L for averaging duration 4 days (4-Day, 3-Year or 7Q10 Design Flow); 0.34 mg/L for averaging duration 1 hr (1-Day, 3-Year or 1Q10 Design Flow)

B Cadmium limits: [e{0.7852[ln(Hardness)]-2.715}]×[1.101672-{ln(Hardness)(0.041838)}] for 4 days averaging duration.
[e{1.128[ln(Hardness)]-3.6867}]×[1.136672-{ln(Hardness)(0.041838)}] for 1 hour averaging duration.

C Chromium limits: Chromium III: [e{0.8190[ln(Hardness)]+0.6848}]×[0.860] for 4 days averaging duration.
Chromium III: [e{0.8190[ln(Hardness)]+3.7256}]×[0.316] for 1 hour averaging duration.
Chromium VI: 0.011 mg/L for averaging duration 4 days (4-Day, 3-Year or 7Q10 Design Flow); 0.016 mg/L for averaging duration 1 hr (1-Day, 3-Year or 1Q10 Design Flow)

D Copper limits: [e{0.8545[ln(Hardness)]-1.702}]×[0.960] for 4 Days hour averaging duration.
[e{0.9422[ln(Hardness)]-1.700}]×[0.960] for 1 hour averaging duration.

E Lead limits: [e{1.273[ln(Hardness)]-4,705}]×[1.46203 -{ln(Hardness)(0.145712)}] for 4 Days averaging duration.
[e{1.273[ln(Hardness)]-1.460}]×[1.46203 -{ln(Hardness)(0.145712)}] for 1 hour averaging duration.

F Nickel limits: [e{0.8460[ln(Hardness)]+0.0584}]×[0.997] for 4 Days averaging duration.
[e{0.8460[ln(Hardness)]+2.255}]×[0.998] for 1 hour averaging duration.

G Zinc limits: [e{0.8473[ln(Hardness)]+0.884}]×[0.976] for 4 Days averaging duration.
[e{0.8473[ln(Hardness)]+0.884}]×[0.978] for 1 hour averaging duration.

Table 6-12 Projected Flow Rates during Year 1 through 8 Operations

	FLOW	Year 1			Year 2			…	Year 7			Year 8		
		Tailings only; max.tailings leaching rate	Tailings only; max.tailings leaching rate	Tailings only; max.tailings leaching rate	Tailings only; max.tailings leaching rate	Tailings only; max.tailings leaching rate	Tailings only; max.tailings leaching rate		Tailings only; max.tailings leaching rate	Tailings only; max.tailings leaching rate	Tailings only; max.tailings leaching rate	Tailings only; max.tailings leaching rate	Tailings only; max.tailings leaching rate	Tailings only; max.tailings leaching rate
		NOVEMBER TO APRIL	MAY	JUNE TO OCTOBER	NOVEMBER TO APRIL	MAY	JUNE TO OCTOBER		NOVEMBER TO APRIL	MAY	JUNE TO OCTOBER	NOVEMBER TO APRIL	MAY	JUNE TO OCTOBER
		m^3/day	m^3/day	m^3/day	m^3/day	m^3/day	m^3/day		m^3/day	m^3/day	m^3/day	m^3/day	m^3/day	m^3/day
UNIT EVAPORATION	UNIT LAKE EVAPORATION	0	18	14	0	18	14		0	18	14	0	18	14
UNIT PPT (U-PPT)	UNIT PRECIPITATION	0	41	21	0	41	21		0	41	21	0	41	21
Q1	FLOW FROM DEWATERING WELLS	31,999	31,999	31,999	31,999	31,999	31,999		31,999	31,999	31,999	31,999	31,999	31,999
Q2	WELL WATER FOR PROCESSING	5,724	5,724	5,724	5,724	5,724	5,724		5,724	5,724	5,724	5,724	5,724	5,724
Q3	EXCESS WATER FROM DEWATERING WELLS	26,276	26,276	26,276	26,276	26,276	26,276		26,276	26,276	26,276	26,276	26,276	26,276
Q4	GROUNDWATER TO OTHER OPERATIONS	1,440	1,440	1,440	1,440	1,440	1,440		1,440	1,440	1,440	1,440	1,440	1,440
Q5	GROUNDWATER TO WATER TREATMENT	96	96	96	96	96	96		96	96	96	96	96	96
Q6	GROUNDWATER TO FRAC SAND PLANT	4,188	4,188	4,188	4,188	4,188	4,188		4,188	4,188	4,188	4,188	4,188	4,188
Q7	GROUNDWATER FOR FIRE FIGHTING	0	0	0	0	0	0		0	0	0	0	0	0
Q8	POTABLE WATER	96	96	96	96	96	96		96	96	96	96	96	96
Q9	WATER TREATMENT PLANT WASTE	0	0	0	0	0	0		0	0	0	0	0	0
Q10	RECYCLE WATER FROM FPP	10,632	10,632	10,632	10,632	10,632	10,632		10,632	10,632	10,632	10,632	10,632	10,632
Q11	POTABLE WATER TO MILL	6	6	6	6	6	6		6	6	6	6	6	6
Q12	POTABLE WATER TO OTHER OPERATIONS	5	5	5	5	5	5		5	5	5	5	5	5
Q13	POTABLE WATER TO OFFICES & CAMP	72	72	72	72	72	72		72	72	72	72	72	72
Q14	POTABLE WATER TO FRAC SAND PLANT	12	12	12	12	12	12		12	12	12	12	12	12
Q15	FLOW FROM OPERATIONS TO MILL	1,440	1,440	1,440	1,440	1,440	1,440		1,440	1,440	1,440	1,440	1,440	1,440
Q16	SEWAGE & GREY WATER FROM CAMP AND OFFICES	72	72	72	72	72	72		72	72	72	72	72	72
Q17	SEWAGE & GREY WATER FROM ALL OTHER ON SITE SOURCES	24	24	24	24	24	24		24	24	24	24	24	24
Q19	FLOW FROM CONCENTRATE THICKENER IN MILL TO MILL	1,080	1,080	1,080	1,080	1,080	1,080		1,080	1,080	1,080	1,080	1,080	1,080
Q20	FLOW FROM MILL TO MILL THICKENER	32,928	32,928	32,928	32,928	32,928	32,928		32,928	32,928	32,928	32,928	32,928	32,928
Q21	RECYCLE WATER FROM MILL THICKENER	20,856	20,856	20,856	20,856	20,856	20,856		20,856	20,856	20,856	20,856	20,856	20,856
Q21x	ATERNATE FLOW FOR RECYCLE WATER FROM MILL THICKENER	0	0	0	0	0	0		0	0	0	0	0	0
Q22	MILL TAILINGS SLURRY	12,072	12,072	12,072	12,072	12,072	12,072		12,072	12,072	12,072	12,072	12,072	12,072
Q23	SEWAGE TREATMENT OUTFLOW	0	676	103	0	676	103		0	676	103	0	676	103
Q24	LIQ. WASTE FROM FSP	2,892	2,892	2,892	2,892	2,892	2,892		2,892	2,892	2,892	2,892	2,892	2,892
Q25	SLURRY FROM FSP	772	772	772	772	772	772		772	772	772	772	772	772
Q26	TWRMF INFLOW	15,736	16,412	15,839	15,736	16,412	15,839		15,736	16,412	15,839	15,736	16,412	15,839
Q - Liquid PPT on TWRMF	PPT on TWRMF	0	8,930	4,694	0	8,930	4,694		0	8,930	4,694	0	8,930	4,694
Q - Retained Water in Tailings Voids	Q - Retained Water in Tailings Voids	726	1,467	1,467	1,467	1,467	1,467		1,467	1,467	1,467	1,467	1,467	1,467
Q - TWRMF Supernatant	TWRMF Supernatant	15,010	55,342	23,084	20,372	55,342	23,084		20,372	55,342	23,084	20,372	55,342	23,084
Q27	TWRMF Decant	8,907	19,907	15,951	14,269	19,907	15,951		14,269	19,907	15,951	14,269	19,907	15,951
Q - Pit Dewatering	OPEN PIT DEWATERING	8,000	8,000	8,000	8,000	8,000	8,000		8,000	8,000	8,000	8,000	8,000	8,000
Q - Precipitation on Pit	Precipitation minus Sublimation on Open Pit	0	7,723	4,059	0	7,723	4,059		0	7,723	4,059	0	7,723	4,059
Q28	TOT. OPEN PIT DEWATERING	8,000	15,723	12,059	8,000	15,723	12,059		8,000	15,723	12,059	8,000	15,723	12,059
Q29	POLISHING POND INFLOW	43,183	128,057	54,285	48,545	137,557	54,285		48,545	123,043	54,285	48,545	121,643	54,285
Q - Precipitation on Polishing Pond	Precipitation minus Sublimation ON POLISHING POND	0	3,049	1,602	0	3,049	1,602		0	3,049	1,602	0	3,049	1,602
Q - Evaporation from Polishing Pond	EVAPORATION FROM POLISHING POND	0	1,355	1,063	0	1,355	1,063		0	1,355	1,063	0	1,355	1,063
Q30	POLISHING POND OUTFLOW	43,183	129,751	54,824	48,545	139,250	54,824		48,545	124,737	54,824	48,545	123,337	54,824
Q31	RECYCLE FROM FINAL POLISHING POND	10,632	10,632	10,632	10,632	10,632	10,632		10,632	10,632	10,632	10,632	10,632	10,632
Q32	DISCHARGE PIPELINE	21,158	119,119	44,192	24,643	128,618	44,192		24,643	114,105	44,192	24,643	112,705	44,192
Q33	DISCHARGE TO MINAGO	21,158	83,383	30,935	24,643	90,033	30,935		24,643	79,873	30,935	24,643	78,894	30,935
Q34	MINAGO UPSTREAM	69,120	864,000	164,160	69,120	864,000	164,160		69,120	864,000	164,160	69,120	864,000	164,160
Q35	MINAGO DOWNSTREAM	90,278	947,383	195,095	93,763	954,033	195,095		93,763	943,873	195,095	93,763	942,894	195,095
Q36	DISCHARGE TO OAKLEY CREEK	0	35,736	13,258	0	38,585	13,258		0	34,231	13,258	0	33,812	13,258
Q37	OAKLEY CREEK UPSTREAM	0	345,600	43,200	0	345,600	43,200		0	345,600	43,200	0	345,600	43,200
Q38	OAKLEY CREEK DOWNSTREAM	0	381,336	56,458	0	384,185	56,458		0	379,831	56,458	0	379,412	56,458
FLOW RATIOS:														
Q33 / Q34	RATIO OF DISCHARGE TO MINAGO TO FLOW IN MINAGO	31%	10%	19%	36%	10%	19%		36%	9%	19%	36%	9%	19%
Q36 / Q37	RATIO OF DISCHARGE TO OAKLEY CK TO FLOW IN OAKLEY CK	0%	10%	31%	0%	11%	31%		0%	10%	31%	0%	10%	31%

Note: A complete listing of projected flowrates during the Year 1 to Year 8 Operations are given in Appendix 2.14.

Table 6-13 Projected Effluent Concentrations in Site Flows during Year 1 through Year 4 Operations

SCENARIO:			ESTIMATED AVERAGE CONCENTRATION												REGULATIONS				
			Year 1			Year 2			Year 3			Year 4			Metal Mining Liquid Effluents (2002)		Manitoba Water Quality Standards, Objectives, and Guidelines (Williamson, 2002)		Canadian Water Quality Guidelines for the Protection of Aquatic Life
			Tailings only; max.tailings leaching rate	Tailings only; max.tailings leaching rate	Tailings only; max.tailings leaching rate	Tailings only; max.tailings leaching rate	Tailings only; max.tailings leaching rate	Tailings only; max.tailings leaching rate	Tailings only; max.tailings leaching rate	Tailings only; max.tailings leaching rate	Tailings only; max.tailings leaching rate	Tailings only; max.tailings leaching rate	Tailings only; max.tailings leaching rate	Tailings only; max.tailings leaching rate			TIER II Water Quality Objectives		
		WATER QUALITY	NOVEMBER TO APRIL	MAY	JUNE TO OCTOBER	NOVEMBER TO APRIL	MAY	JUNE TO OCTOBER	NOVEMBER TO APRIL	MAY	JUNE TO OCTOBER	NOVEMBER TO APRIL	MAY	JUNE TO OCTOBER					
FLOW		PARAM.	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	Monthly Mean	Grab Sample	assuming hardness = 150 mg/L $CaCO_3$	Freshwater	(CCME, 2007)
Q30	POLISHING POND OUTFLOW	Al	0.119	0.139	0.154	0.169	0.169	0.156	0.171	0.174	0.160	0.174	0.181	0.165				0.005 - 0.1	0.005
Q30	POLISHING POND OUTFLOW	Sb	0.00092	0.00115	0.00130	0.00135	0.00139	0.00132	0.00136	0.00144	0.00135	0.00138	0.00149	0.00139					
Q30	POLISHING POND OUTFLOW	As	0.001	0.001	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.5	1	0.15 mg/L (4-Day, 3-Year) [A]	Tier II	0.005
Q30	POLISHING POND OUTFLOW	Cd	0.00018	0.00021	0.00024	0.00026	0.00026	0.00024	0.00027	0.00027	0.00025	0.00028	0.00029	0.00027			0.00302 [B]	Tier II	0.000017 or $10^{\{0.86[\log(hardness)]-3.2}$
Q30	POLISHING POND OUTFLOW	Cr	0.0038	0.0043	0.0048	0.0051	0.0051	0.0048	0.0051	0.0052	0.0049	0.0052	0.0054	0.0050			0.10331 [C]	Tier II	
Q30	POLISHING POND OUTFLOW	Co	0.00245	0.00292	0.00324	0.00353	0.00353	0.00329	0.00355	0.00364	0.00336	0.00358	0.00375	0.00344					
Q30	POLISHING POND OUTFLOW	Cu	0.0084	0.0100	0.0110	0.0122	0.0122	0.0114	0.0124	0.01272	0.0118	0.0127	0.0133	0.0122	0.3	0.6	0.01266 [D]	Tier II	0.002
Q30	POLISHING POND OUTFLOW	Fe	0.527	0.628	0.696	0.762	0.761	0.704	0.765	0.781	0.717	0.769	0.804	0.733				0.3	0.3
Q30	POLISHING POND OUTFLOW	Pb	0.00141	0.00172	0.00193	0.00216	0.00220	0.00209	0.00233	0.00242	0.00228	0.00250	0.00266	0.00249	0.2	0.4	0.0039 [E]	Tier II	0.001
Q30	POLISHING POND OUTFLOW	Mo	0.0032	0.0037	0.0041	0.0045	0.0046	0.0043	0.0047	0.0049	0.0046	0.0049	0.0052	0.0049				0.073	
Q30	POLISHING POND OUTFLOW	Ni	0.120	0.142	0.158	0.174	0.173	0.160	0.175	0.178	0.164	0.177	0.184	0.168	0.5	1	0.07329 [F]	Tier II	0.025
Q30	POLISHING POND OUTFLOW	Se	0.0018	0.0022	0.0025	0.0026	0.0027	0.0026	0.0027	0.0028	0.0026	0.0027	0.0029	0.0027				0.001	0.001
Q30	POLISHING POND OUTFLOW	Zn	0.011	0.012	0.014	0.015	0.015	0.014	0.015	0.016	0.015	0.016	0.017	0.016	0.5	1	0.16657 [G]	Tier II	0.03
Q35	MINAGO DOWNSTREAM	Al	0.037	0.023	0.034	0.053	0.027	0.035	0.054	0.027	0.036	0.055	0.027	0.036				0.005 - 0.1	0.005
Q35	MINAGO DOWNSTREAM	Sb	0.00025	0.00015	0.00025	0.00039	0.00018	0.00025	0.00039	0.00018	0.00026	0.00040	0.00018	0.00026					
Q35	MINAGO DOWNSTREAM	As	0.0008	0.0007	0.0008	0.0009	0.0007	0.0008	0.0009	0.0007	0.0008	0.0009	0.0007	0.0008	0.5	1	0.15 mg/L (4-Day, 3-Year) [A]	Tier II	0.005
Q35	MINAGO DOWNSTREAM	Cd	0.000054	0.000034	0.000052	0.000081	0.000040	0.000053	0.000083	0.000041	0.000054	0.000085	0.000041	0.000056			0.00302 [B]	Tier II	0.000017 or $10^{\{0.86[\log(hardness)]-3.2}$
Q35	MINAGO DOWNSTREAM	Cr	0.00107	0.00059	0.00095	0.00151	0.00069	0.00096	0.00152	0.00069	0.00097	0.00153	0.00070	0.00099			0.10331 [C]	Tier II	
Q35	MINAGO DOWNSTREAM	Co	0.00061	0.00030	0.00056	0.00096	0.00038	0.00056	0.00097	0.00038	0.00057	0.00098	0.00039	0.00059					
Q35	MINAGO DOWNSTREAM	Cu	0.002	0.001	0.002	0.004	0.002	0.002	0.004	0.002	0.002	0.004	0.002	0.002	0.3	0.6	0.01266 [D]	Tier II	0.002
Q35	MINAGO DOWNSTREAM	Fe	0.177	0.118	0.169	0.251	0.135	0.170	0.252	0.135	0.172	0.253	0.136	0.175				0.3	0.3
Q35	MINAGO DOWNSTREAM	Pb	0.00037	0.00020	0.00035	0.00061	0.00026	0.00038	0.00065	0.00028	0.00041	0.00070	0.00029	0.00044	0.2	0.4	0.0039 [E]	Tier II	0.001
Q35	MINAGO DOWNSTREAM	Mo	0.00085	0.00045	0.00076	0.00128	0.00055	0.00079	0.00134	0.00057	0.00083	0.00139	0.00059	0.00088				0.073	
Q35	MINAGO DOWNSTREAM	Ni	0.029	0.013	0.026	0.046	0.017	0.026	0.047	0.017	0.027	0.047	0.018	0.028	0.5	1	0.07329 [F]	Tier II	0.025
Q35	MINAGO DOWNSTREAM	Se	0.00062	0.00042	0.00061	0.00087	0.00048	0.00061	0.00088	0.00048	0.00062	0.00089	0.00048	0.00063				0.001	0.001
Q35	MINAGO DOWNSTREAM	Zn	0.003	0.002	0.003	0.005	0.002	0.003	0.005	0.002	0.003	0.005	0.002	0.003	0.5	1	0.16657 [G]	Tier II	0.03

Table 6-13 (Cont.'d) Projected Effluent Concentrations in Site Flows during Year 1 through Year 4 Operations

SCENARIO:		WATER QUALITY	ESTIMATED AVERAGE CONCENTRATION												REGULATIONS				
			Year 1			Year 2			Year 3			Year 4			Metal Mining Liquid Effluents (2002)		Manitoba Water Quality Standards, Objectives, and Guidelines (Williamson, 2002)		Canadian Water Quality Guidelines for the Protection of Aquatic Life
			Tailings only; max.tailings leaching rate	Tailings only; max.tailings leaching rate	Tailings only; max.tailings leaching rate	Tailings only; max.tailings leaching rate	Tailings only; max.tailings leaching rate	Tailings only; max.tailings leaching rate	Tailings only; max.tailings leaching rate	Tailings only; max.tailings leaching rate	Tailings only; max.tailings leaching rate	Tailings only; max.tailings leaching rate	Tailings only; max.tailings leaching rate	Tailings only; max.tailings leaching rate			TIER II Water Quality Objectives		
			NOVEMBER TO APRIL	MAY	JUNE TO OCTOBER	NOVEMBER TO APRIL	MAY	JUNE TO OCTOBER	NOVEMBER TO APRIL	MAY	JUNE TO OCTOBER	NOVEMBER TO APRIL	MAY	JUNE TO OCTOBER					
FLOW		PARAM.	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	Monthly Mean	Grab Sample	assuming hardness = 150 mg/L $CaCO_3$	Freshwater	(CCME, 2007)
Q38	OAKLEY CREEK DOWNSTREAM	Al	0.0000	0.0155	0.0381	0.0000	0.0193	0.0388	0.0000	0.0195	0.0397	0.0000	0.0198	0.0408				0.005 - 0.1	0.005
Q38	OAKLEY CREEK DOWNSTREAM	Sb	0.000000	0.000138	0.000330	0.000000	0.000170	0.000336	0.000000	0.000172	0.000344	0.000000	0.000174	0.000353					
Q38	OAKLEY CREEK DOWNSTREAM	As	0.0000	0.0005	0.0007	0.0000	0.0005	0.0007	0.0000	0.0005	0.0007	0.0000	0.0005	0.0007	0.5	1	0.15 mg/L (4-Day, 3-Year) [A]	Tier II	0.005
Q38	OAKLEY CREEK DOWNSTREAM	Cd	0.000000	0.000031	0.000065	0.000000	0.000038	0.000067	0.000000	0.000038	0.000069	0.000000	0.000039	0.000072			0.00302 [B]	Tier II	0.000017 or $10^{\{0.86[\log(hardness)]-3.2\}}$
Q38	OAKLEY CREEK DOWNSTREAM	Cr	0.0000	0.0007	0.0013	0.0000	0.0008	0.0014	0.0000	0.0008	0.0014	0.0000	0.0008	0.0014			0.10331 [C]	Tier II	
Q38	OAKLEY CREEK DOWNSTREAM	Co	0.0000	0.0003	0.0008	0.0000	0.0004	0.0008	0.0000	0.0004	0.0008	0.0000	0.0004	0.0008					
Q38	OAKLEY CREEK DOWNSTREAM	Cu	0.0000	0.0011	0.0027	0.0000	0.0014	0.0028	0.0000	0.0014	0.0029	0.0000	0.0014	0.0030	0.3	0.6	0.01266 [D]	Tier II	0.002
Q38	OAKLEY CREEK DOWNSTREAM	Fe	0.0000	0.1046	0.2021	0.0000	0.1218	0.2040	0.0000	0.1224	0.2071	0.0000	0.1231	0.2108				0.3	0.3
Q38	OAKLEY CREEK DOWNSTREAM	Pb	0.0000	0.0002	0.0005	0.0000	0.0002	0.0005	0.0000	0.0003	0.0006	0.0000	0.0003	0.0006	0.2	0.4	0.0039 [E]	Tier II	0.001
Q38	OAKLEY CREEK DOWNSTREAM	Mo	0.0000	0.0004	0.0010	0.0000	0.0005	0.0011	0.0000	0.0006	0.0012	0.0000	0.0006	0.0012				0.073	
Q38	OAKLEY CREEK DOWNSTREAM	Ni	0.0000	0.0135	0.0372	0.0000	0.0176	0.0377	0.0000	0.0178	0.0386	0.0000	0.0180	0.0396	0.5	1	0.07329 [F]	Tier II	0.025
Q38	OAKLEY CREEK DOWNSTREAM	Se	0.0000	0.0004	0.0008	0.0000	0.0005	0.0008	0.0000	0.0005	0.0008	0.0000	0.0005	0.0008				0.001	0.001
Q38	OAKLEY CREEK DOWNSTREAM	Zn	0.0000	0.0017	0.0036	0.0000	0.0020	0.0038	0.0000	0.0021	0.0040	0.0000	0.0022	0.0043	0.5	1	0.16657 [G]	Tier II	0.03

Notes:
August 2008 groundwater chemistry was assumed in the modeling.

A Arsenic li 0.15 mg/L for averaging duration 4 days (4-Day, 3-Year or 7Q10 Design Flow); 0.34 mg/L for averaging duration 1 hr (1-Day, 3-Year or 1Q10 Design Flow)

B Cadmium [e{0.7852[ln(Hardness)]-2.715}]×[1.101672-{ln(Hardness)(0.041838)}] for 4 days averaging duration.
[e{1.128[ln(Hardness)]-3.6867}]×[1.136672-{ln(Hardness)(0.041838)}] for 1 hour averaging duration.

C Chromium Chromium III: [e{0.8190[ln(Hardness)]+0.6848}]×[0.860] for 4 days averaging duration.
Chromium III: [e{0.8190[ln(Hardness)]+3.7256}]×[0.316] for 1 hour averaging duration.
Chromium VI: 0.011 mg/L for averaging duration 4 days (4-Day, 3-Year or 7Q10 Design Flow); 0.016 mg/L for averaging duration 1 hr (1-Day, 3-Year or 1Q10 Design Flow)

D Copper li [e{0.8545[ln(Hardness)]-1.702}]×[0.960] for 4 Days hour averaging duration.
[e{0.9422[ln(Hardness)]-1.700}]×[0.960] for 1 hour averaging duration.

E Lead limit [e{1.273[ln(Hardness)]-4,705}]×[1.46203 -{ln(Hardness)(0.145712)}] for 4 Days averaging duration.
[e{1.273[ln(Hardness)]-1.460}]×[1.46203 -{ln(Hardness)(0.145712)}] for 1 hour averaging duration.

F Nickel lim [e{0.8460[ln(Hardness)]+0.0584}]×[0.997] for 4 Days averaging duration.
[e{0.8460[ln(Hardness)]+2.255}]×[0.998] for 1 hour averaging duration.

G Zinc limit [e{0.8473[ln(Hardness)]+0.884}]×[0.976] for 4 Days averaging duration.
[e{0.8473[ln(Hardness)]+0.884}]×[0.978] for 1 hour averaging duration.

Table 6-14 Projected Effluent Concentrations in Site Flows during Year 5 through Year 8 Operations

SCENARIO:			ESTIMATED AVERAGE CONCENTRATION												REGULATIONS				
			Year 5			Year 6			Year 7			Year 8			Metal Mining Liquid Effluents (2002)		Manitoba Water Quality Standards, Objectives, and Guidelines (Williamson, 2002)		Canadian Water Quality Guidelines for the Protection of Aquatic Life
			Tailings only; max.tailings leaching rate	Tailings only; max.tailings leaching rate	Tailings only; max.tailings leaching rate	Tailings only; max.tailings leaching rate	Tailings only; max.tailings leaching rate	Tailings only; max.tailings leaching rate	Tailings only; max.tailings leaching rate	Tailings only; max.tailings leaching rate	Tailings only; max.tailings leaching rate	Tailings only; max.tailings leaching rate	Tailings only; max.tailings leaching rate	Tailings only; max.tailings leaching rate			TIER II Water Quality Objectives		
		WATER QUALITY	NOVEMBER TO APRIL	MAY	JUNE TO OCTOBER	NOVEMBER TO APRIL	MAY	JUNE TO OCTOBER	NOVEMBER TO APRIL	MAY	JUNE TO OCTOBER	NOVEMBER TO APRIL	MAY	JUNE TO OCTOBER					
FLOW		PARAM.	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	Monthly Mean	Grab Sample	assuming hardness = 150 mg/L $CaCO_3$	Freshwater	(CCME, 2007)
Q30	POLISHING POND OUTFLOW	Al	0.176	0.188	0.170	0.179	0.196	0.177	0.182	0.206	0.184	0.185	0.212	0.189				0.005 - 0.1	0.005
Q30	POLISHING POND OUTFLOW	Sb	0.00140	0.00155	0.00143	0.00142	0.00162	0.00149	0.00145	0.00170	0.00155	0.00147	0.00175	0.00159					
Q30	POLISHING POND OUTFLOW	As	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.5	1	0.15 mg/L (4-Day, 3-Year) [A]	Tier II	0.005
Q30	POLISHING POND OUTFLOW	Cd	0.00029	0.00031	0.00028	0.00030	0.00033	0.00030	0.00031	0.00035	0.00031	0.00031	0.00036	0.00033			0.00302 [B]	Tier II	0.000017 or $10^{\{0.86[\log(hardness)]-3.}$
Q30	POLISHING POND OUTFLOW	Cr	0.0052	0.0056	0.0051	0.0053	0.0058	0.0053	0.0053	0.0060	0.0055	0.0054	0.0062	0.0056			0.10331 [C]	Tier II	
Q30	POLISHING POND OUTFLOW	Co	0.00361	0.00389	0.00353	0.00365	0.00404	0.00365	0.00370	0.00421	0.00379	0.00374	0.00433	0.00387					
Q30	POLISHING POND OUTFLOW	Cu	0.0130	0.0140	0.0127	0.0133	0.0147	0.0133	0.0137	0.0156	0.0140	0.0140	0.0161	0.0144	0.3	0.6	0.01266 [D]	Tier II	0.002
Q30	POLISHING POND OUTFLOW	Fe	0.774	0.830	0.752	0.781	0.860	0.774	0.788	0.896	0.802	0.797	0.920	0.820				0.3	0.3
Q30	POLISHING POND OUTFLOW	Pb	0.00269	0.00293	0.00271	0.00287	0.00321	0.00295	0.00306	0.00353	0.00322	0.00320	0.00375	0.00338	0.2	0.4	0.0039 [E]	Tier II	0.001
Q30	POLISHING POND OUTFLOW	Mo	0.0052	0.0056	0.0052	0.0054	0.0060	0.0055	0.0056	0.0064	0.0059	0.0058	0.0068	0.0061				0.073	
Q30	POLISHING POND OUTFLOW	Ni	0.179	0.191	0.173	0.181	0.199	0.179	0.183	0.208	0.186	0.186	0.214	0.191	0.5	1	0.07329 [F]	Tier II	0.025
Q30	POLISHING POND OUTFLOW	Se	0.0027	0.0030	0.0028	0.0028	0.0031	0.0029	0.0028	0.0033	0.0030	0.0029	0.0034	0.0031				0.001	0.001
Q30	POLISHING POND OUTFLOW	Zn	0.017	0.018	0.017	0.018	0.020	0.018	0.019	0.022	0.020	0.020	0.023	0.021	0.5	1	0.16657 [G]	Tier II	0.03
Q35	MINAGO DOWNSTREAM	Al	0.055	0.028	0.037	0.056	0.028	0.038	0.057	0.028	0.039	0.057	0.029	0.040				0.005 - 0.1	0.005
Q35	MINAGO DOWNSTREAM	Sb	0.00040	0.00018	0.00027	0.00041	0.00019	0.00028	0.00042	0.00019	0.00029	0.00042	0.00019	0.00029					
Q35	MINAGO DOWNSTREAM	As	0.0009	0.0007	0.0008	0.0010	0.0007	0.0008	0.0010	0.0007	0.0008	0.0010	0.0008	0.0009	0.5	1	0.15 mg/L (4-Day, 3-Year) [A]	Tier II	0.005
Q35	MINAGO DOWNSTREAM	Cd	0.000088	0.000042	0.000058	0.000090	0.000044	0.000061	0.000093	0.000045	0.000064	0.000095	0.000046	0.000066			0.00302 [B]	Tier II	0.000017 or $10^{\{0.86[\log(hardness)]-3.}$
Q35	MINAGO DOWNSTREAM	Cr	0.00154	0.00070	0.00101	0.00155	0.00071	0.00103	0.00157	0.00072	0.00106	0.00159	0.00073	0.00108			0.10331 [C]	Tier II	
Q35	MINAGO DOWNSTREAM	Co	0.00099	0.00039	0.00060	0.00100	0.00040	0.00062	0.00101	0.00040	0.00064	0.00102	0.00041	0.00066					
Q35	MINAGO DOWNSTREAM	Cu	0.004	0.002	0.003	0.004	0.002	0.003	0.004	0.002	0.003	0.004	0.002	0.003	0.3	0.6	0.01266 [D]	Tier II	0.002
Q35	MINAGO DOWNSTREAM	Fe	0.255	0.137	0.177	0.256	0.138	0.181	0.258	0.139	0.186	0.260	0.140	0.188				0.3	0.3
Q35	MINAGO DOWNSTREAM	Pb	0.00075	0.00031	0.00048	0.00080	0.00033	0.00052	0.00085	0.00035	0.00056	0.00088	0.00037	0.00058	0.2	0.4	0.0039 [E]	Tier II	0.001
Q35	MINAGO DOWNSTREAM	Mo	0.00145	0.00061	0.00092	0.00151	0.00063	0.00098	0.00158	0.00066	0.00104	0.00163	0.00068	0.00107				0.073	
Q35	MINAGO DOWNSTREAM	Ni	0.048	0.018	0.028	0.048	0.018	0.029	0.049	0.019	0.030	0.050	0.019	0.031	0.5	1	0.07329 [F]	Tier II	0.025
Q35	MINAGO DOWNSTREAM	Se	0.00090	0.00049	0.00065	0.00091	0.00049	0.00066	0.00092	0.00050	0.00068	0.00093	0.00051	0.00069				0.001	0.001
Q35	MINAGO DOWNSTREAM	Zn	0.005	0.003	0.004	0.005	0.003	0.004	0.006	0.003	0.004	0.006	0.003	0.004	0.5	1	0.16657 [G]	Tier II	0.03

Table 6-14 (Cont.'d) Projected Effluent Concentrations in Site Flows during Year 5 through Year 8 Operations

SCENARIO:			ESTIMATED AVERAGE CONCENTRATION												REGULATIONS				
			Year 5			Year 6			Year 7			Year 8			Metal Mining Liquid Effluents (2002)		Manitoba Water Quality Standards, Objectives, and Guidelines (Williamson, 2002)		Canadian Water Quality Guidelines for the Protection of Aquatic Life
			Tailings only; max.tailings leaching rate	Tailings only; max.tailings leaching rate	Tailings only; max.tailings leaching rate	Tailings only; max.tailings leaching rate	Tailings only; max.tailings leaching rate	Tailings only; max.tailings leaching rate	Tailings only; max.tailings leaching rate	Tailings only; max.tailings leaching rate	Tailings only; max.tailings leaching rate	Tailings only; max.tailings leaching rate	Tailings only; max.tailings leaching rate	Tailings only; max.tailings leaching rate			TIER II Water Quality Objectives		
		WATER QUALITY	NOVEMBER TO APRIL	MAY	JUNE TO OCTOBER	NOVEMBER TO APRIL	MAY	JUNE TO OCTOBER	NOVEMBER TO APRIL	MAY	JUNE TO OCTOBER	NOVEMBER TO APRIL	MAY	JUNE TO OCTOBER					
FLOW		PARAM.	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	Monthly Mean	Grab Sample	assuming hardness = 150 mg/L $CaCO_3$	Freshwater	(CCME, 2007)
Q38	OAKLEY CREEK DOWNSTREAM	Al	0.0000	0.0201	0.0421	0.0000	0.0205	0.0436	0.0000	0.0210	0.0453	0.0000	0.0213	0.0464				0.005 - 0.1	0.005
Q38	OAKLEY CREEK DOWNSTREAM	Sb	0.000000	0.000177	0.000363	0.000000	0.000180	0.000375	0.000000	0.000184	0.000389	0.000000	0.000187	0.000398					
Q38	OAKLEY CREEK DOWNSTREAM	As	0.0000	0.0005	0.0007	0.0000	0.0005	0.0008	0.0000	0.0005	0.0008	0.0000	0.0006	0.0008	0.5	1	0.15 mg/L (4-Day, 3-Year) [A]	Tier II	0.005
Q38	OAKLEY CREEK DOWNSTREAM	Cd	0.000000	0.000040	0.000075	0.000000	0.000042	0.000079	0.000000	0.000043	0.000083	0.000000	0.000044	0.000086			0.00302 [B]	Tier II	0.000017 or $10^{\{0.86[\log(hardness)]-3.2\}}$
Q38	OAKLEY CREEK DOWNSTREAM	Cr	0.0000	0.0008	0.0014	0.0000	0.0008	0.0015	0.0000	0.0008	0.0015	0.0000	0.0008	0.0015			0.10331 [C]	Tier II	
Q38	OAKLEY CREEK DOWNSTREAM	Co	0.0000	0.0004	0.0009	0.0000	0.0004	0.0009	0.0000	0.0004	0.0009	0.0000	0.0004	0.0009					
Q38	OAKLEY CREEK DOWNSTREAM	Cu	0.0000	0.0015	0.0031	0.0000	0.0015	0.0032	0.0000	0.0015	0.0034	0.0000	0.0016	0.0035	0.3	0.6	0.01266 [D]	Tier II	0.002
Q38	OAKLEY CREEK DOWNSTREAM	Fe	0.0000	0.1240	0.2151	0.0000	0.1252	0.2204	0.0000	0.1267	0.2270	0.0000	0.1280	0.2312				0.3	0.3
Q38	OAKLEY CREEK DOWNSTREAM	Pb	0.0000	0.0003	0.0007	0.0000	0.0003	0.0007	0.0000	0.0003	0.0008	0.0000	0.0004	0.0008	0.2	0.4	0.0039 [E]	Tier II	0.001
Q38	OAKLEY CREEK DOWNSTREAM	Mo	0.0000	0.0006	0.0013	0.0000	0.0006	0.0014	0.0000	0.0007	0.0015	0.0000	0.0007	0.0015				0.073	
Q38	OAKLEY CREEK DOWNSTREAM	Ni	0.0000	0.0182	0.0408	0.0000	0.0186	0.0422	0.0000	0.0190	0.0439	0.0000	0.0193	0.0449	0.5	1	0.07329 [F]	Tier II	0.025
Q38	OAKLEY CREEK DOWNSTREAM	Se	0.0000	0.0005	0.0008	0.0000	0.0005	0.0009	0.0000	0.0005	0.0009	0.0000	0.0005	0.0009				0.001	0.001
Q38	OAKLEY CREEK DOWNSTREAM	Zn	0.0000	0.0023	0.0045	0.0000	0.0024	0.0048	0.0000	0.0025	0.0051	0.0000	0.0026	0.0053	0.5	1	0.16657 [G]	Tier II	0.03

Notes:
August 2008 groundwater chemistry was assumed in the modeling.

A Arsenic limits: 0.15 mg/L for averaging duration 4 days (4-Day, 3-Year or 7Q10 Design Flow); 0.34 mg/L for averaging duration 1 hr (1-Day, 3-Year or 1Q10 Design Flow)

B Cadmium limits [e{0.7852[ln(Hardness)]-2.715}]×[1.101672-{ln(Hardness)(0.041838)}] for 4 days averaging duration.
[e{1.128[ln(Hardness)]-3.6867}]×[1.136672-{ln(Hardness)(0.041838)}] for 1 hour averaging duration.

C Chromium limit Chromium III: [e{0.8190[ln(Hardness)]+0.6848}]×[0.860] for 4 days averaging duration.
Chromium III: [e{0.8190[ln(Hardness)]+3.7256}]×[0.316] for 1 hour averaging duration.
Chromium VI: 0.011 mg/L for averaging duration 4 days (4-Day, 3-Year or 7Q10 Design Flow); 0.016 mg/L for averaging duration 1 hr (1-Day, 3-Year or 1Q10 Design Flow)

D Copper limits: [e{0.8545[ln(Hardness)]-1.702}]×[0.960] for 4 Days hour averaging duration.
[e{0.9422[ln(Hardness)]-1.700}]×[0.960] for 1 hour averaging duration.

E Lead limits: [e{1.273[ln(Hardness)]-4,705}]×[1.46203 -{ln(Hardness)(0.145712)}] for 4 Days averaging duration.
[e{1.273[ln(Hardness)]-1.460}]×[1.46203 -{ln(Hardness)(0.145712)}] for 1 hour averaging duration.

F Nickel limits: [e{0.8460[ln(Hardness)]+0.0584}]×[0.997] for 4 Days averaging duration.
[e{0.8460[ln(Hardness)]+2.255}]×[0.998] for 1 hour averaging duration.

G Zinc limits: [e{0.8473[ln(Hardness)]+0.884}]×[0.976] for 4 Days averaging duration.
[e{0.8473[ln(Hardness)]+0.884}]×[0.978] for 1 hour averaging duration.

The projected outflow from the Polishing Pond meets MMER requirements at all times. Projected results range from 0.17 to 0.21 mg/L for Al, from 0.013 to 0.016 mg/L for Cu, from 0.75 to 0.92 mg/L for Fe, from 0.003 to 0.004 mg/L for Pb, from 0.17 to 0.21 mg/L for Ni, and from 0.003 to 0.003 mg/L for Se.

Year 9 and Year 10 Operations

Estimated flowrates during Year 9 and Year 10 are listed in Table 6-25 and the corresponding water management plan is illustrated in Figure 6-4

Year 9

The Polishing Pond discharge to Minago River (Q33) in relation to the Minago River streamflow (Q34) will be 1% in May, 4% in the summer months (June to October) and 5% in the winter months (November to April). In absolute quantities, discharge to Minago River will range from 3,665 m^3/day to 10,670 m^3/day during Year 9 operations. The Polishing Pond discharge to Oakley Creek (Q36) in relation to the Oakley Creek streamflow (Q37) will be 0% year round.

Table 6-16 presents projected parametric concentrations for the Polishing Pond outflow (Q30), Minago downstream (Q35), and Oakley Creek downstream (Q38). Additional results for Q26 (TWRMF Inflow), Q27 (TWRMF Decant), and Q29 (Polishing Pond Inflow) are provided in Appendix 2.14. All Polishing Pond outflow concentrations are projected to meet the MMER levels and the projected water quality downstream of the mixing zones in the Minago River and the Oakley Creek meets the CCME (2007) and Manitoba Tier III Freshwater guidelines levels.

Year 10

The Polishing Pond discharge to Minago River (Q33) in relation to the Minago River streamflow (Q34) will be 0% year round. The Polishing Pond discharge to Oakley Creek (Q36) in relation to the Oakley Creek streamflow (Q37) will be 9% in May, 14% in the summer months (June to October) and 0% in the winter months (November to April).

Table 6-16 presents projected parametric concentrations for the Polishing Pond outflow (Q30), Minago downstream (Q35), and Oakley Creek downstream (Q38). Additional results for Q26 (TWRMF Inflow), Q27 (TWRMF Decant), and Q29 (Polishing Pond Inflow) are provided in Appendix 2.14. All Polishing Pond outflow concentrations are projected to meet the MMER levels and the projected water quality downstream of the mixing zones in the Minago River and the Oakley Creek meets the CCME (2007) and Manitoba Tier III Freshwater guidelines levels.

Table 6-15 Projected Flow Rates during Year 9 and Year 10 Operations

		Year 9			Year 10		
		Tailings only; max.tailings leaching rate	Tailings only; max.tailings leaching rate	Tailings only; max.tailings leaching rate	Tailings only; max.tailings leaching rate	Tailings only; max.tailings leaching rate	Tailings only; max.tailings leaching rate
		NOVEMBER TO APRIL	MAY	JUNE TO OCTOBER	NOVEMBER TO APRIL	MAY	JUNE TO OCTOBER
	FLOW	m^3/day	m^3/day	m^3/day	m^3/day	m^3/day	m^3/day
UNIT EVAPORATION	UNIT LAKE EVAPORATION	0	18	14	0	18	14
UNIT PPT (U-PPT)	UNIT PRECIPITATION	0	41	21	0	41	21
Q1	FLOW FROM DEWATERING WELLS	4,236	4,236	4,236	4,236	4,236	4,236
Q2	WELL WATER FOR PROCESSING	4,236	4,236	4,236	4,236	4,236	4,236
Q3	EXCESS WATER FROM DEWATERING WELLS	0	0	0	0	0	0
Q4	GROUNDWATER TO OTHER OPERATIONS	0	0	0	0	0	0
Q5	GROUNDWATER TO WATER TREATMENT	48	48	48	48	48	48
Q6	GROUNDWATER TO FRAC SAND PLANT	4,188	4,188	4,188	4,188	4,188	4,188
Q7	GROUNDWATER FOR FIRE FIGHTING	0	0	0	0	0	0
Q8	POTABLE WATER	48	48	48	48	48	48
Q9	WATER TREATMENT PLANT WASTE	0	0	0	0	0	0
Q10	RECYCLE WATER FROM FPP	0	0	0	0	0	0
Q11	POTABLE WATER TO MILL	0	0	0	0	0	0
Q12	POTABLE WATER TO OTHER OPERATIONS	0	0	0	0	0	0
Q13	POTABLE WATER TO OFFICES & CAMP	36	36	36	36	36	36
Q14	POTABLE WATER TO FRAC SAND PLANT	12	12	12	12	12	12
Q15	FLOW FROM OPERATIONS TO MILL	0	0	0	0	0	0
Q16	SEWAGE & GREY WATER FROM CAMP AND OFFICES	36	36	36	36	36	36
Q17	SEWAGE & GREY WATER FROM ALL OTHER ON SITE SOURCES	12	12	12	12	12	12
Q19	FLOW FROM CONCENTRATE THICKENER IN MILL TO MILL	0	0	0	0	0	0
Q20	FLOW FROM MILL TO MILL THICKENER	0	0	0	0	0	0
Q21	RECYCLE WATER FROM MILL THICKENER	0	0	0	0	0	0
Q21x	ATERNATE FLOW FOR RECYCLE WATER FROM MILL THICKENER	0	0	0	0	0	0
Q22	MILL TAILINGS SLURRY	0	0	0	0	0	0
Q23	SEWAGE TREATMENT OUTFLOW	0	349	55	0	349	55
Q24	LIQ. WASTE FROM FSP	2,892	2,892	2,892	2,892	2,892	2,892
Q25	SLURRY FROM FSP	772	772	772	772	772	772
Q26	TWRMF INFLOW	3,664	4,013	3,719	3,664	4,013	3,719
Q - Liquid PPT on TWRMF	PPT on TWRMF	0	8,930	4,694	0	8,930	4,694
Q - Retained Water in Tailings Voids	Q - Retained Water in Tailings Voids	0	0	0	0	0	0
Q - TWRMF Supernatant	TWRMF Supernatant	9,766	44,410	12,430	9,766	44,410	12,430
Q27	TWRMF Decant	3,664	8,975	5,297	3,664	8,975	5,297
Q - Pit Dewatering	OPEN PIT DEWATERING	0	0	0	0	0	0
Q - Precipitation on Pit	Precipitation minus Sublimation on Open Pit	0	7,723	4,059	0	7,723	4,059
Q28	TOT. OPEN PIT DEWATERING	0	0	0	0	0	0
Q29	POLISHING POND INFLOW	3,664	8,975	5,297	3,664	30,247	5,297
Q - Precipitation on Polishing Pond	Precipitation minus Sublimation ON POLISHING POND	0	3,049	1,602	0	3,049	1,602
Q - Evaporation from Polishing Pond	EVAPORATION FROM POLISHING POND	0	1,355	1,063	0	1,355	1,063
Q30	POLISHING POND OUTFLOW	3,664	10,668	5,836	3,664	31,941	5,836
Q31	RECYCLE FROM FINAL POLISHING POND	0	0	0	0	0	0
Q32	DISCHARGE PIPELINE	3,664	10,668	5,836	0	31,941	5,836
Q33	DISCHARGE TO MINAGO	3,664	10,668	5,836	0	0	0
Q34	MINAGO UPSTREAM	69,120	864,000	164,160	69,120	864,000	164,160
Q35	MINAGO DOWNSTREAM	72,784	874,668	169,996	69,120	864,000	164,160
Q36	DISCHARGE TO OAKLEY CREEK	0	0	0	0	31,941	5,836
Q37	OAKLEY CREEK UPSTREAM	0	345,600	43,200	0	345,600	43,200
Q38	OAKLEY CREEK DOWNSTREAM	0	345,600	43,200	0	377,541	49,036
FLOW RATIOS:							
Q33 / Q34	RATIO OF DISCHARGE TO MINAGO TO FLOW IN MINAGO	5%	1%	4%	0%	0%	0%
Q36 / Q37	RATIO OF DISCHARGE TO OAKLEY CK TO FLOW IN OAKLEY CK	0%	0%	0%	0%	9%	14%

Table 6-16 Projected Effluent Concentrations in Site Flows Year 9 and Year 10 Operations

SCENARIO:			ESTIMATED AVERAGE CONCENTRATION						REGULATIONS				
			Year 9			Year 10			(2002)		TIER II Water Quality Objectives		the Protection of Aquatic Life
			Tailings only; max.tailings leaching rate	Tailings only; max.tailings leaching rate	Tailings only; max.tailings leaching rate	Tailings only; max.tailings leaching rate	Tailings only; max.tailings leaching rate	Tailings only; max.tailings leaching rate					
FLOW		WATER QUALITY PARAM.	NOVEMBER TO APRIL (mg/L)	MAY (mg/L)	JUNE TO OCTOBER (mg/L)	NOVEMBER TO APRIL (mg/L)	MAY (mg/L)	JUNE TO OCTOBER (mg/L)	Monthly Mean	Grab Sample	assuming hardness = 150 mg/L $CaCO_3$	Freshwater	(CCME, 2007)
Q30	POLISHING POND OUTFLOW	Al	0.448	0.313	0.235	0.215	0.196	0.138				0.005 - 0.1	0.005
Q30	POLISHING POND OUTFLOW	Sb	0.00422	0.00324	0.00291	0.00289	0.00271	0.00236					
Q30	POLISHING POND OUTFLOW	As	0.006	0.005	0.005	0.006	0.006	0.005	0.5	1	0.15 mg/L (4-Day, 3-Year) [A]	Tier II	0.005
Q30	POLISHING POND OUTFLOW	Cd	0.00099	0.00073	0.00068	0.00074	0.00067	0.00056			0.00302 [B]	Tier II	0.000017 or $10^{\{0.86[\log(hardness)]-3.2\}}$
Q30	POLISHING POND OUTFLOW	Cr	0.0113	0.0082	0.0061	0.0048	0.0045	0.0034			0.10331 [C]	Tier II	
Q30	POLISHING POND OUTFLOW	Co	0.00901	0.00635	0.00469	0.00406	0.00373	0.00265					
Q30	POLISHING POND OUTFLOW	Cu	0.0393	0.0286	0.0247	0.0261	0.0240	0.0192	0.3	0.6	0.01266 [D]	Tier II	0.002
Q30	POLISHING POND OUTFLOW	Fe	1.772	1.208	0.779	0.555	0.500	0.273				0.3	0.3
Q30	POLISHING POND OUTFLOW	Pb	0.01304	0.01008	0.01070	0.01318	0.01218	0.01076	0.2	0.4	0.0039 [E]	Tier II	0.001
Q30	POLISHING POND OUTFLOW	Mo	0.0249	0.0196	0.0218	0.0278	0.0257	0.0230				0.073	
Q30	POLISHING POND OUTFLOW	Ni	0.447	0.308	0.219	0.190	0.172	0.113	0.5	1	0.07329 [F]	Tier II	0.025
Q30	POLISHING POND OUTFLOW	Se	0.0070	0.0054	0.0044	0.0038	0.0036	0.0031				0.001	0.001
Q30	POLISHING POND OUTFLOW	Zn	0.068	0.054	0.058	0.071	0.066	0.059	0.5	1	0.16657 [G]	Tier II	0.03
Q35	MINAGO DOWNSTREAM	Al	0.034	0.016	0.020	0.012	0.012	0.012				0.005 - 0.1	0.005
Q35	MINAGO DOWNSTREAM	Sb	0.00026	0.00009	0.00015	0.00005	0.00005	0.00005					
Q35	MINAGO DOWNSTREAM	As	0.0009	0.0007	0.0008	0.0006	0.0006	0.0006	0.5	1	0.15 mg/L (4-Day, 3-Year) [A]	Tier II	0.005
Q35	MINAGO DOWNSTREAM	Cd	0.000066	0.000025	0.000039	0.000017	0.000017	0.000017			0.00302 [B]	Tier II	0.000017 or $10^{\{0.86[\log(hardness)]-3.2\}}$
Q35	MINAGO DOWNSTREAM	Cr	0.00078	0.00033	0.00043	0.00023	0.00023	0.00023			0.10331 [C]	Tier II	
Q35	MINAGO DOWNSTREAM	Co	0.00050	0.00013	0.00021	0.00005	0.00005	0.00005					
Q35	MINAGO DOWNSTREAM	Cu	0.003	0.001	0.001	0.001	0.001	0.001	0.3	0.6	0.01266 [D]	Tier II	0.002
Q35	MINAGO DOWNSTREAM	Fe	0.155	0.083	0.094	0.069	0.069	0.069				0.3	0.3
Q35	MINAGO DOWNSTREAM	Pb	0.00071	0.00018	0.00042	0.00006	0.00006	0.00006	0.2	0.4	0.0039 [E]	Tier II	0.001
Q35	MINAGO DOWNSTREAM	Mo	0.00138	0.00036	0.00087	0.00013	0.00013	0.00013				0.073	
Q35	MINAGO DOWNSTREAM	Ni	0.024	0.005	0.009	0.001	0.001	0.001	0.5	1	0.07329 [F]	Tier II	0.025
Q35	MINAGO DOWNSTREAM	Se	0.00059	0.00031	0.00039	0.00024	0.00024	0.00024				0.001	0.001
Q35	MINAGO DOWNSTREAM	Zn	0.004	0.002	0.003	0.001	0.001	0.001	0.5	1	0.16657 [G]	Tier II	0.03

Table 6-16 (Cont.'d) Projected Effluent Concentrations in Site Flows during Year 9 and Year 10 Operations

SCENARIO:			ESTIMATED AVERAGE CONCENTRATION						REGULATIONS				
			Year 9			Year 10			(2002)		TIER II Water Quality Objectives		the Protection of Aquatic Life
			Tailings only; max.tailings leaching rate	Tailings only; max.tailings leaching rate	Tailings only; max.tailings leaching rate	Tailings only; max.tailings leaching rate	Tailings only; max.tailings leaching rate	Tailings only; max.tailings leaching rate					
		WATER QUALITY	NOVEMBER TO APRIL	MAY	JUNE TO OCTOBER	NOVEMBER TO APRIL	MAY	JUNE TO OCTOBER	Monthly Mean	Grab Sample	assuming hardness = 150 mg/L $CaCO_3$	Freshwater	(CCME, 2007)
FLOW		PARAM.	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)					
Q38	OAKLEY CREEK DOWNSTREAM	Al	0.0000	0.0027	0.0027	0.0000	0.0190	0.0188				0.005 - 0.1	0.005
Q38	OAKLEY CREEK DOWNSTREAM	Sb	0.000000	0.000034	0.000034	0.000000	0.000261	0.000311					
Q38	OAKLEY CREEK DOWNSTREAM	As	0.0000	0.0004	0.0004	0.0000	0.0008	0.0009	0.5	1	0.15 mg/L (4-Day, 3-Year) [A]	Tier II	0.005
Q38	OAKLEY CREEK DOWNSTREAM	Cd	0.000000	0.000013	0.000013	0.000000	0.000069	0.000077			0.00302 [B]	Tier II	0.000017 or $10^{0.86[\log(hardness)]-3.2}$
Q38	OAKLEY CREEK DOWNSTREAM	Cr	0.0000	0.0003	0.0003	0.0000	0.0006	0.0007			0.10331 [C]	Tier II	
Q38	OAKLEY CREEK DOWNSTREAM	Co	0.0000	0.0000	0.0000	0.0000	0.0003	0.0003					
Q38	OAKLEY CREEK DOWNSTREAM	Cu	0.0000	0.0002	0.0002	0.0000	0.0022	0.0024	0.3	0.6	0.01266 [D]	Tier II	0.002
Q38	OAKLEY CREEK DOWNSTREAM	Fe	0.0000	0.0505	0.0505	0.0000	0.0885	0.0769				0.3	0.3
Q38	OAKLEY CREEK DOWNSTREAM	Pb	0.0000	0.0000	0.0000	0.0000	0.0010	0.0013	0.2	0.4	0.0039 [E]	Tier II	0.001
Q38	OAKLEY CREEK DOWNSTREAM	Mo	0.0000	0.0001	0.0001	0.0000	0.0023	0.0028				0.073	
Q38	OAKLEY CREEK DOWNSTREAM	Ni	0.0000	0.0002	0.0002	0.0000	0.0148	0.0136	0.5	1	0.07329 [F]	Tier II	0.025
Q38	OAKLEY CREEK DOWNSTREAM	Se	0.0000	0.0002	0.0002	0.0000	0.0005	0.0006				0.001	0.001
Q38	OAKLEY CREEK DOWNSTREAM	Zn	0.0000	0.0006	0.0006	0.0000	0.0061	0.0076	0.5	1	0.16657 [G]	Tier II	0.03

Notes:
August 2008 groundwater chemistry was assumed in the modeling.

A Arsenic limits: 0.15 mg/L for averaging duration 4 days (4-Day, 3-Year or 7Q10 Design Flow); 0.34 mg/L for averaging duration 1 hr (1-Day, 3-Year or 1Q10 Design Flow)

B Cadmium limits [e{0.7852[ln(Hardness)]-2.715}]×[1.101672-{ln(Hardness)(0.041838)}] for 4 days averaging duration.
[e{1.128[ln(Hardness)]-3.6867}]×[1.136672-{ln(Hardness)(0.041838)}] for 1 hour averaging duration.

C Chromium limi Chromium III: [e{0.8190[ln(Hardness)]+0.6848}]×[0.860] for 4 days averaging duration.
Chromium III: [e{0.8190[ln(Hardness)]+3.7256}]×[0.316] for 1 hour averaging duration.
Chromium VI: 0.011 mg/L for averaging duration 4 days (4-Day, 3-Year or 7Q10 Design Flow); 0.016 mg/L for averaging duration 1 hr (1-Day, 3-Year or 1Q10 Design Flow)

D Copper limits: [e{0.8545[ln(Hardness)]-1.702}]×[0.960] for 4 Days hour averaging duration.
[e{0.9422[ln(Hardness)]-1.700}]×[0.960] for 1 hour averaging duration.

E Lead limits: [e{1.273[ln(Hardness)]-4,705}]×[1.46203 -{ln(Hardness)(0.145712)}] for 4 Days averaging duration.
[e{1.273[ln(Hardness)]-1.460}]×[1.46203 -{ln(Hardness)(0.145712)}] for 1 hour averaging duration.

F Nickel limits: [e{0.8460[ln(Hardness)]+0.0584}]×[0.997] for 4 Days averaging duration.
[e{0.8460[ln(Hardness)]+2.255}]×[0.998] for 1 hour averaging duration.

G Zinc limits: [e{0.8473[ln(Hardness)]+0.884}]×[0.976] for 4 Days averaging duration.
[e{0.8473[ln(Hardness)]+0.884}]×[0.978] for 1 hour averaging duration.

6.4 Chemical and Waste Management

A waste management plan will be developed during the operational phase to deal with the site waste. All mine wastes will be handled, stored, managed and disposed of in an environmentally sound manner. Tailings will be co-disposed of with ultramafic rock in the Tailings and Waste Rock Management Facility (TWRMF); Country waste rock in one of the dedicated waste rock dumps, sludge from the Potable Water Treatment Plant (WTP) will be disposed of in the TWRMF. Grey water and sewage will be deposited in an Engineered Treatment Lagoon. All domestic refuse will be transported to a designated landfill for disposal. Non-hazardous solid wastes (garbage) will be disposed of in an acceptable manner as per Solid Waste Regulations. VNI may also apply for a license to burn (Burning Permit) some of the waste materials on site.

6.4.1 Mill Reagent and Laboratory Chemicals

Various chemical reagents are added during the mineral processing. Some of the reagents added are consumed or degraded in the process circuit itself. Most of the remaining reagents used in processing remain with concentrate. However, small residual amounts of some reagents may enter the tailings stream and be deposited in the Minago Tailings Facility. Typically, these reagents are present in low concentrations and the organic components degrade rapidly upon entering the Tailings Facility.

6.4.2 Oils and Lubricants

VNI will maintain the appropriate permits to ensure compliance with conditions under the Environment Act and applicable regulations such as the Storage Tanks Regulations for the storage and handling of petroleum products, lubricants, and other hazardous substances.

6.4.2.1 Typical Reagent Consumption – Flotation

Flotation optimization will be provided by on-stream samplers, particle size analyzers and an on-line x-ray analyzer. The samplers and analyzers will be used to monitor performance of the flotation process to optimize concentrate grade and nickel recoveries. An assay and metallurgical laboratory will be incorporated into the mill building to perform laboratory tests.

7. DECOMISSIONING AND CLOSURE ACTIVITIES

. Closure planning and its implementation will be undertaken with appropriate environmental care to meet provincial and federal laws, satisfy the interests of the public, Communities of Interest, and the company's environmental standards. Victory Nickel will exercise reasonable efforts to plan, design, construct and operate the facilities for closure, with the intention of achieving a "walk-away" scenario.

Closure activities planning involved an assessment of the key site components that may place the public or the environment at risk after closure. Mitigation measures were designed to address public safety issues and environmental concerns. Post-closure monitoring and inspections were planned at the commencement of the Project to ensure that objectives are met. Wardrop anticipates that final determination of the effectiveness of closure measures for walk-away status of the project will be subject to review to ensure compliance regulatory requirements.

Where possible, performance-based criteria have been adopted for the decommissioning and closure plan. The Metal Mines Effluent Regulations (MMER) end-of- pipe effluent discharge standards were used as criteria for waters emanating from the polishing pond. CCME Water Quality Guidelines for the Protection of Freshwater Aquatic Life, (CCME, 1999) were used to assess effectiveness of closure measures to local downstream receiving waters. These same performance-based criteria will be used to determine the effectiveness of closure measures during post-closure monitoring. It is expected that post closure monitoring, and inspection results will be reviewed to ensure that the projected objectives continue to be met after the Project is decommissioned. If the projected objectives are not met, maintenance or contingency plans will be developed as necessary to address potential areas requiring further mitigation.

The closure strategy was developed to achieve the following objectives:

- protection of public health and safety.
- implementation of environmental protection measures that prevent adverse environmental impact.
- ensuring land use commensurate with surrounding lands.
- implementation of progressive reclamation measures during mine operations.
- post-closure monitoring of the Project site to assess effectiveness of closure measures for the long-term.

achieve "walk-away" post-closure monitoring and management until the mine presents evidence of long-term compliance with closure criteria and objectives.

7.1 Land Reclamation and Land Use

7.1.1 Post-Mining Land Use

Reclamation plans will be developed to return the site to a condition that will support wildlife uses, which in a large part centres on the deactivation of access corridors and surface openings. The projected end land use is qualified by the fact that the site experiences significant snow depths, prolonged winter climatic conditions and isolation from large population centres. There will be no losses of valuable aquatic habitat during the operational, TS, SI and closure phases.

The project area does not have any significant marketable timber and therefore, commercial harvesting of timber from the claims area in the future is unlikely. Consequently, lands within the project area are classified as having low forestry capability.

7.1.2 Land Reclamation

The primary objectives of land reclamation will be to provide short and long-term erosion control, to ensure land uses compatible with surrounding lands, and to create a self-supporting ecosystem. The overall goal is to prepare the site so that the vegetation returns to a state as near as possible to that in existence prior to mining activities.

This section describes the areas projected for reclamation, and the closure constraints and measures proposed.

Willows and graminoids are the predominant plant species found near the Project area. An initial ground cover of graminoids will stabilize slopes and control soil erosion. Victory Nickel will determine the availability of natural seed or productive seed material available from local surroundings for the reclamation of the disturbed areas. The natural vegetation found on undisturbed sites around the project area generally indicate the underlying soil properties, including texture, drainage, and pH, and the level of available nutrients.

Re-vegetation seed mixtures will be formulated using knowledge of the naturally occurring vegetation and soil conditions. Additional soil samples on the disturbed areas will be required to determine areas of localized nutrient deficiencies. Further to soil sampling, experimentation with seeding and fertilizer rates will be carried out at the property to determine the optimum mixes for preventing seeded species from becoming too firmly established which will in turn inhibit the invasion of the area's natural colonizing species.

The nutrient uptake by northern native seed varieties on nutrient deficient soil is usually more effective than nutrient uptake by southern agronomic species. Seeding with agronomic species at the site may be required due to high cost and limited availability of northern native re-vegetation species.

To determine whether wildlife are exposed to metal poisoning, Victory Nickel will test various site plant species for metals uptake to assess if there are any potential concerns of ingestion of the plants by grazing and/or browsing animals.

In order to establish a successful re-vegetation program, Victory Nickel will initiate a methodical program to confirm:

- an inventory of overburden dump soils around the site for reclamation cover.
- the nutrients in available soils to determine level of amendments required.
- optimum seed mixes to determine appropriate seed mixes for reclamation.
- the potential metals uptake by the plants.

These studies are expected be implemented during the operational phase to establish the recipe for progressive reclamation and closure. Victory Nickel plans to develop field test trials and test plots as part of the assessment.

In large areas, such as the industrial areas, where natural seed sources are less available, the seeding/planting of indigenous shrub species (primarily willow, birch and alders) may be required to encourage the later stages of plant succession on these sites. Shrub species will be planted concurrent to the re-vegetation program.

7.1.3 Post-Closure Land Use

The land will become undeveloped wilderness at the conclusion of the Project. Trapping and hunting capabilities are expected to improve after mine closure.

7.2 Special Considerations

7.2.1 Environmental Criteria

All effluents will be maintained to ensure that all discharges to the receiving environment meet the MMER discharge criteria. The MMER discharge criteria are presented in Table 7-1.

Table 7-1 MMER End of Pipe Effluent Discharge Criteria

Contaminant of Concern	Maximum Authorized Monthly Mean Concentration	Maximum Authorized Concentration in a Composite Sample	Maximum Authorized Concentration in a Grab Sample
Arsenic	0.50 mg/L	0.75 mg/L	1.00 mg/L
Copper	0.30 mg/L	0.45 mg/L	0.60 mg/L
Lead	0.20 mg/L	0.30 mg/L	0.40 mg/L
Nickel	0.50 mg/L	0.75 mg/L	1.00 mg/L
Zinc	0.50 mg/L	0.75 mg/L	1.00 mg/L
TSS	15 mg/L	22.50 mg/L	30.00 mg/L
Radium 226	0.37 Bq/L	0.74 Bq/L	1.11 Bq/L

7.2.2 Design for Closure

The majority of the Minago River project components have been designed for closure. These include Waste Rock Dumps (Dolomite and Country Rock Dumps), Overburden Dump, TWRMF (spillway, submerged ultramafic rock and tailings) and the Polishing Pond.

7.3 Progressive Rehabilitation Programs

During the Operational Phase, VNI will focus on progressive reclamation as appropriate. The criteria used to select candidate areas for progressive reclamation initiatives will take into account the redundant nature of site components with respect to inherent risks, impacts on the receiving environment and budgetary constraints.

At this stage, the areas that will be considered for progressive reclamation may include, but are not limited to:

- lay down areas that will not be needed after construction of the mine site.
- temporary structures installed during the construction phase.
- areas disturbed during the construction phase.
- redundant transportation corridors developed during the construction phase.
- redundant components during the operational phase.

Components required for ongoing operations will not be subject to progressive reclamation. Necessary environmental protection measures have been adopted in the development of the overall project plan to ensure a healthy environment after mine closure.

7.3.1 Pre-mining and Current Land Use

Existing land use for the project area consists largely of wildlife habitat with some limited hunting, trapping and fishing. Land uses for TS, and SI phases will be the same as those for the operational phase. The recreational capability of the area is limited by poor accessibility due to presence of muskegs and soft clays, excessive snow depths and prolonged climatic winter conditions.

At present there are no agricultural activities in the area. Soil capability for agriculture is restricted by climatic limitations including short growing season and wetland conditions.

7.4 Post-mining Land Use

Reclamation plans will be developed to return the site to a condition that will support wildlife uses, which in a large part centres on the deactivation of access corridors and surface openings. The projected end land use is qualified by the fact that the site experiences significant snow depths, prolonged winter climatic conditions and isolation from large population centres. There will be no losses of valuable aquatic habitat during the operational, TS, SI and closure phases.

The project area does not have any significant marketable timber and therefore, commercial harvesting of timber from the claims area in the future is unlikely. Consequently, lands within the project area are classified as having low forestry capability.

7.5 Reclamation Research

Victory Nickel will continue to gather additional information to develop a cost- effective and environmentally and technologically feasible optimal closure plan. Victory Nickel has recognized the need to improve the co-disposal approach for tailings and ultramafic rock to mitigate acid rock drainage (ARD) from reactive ultramafic waste rock. Special industry/government/university task forces, such as the Mine Environment Neutral Drainage (MEND) Program and the B.C. Task Force on ARD Program, were established by the industry to address acid rock drainage and its control. The MEND program completed its mandate a number of years ago and produced guidelines for the prediction and control of ARD. However, respective components of the guides commonly require fine-tuning to reflect the site-specific nature of mine environs. To achieve this, Victory Nickel will undertake ongoing studies to develop and optimize the proposed mitigation measures. The areas of studies will include but will not limited to:

- Undertake ARD and Metal Leaching (ML) studies specific to Minago Project mine wastes, namely, ultramafic waste rock
- Develop Site-Specific Water Quality Objectives (SSWQO) specific for the Oakley Creek Watershed. The SSWQO will replace the generic guidelines used at the inception of the project such as the CCME Canadian Water Quality Guidelines for the Protection of Freshwater Aquatic Life
- Undertake an Environmental Effects Monitoring (EEM) program to better understand the impacts of the discharges on the receiving environment. The EEM program will be undertaken in part to fulfill the MMER requirements and as a tool to fine-tune and optimize the Victory Nickel environmental programs
- Develop a custom seed mixture specific to the local conditions for the reclamation of the disturbed areas
- Undertake vegetative trials using local plant species e.g. green alder for the reclamation of disturbed areas
- Undertake hydrological and hydro-geological studies to optimize the site water balance
- Fine-tune the TWRMF operational phase wet cover option to prepare for the closure phase
- Confirm the performance of the planned operational water cover for the TWRMF taking into account extreme wet and dry years and
    - Develop approaches towards maintenance-free methods including passive technologies to treat mine site effluent.

All of the above studies will be undertaken during the operational, temporary suspension and state of inactivity and post-closure phases, if required. Victory Nickel will work with consultants and other technical groups to address the environmental constraints associated with aspects such as ARD and/or ML, and overall site issues.

7.6 Acid Rock Drainage

URS (2008i) conducted a geochemical (acid rock drainage and metal leaching (ARD/ML)) assessment of major lithologic units and Precambrian geologic units expected to be encountered, excavated and/or exposed during open pit mining of and tailings generated by the proposed Minago Project.

The overall objectives of the geochemical (ARD/ML) assessment were to:

- Conduct static and kinetic tests to assess the ARD/ML potential of major lithologic units and Precambrian geologic units anticipated to be exposed, excavated, or otherwise disturbed during the proposed open pit mining activities and tailings generated by milling activities.
    - Based on the results of the geochemical test program, provide recommendations to support Victory Nickel's Environmental Impact Assessment and Feasibility Study submissions in support of mine development of the Minago Project.

Based on the results of the geochemical characterization program to date, overburden, limestone, and sandstone major lithologic units are considered non-acid generating and minor metal leaching. The Precambrian geologic units - amphibolite, mafic dike, and regolith are also considered non-acid generating. Overall, the Precambrian granite geologic unit is considered to be non-acid generating; however, local hot spots of moderate to high sulphide sulphur and negligible carbonate may create localized potentially acid generating. The Precambrian geologic unit serpentinite is considered non-acid generating primarily due to an abundance of carbonate neutralization. The Precambrian geologic unit mafic metavolcanic is considered potentially acid generating based on the presence of sulphides and negligible carbonate neutralization. The Precamabrian geologic unit metasediment is considered to be potentially acid generating due to variable (low to high) sulphide sulphur content and low carbonate neutralization. Overall, these units represent small quantities of rock during mining.

URS (2008i) recommended to conduct an operational program for static testing on blast hole cuttings to be able to segregate and dispose potentially acid generating waste in an appropriate facility from non-acid generating mine waste. Based on kinetic test carbonate molar ratios, URS (2008i) recommended a preliminary Neutralization Potential Ratio criterion of 1.7 for segregation of potentially acid generating from non-potentially acid generating waste.

Laboratory kinetic humidity cell tests indicate that the time to deplete sulphides in Precambrian lithologies (AR and ORE) encountered within and adjacent to the pit shell is of the order of 12 to 58 years compared to a carbonate neutralization within 49 to 54 years. Humidity cell results also suggest that limestone mixed with Precambrian AR and ORE is effective at providing excess carbonate neutralization to neutralize secondary sulphide oxidation products on a micro-scale (mm-cm) or meso-scale (cm-m) in-situ.

Static and laboratory kinetic subaqueous column test results indicate that the tailings are non-acid generating due to very low sulphide sulphur content and moderate carbonate content.

7.7 Site Enhancement Program

Erosion and sedimentation caused by work-related activities will be minimized by managing onsite runoff. Erosion and sedimentation control will involve:

- minimizing the disturbance to vegetation and limiting the area of clearing
- installation of sediment control measures (silt fences, sediment traps, etc.) before starting work
- regular inspection and maintenance of sediment control measures
- minimizing the length of time that unstable erodible soils are exposed
- conveying sediment-laden or turbid runoff into settling ponds or vegetated areas and
- stabilizing erodible soils as soon as practical by seeding, re-vegetation or installing erosion control blankets.

The primary mitigation measures regarding vegetation involve land reclamation and re-vegetation of the Minago Project property to provide short- and long-term erosion control, to ensure that end land use is compatible with surrounding lands, and to leave the area as a self-supporting ecosystem. The overall goal will be to prepare the site so that the vegetation returns to a state as near as possible to that in existence prior to mining activities by modifying site features where necessary and by facilitating ”natural” reestablishment of indigenous vegetation and productive habitat for wildlife. Victory Nickel will develop a reclamation plan during the operational phase for the Project site to specify appropriate reclamation techniques for the different types of conditions identified. Reclamation techniques will include site preparation (such as scarification), planting or seeding techniques, specification of suitable planting stock or seed mix(es) for re-vegetation, and specifications for fertilization if required. Best periods for planting/seeding will be determined. The progressive reclamation plan will also detail stockpiling techniques for muskeg and surface soils that will be removed during the construction and operation of site facilities to ensure their viability as top soils.

The Project reclamation plan will include the identification and amelioration of physical environmental impediments to restoration. The plan will ensure low side slope angles for waste rock dumps (2.5H: 1V), ripping/scarifying of compacted surfaces prior to replanting/re-vegetating; recontouring and scarifying of decommissioned roads and borrow pits if necessary. The goal is to facilitate the reestablishment of native vegetation; and where possible, applying of organic matter such as peat/muskeg stockpiled in the initial construction phase to nutrient and organic matter deficient sites. Stockpiled top soil/muskeg will be spread, where available, to facilitate re-vegetation and to increase the organic matter content and water holding capacity of disturbed sites.

The re-vegetation program will include a research component that will identify the most suitable local species and reclamation techniques for the range of disturbed sites that will need to be reclaimed and re-vegetated, including the waste rock dumps. The research component will include the installation of field test plots established on representative disturbed site conditions to evaluate the vegetation's rate of establishment, growth, and nutrient and metal status as well as its suitability as wildlife habitat. The Project's reclamation plan will be based on the results of the research component, and will incorporate a progressive reclamation strategy for disturbed areas that will no longer be used for site operations. Whenever possible, local, native planting stock and seed mixes will be used to ensure a high success rate of the re-vegetation program and compatibility with surrounding lands. Freshly re-vegetated or reseeded sites will also be protected from further disturbance by humans by posting signs and/or restricting access where possible for example with soil or rock roadblocks. Restricted access will allow seedlings to become established.

7.8 Revegetation Program

7.8.1 Currently Established and Potential Re-Vegetation Species

To identify potential, local and native re-vegetation species, the established shrub and vascular herb strata were reviewed Succession studies reported in the literature identified pioneer vegetation species and their seed dispersal capability, reproductive capabilities, and timeframes for establishment. The established shrubs and herbs in the dominant in tree and shrub units are summarized in the next Section.

Established Shrubs and Herbs in the Tree and Shrub Units

The currently-established shrubs and herbs in the dominant in tree and shrub units are summarized below based on the vegetation baseline studies conducted at Minago Project.

In the Intermediate Closed Evergreen Tree (IB1c) unit (Table 7-2), encountered on 34% of the Minago Project site, the shrub stratum was composed of diamond leaf willow (Salix planifolia), green alder (Alnus crispa), and small paper birch (Betula papyrifera) found primarily atop the hummocks. The herb stratum was fairly diverse, but was dominated by sedges (Carex sp.), bluejoint reedgrass (Calamagrostis canadensis), and arrow-leaved TWRMF (Petasites sagittatus) (URS, 2008d).

In the Dwarf Open Evergreen Tree (IB2e) unit (Table 7-2), encountered on 25% of the site, the shrub stratum was dominated by shrub birch (Betula glandulosa), bog rosemary (Andromeda polifolia), and small bog cranberry (Oxycoccus microcarpus). The herb stratum was dominated by sedges (Carex sp.) and buckbean (Menyanthes trifoliata) (URS, 2008d).

In the Dwarf Closed Evergreen Tree (IB1e) unit (Table 7-2), encountered on 14% of the site and located on poorly-drained soils, the shrub stratum was dominated by shrub birch (Betula glandulosa), bog rosemary (Andromeda polifolia), and small bog cranberry (Oxycoccus microcarpus). Sedges (Carex sp.) made up most of the herb layer (URS, 2008d).

In the Intermediate Open Evergreen Tree (IB2c) unit (Table 7-2), encountered on 7% of the site, the shrub stratum was dominated by shrub birch (Betula glandulosa), Labrador tea (Ledum groenlandicum), and diamond leaf willow (Salix planifolia). The herb stratum was dominated by sedges (Carex sp.) and buckbean (Menyanthes trifoliata) (URS, 2008d).

The Intermediate Open Deciduous Shrub (IIA2c) unit (Table 7-2), encountered on 8% of the site and located on poorly-drained soils, the dominant shrubs were shrub birch (Betula glandulosa) and tall blueberry willow (Salix myrtillifolia var. cordata). The herb stratum was dominated by swamp horsetail (Equisetum fluviatile) and bog sedge (Carex magellanica) (URS, 2008d).

The Intermediate Sparse Deciduous Shrub (IIA3c) (Table 7-2), encountered on 6% of the site and was located on very poorly-drained soils, the dominant plant in the shrub stratum was myrtle-leaved willow (Salix myrtillfolia). The herb stratum was dominated by beaked sedge (Carex utriculata) and water sedge (Carex aquatilis) (URS, 2008d).

7.8.2 Potential Re-vegetation Species

Based on the review of currently established shrub species in the previous Section, green alder (Alnus crispa), willows (Salix spp.), and potentially paper birch (Betula papyrifera) and/or shrub birch (Betula glandulosa) appear to be candidates for successful re-vegetation at Minago Project (Table 7-2). All of these species have been successfully used or recommended at other sites for the purposes of reclamation and re-vegetation (Densmore et al., 2000; Smyth and Butler, 2004; Geographic Dynamics Corp., 2002; Strathcona County, 2008).

Table 7-2 Potential Re-vegetation Species Based on Currently Established Vegetation

Vegetation Classification	Current Site Coverage at Minago Project	Currently Dominant Shrubs	Currently Dominant Herbs
Intermediate Closed Evergreen Tree (IB1c)	34%	green alder (*Alnus crispa*), paper birch (*Betula papyrifera*)	bluejoint reedgrass (*Calamagrostis canadensis*)
Dwarf Open Evergreen Tree (IB2e)	25%	shrub birch (*Betula glandulosa*)	sedges (*Carex sp.)*
Dwarf Closed Evergreen Tree (IB1e)	14%	shrub birch (*Betula glandulosa*)	sedges (*Carex sp*.)
Intermediate Open Deciduous Shrub (IIA2c)	8%	shrub birch (*Betula glandulosa*)	swamp horsetail (*Equisetum fluviatile*)
Intermediate Open Evergreen Tree (IB2c)	7%	shrub birch (*Betula glandulosa*)	sedges (*Carex sp*.)
Intermediate Closed Evergreen Tree (IB1c)	34%	diamond leaf willow (*Salix planifolia*)	sedges (*Carex sp*.)
Intermediate Open Evergreen Tree (IB2c)	7%	diamond leaf willow (*Salix planifolia*)	sedges (*Carex sp.)*
Intermediate Open Deciduous Shrub (IIA2c)	8%	tall blueberry willow (*Salix myrtillifolia var. cordata)*	bog sedge (*Carex magellanica*)
Intermediate Sparse Deciduous Shrub (IIA3c)	6%	myrtle-leaved willow (Salix myrtillfolia)	beaked sedge (*Carex utriculata*) and water sedge (*Carex aquatilis*)

Out of these potential re-vegetation species, green alder and willows will be used for the reclamation program at the Project.

Green alder seedlings will be planted throughout the site to result in an approximate density of 0.1 alder per square metre, and willows in islands amongst the alders to facilitate their establishment and seed dispersal as soon as possible (progressive re-vegetation). It is anticipated that there will be approximately one willow island consisting of 50 stems per hectare. A custom seed mix will also be developed or obtained to seed small areas prone to erosion or areas for which re-vegetation with shrubs is not suitable (e.g. shoulders of access roads that will remain trafficable)

Alnus crispa (Green Alder)

Alnus crispa (= Alnus viridis ssp. crispa), a common alder species at Minago Project, is useful for re-vegetation projects. Green Alder grows growth on harsh sites, their ability to fix nitrogen, easy seed collection, and simple propagation make alder the species of choice for many re-vegetation projects (Densmore et al., 2000). Planting container grown seedlings is typically the most efficient, because on disturbed sites with very poor soils, alders tend to have trouble getting started from seed, but will grow well once they are established (Densmore et al., 2000).

To obtain green alder planting stock for Minago Project, potential nurseries in Manitoba and Saskatchewan, and Alberta will be contacted. Victory Nickel will collect green alder cones, if no suitable planting stock is available for the Minago Project site from potential suppliers. The collected cones will be kept dry and warm to ensure complete drying of the seeds. Seeds will then be collected from the dried cones, kept in sealed plastic bags and stored in a freezer until use. Alders form root nodules that contain the microorganism Frankia sp., which fix nitrogen, and convert it to a form of nitrogen usable by plants.

If treated and planted appropriately, survival rates of alders are usually very high (> 95%) after 5 years for container grown alder seedlings, with a growth of 1 m in 3 years (Densmore et al., 2000).

Salix spp. (Willows)

Willows typically produce numerous seeds, which are dispersed for kilometres by wind, and they will establish naturally from seed on all disturbed sites suitable for willow growth (Densmore et al., 2000). Willows (Salix spp.), when grown alongside alders, will use some of the nitrogen fixed by the alders, which promotes growth of willows on soils where soil nitrogen is low. To speed up the restoration process at Minago Project, willows will be planted alongside green alders in clumps (vegetation islands) on the disturbed sites. To protect the genetic integrity of the Minago Project site, willow cuttings will be collected from the site and its vicinity. Most willows are adapted to root rapidly after stems are buried by flooding and have dormant root buds all along the stems. These buds, called preformed root initials, are formed in each year's new shoot growth and are covered by wood in subsequent years. As not all willows root readily from root initials, only willows will be selected for the reclamation at Minago Project that will grow readily from root initials and are acclimatized to the site conditions. Cuttings will be 1.0-2.5 cm in diameter at the base and 25-45 cm in length. Each cutting will at least have one leaf node or bud. The node is the place where shoots originate, and without a node, the cutting will not grow.

The re-vegetation program will rely mainly on dormant willow cuttings. Dormant willow cuttings are typically preferred for re-vegetation because they have higher carbohydrate reserves and can be stored frozen for long periods of time. Cuttings can be stored in a freezer or under snow and sawdust (Densmore et al., 2000). Once the air temperature rises above freezing in the spring, the cuttings will be planted as soon as possible. If not planted, the quality of the cuttings will deteriorate as melting snow will thaw the cuttings after which the cuttings will start using the stored carbohydrates, which they will also need for establishing themselves on a disturbed site.

It is anticipated that willow cuttings will be planted in shallow holes at an approximate angle of 45°. The planting holes will be deep enough to bury the cuttings and allow 5-8 cm of the cuttings to protrude above the soil surface. Willow cuttings will be fertilized with a slow release fertilizer or fertilizer tablets designed for trees and shrubs. The fertilizer will be placed at the bottom of the hole, but will not touch the cutting. Each planted cutting will be watered, if possible. Typically, willow cuttings root in 1-3 weeks. Growth rates of 0.5 m per year are considered good. Moose and snowshoe hares often browse planted willows (Densmore et al., 2000).

Custom Seed Mix

A custom seed mix will be developed or obtained to seed small areas prone to erosion or areas for which re-vegetation with shrubs is not suitable (e.g. shoulders of access roads that will remain trafficable). An effort will be made to source local and native seed mixes. Due to the remote site location, suitable seed mixes for the climatic and soil conditions at the Project site may not be commercially available. An “autumn seed blitz technique” (Densmore et al., 2000) may be used in the event that suitable seed mixes cannot be easily sourced,

The autumn blitz technique involves harvesting a variety of seeds near the disturbed area, and may also involve sowing them immediately on the disturbed areas. In the autumn seed blitz technique, seeds are collected from a variety of plants that are ripe. Seeds must be dry on the plant. Whole seed heads may be collected for later separation of individual seeds from the seed heads.

By swamping a disturbed site with seeds from a variety of native species, prevailing site conditions will determine which species will survive. This technique usually provides cover and high species diversity, especially if sown seeds are raked into the soil and fertilized to enhance seed germination (Densmore et al., 2000).

7.8.3 Monitoring and Follow-up

The re-vegetated areas will be subject to scheduled periodic inspections for the first five years, in order to track the re-vegetation success and to make adjustments to the program as required. Success of the re-vegetation program will be determined by measuring a number of aspects including growth, survival, density and diversity of perennial species, metal uptake in vegetation, and the inspection of native plant invasion. Monitoring locations will include randomly located plots within areas representative of the reclaimed lands. A number of transects will also be established permanently across selected disturbed sites to assess native species ingress. The monitoring will be continued until the ecosystem has been self-regulating for some period of time.

Monitoring reports will be submitted to the regulatory agencies and communities of interest as required to obtain feedback on the success of the reclamation program.

A summary of projected spatial disturbances for the project are given in Table 7-3.

Table 7-3 Summary of Projected Spatial Disturbances for the Minago Project

Component	Area	Units
Industrial Complex (Buildings)	4.2	ha
Transportation Corridors and Access Road	40	ha
Dolomite Waste Rock Dump	191	ha
Country Rock Dump	301.4	ha
Polishing Pond	75	ha
TWRMF	219.7	ha
Overburden Dump	300	ha
300 Person Camp	2.4	ha
Total	1323.3	ha

The proposed reclamation measures for the disturbed areas are provided in Table 7-3. For costing purposes, seed mixes for linear development; and for landfill and borrow pit areas were selected and are provided in Table 7-5 and Table 7-6.

Table 7-4 Proposed Land Reclamation Measures

Component	Approach
Slope on Side of the Tailings Pond	Seeded with shallow rooted grass
Landfill	Decommission and cover the dump with a 300 mm soil layer and re-vegetate
Quarry and other Borrow Areas	Scarify, recontour and re-vegetate
Access Road and other Transportation Corridors	Will be deactivate
Tailings/Reclaim Pipelines	Remove the pipelines and scarify and re-vegetate
300 Person Camp	Demolish portions of the camp when needed and reclaim the area and remove for sale
Industrial Area	Isolate contaminated areas and demolish buildings and infrastructure and scarify, recontour and re-vegetate
TWRMF	Maintain operational spillway and construct exist channel at the discharge end of the Polishing Pond
Organic Material Stockpile	Remove material, assess for soil contamination and reclaim
Haul Roads	Stabilize slopes and re-vegetate and fertilize

Table 7-5 Proposed Seed Mixes for Linear Development

Agronomic Selections		Native Alternatives	
Type	**kg/ha**	**Type**	**kg/ha**
Red top *(Agrostis gigantea)*	4	Red top *(Agrostis gigantea)*	2
Meadow foxtail *(Alopecurus pratensis)*	6	Meadow foxtail *(Alopecurus pratensis)*	3
Smooth brome *(Bromus inermis)*	8	Violet wheatgrass *(Agropyron violaceum)*	5
Sheep Fescue *(Festuca ovina)*	4	Sheep Fescue *(Festuca ovina)*	2
Creeping red fescue *(Festuna rubra)*	3	Tufted hairgrass *(Deschampsia caespitosa)*	2
Fowl bluegrass *(Poa palustris)*	6	Glaucous bluegrass *(Poa glauca)*	3
Alfalfa *(MedicaOakley sp.)*	3	Mackenzie's hedysarum *(Hedysarum mackenzii)*	2
Alsike clover *(Trifolium hybridum)*	3	Arctic lupine *(Lupinus arcticus)*	2
Total	37	Total	21

Note: The nutrient requirements for the seed mix are Nitrogen (100 kg N/ha) and Phosphorus (120 kg P_2O_5 per hectare).

Table 7-6 Proposed Seed Mixes – Borrow Pits

Agronomic Selections		Native Alternatives	
Type	**kg/ha**	**Type**	**kg/ha**
Meadow foxtail *(Alopecurus pratensis)*	8	Meadow foxtail *(Alopecurus pratensis)*	3
Tufted hairgrass *(Deschampsia caespitosa)*	4	Tufted hairgrass *(Deschampsia caespitosa)*	2
Timothy *(Phleum pretense)*	8	Violet wheatgrass *(Agropyron violaceum)*	5
Sheep Fescue *(Festuca ovina)*	6	Sheep Fescue *(Festuca ovina)*	3
Creeping red fescue *(Festuna rubra)*	8	Alpine bluegrass *(Poa alpine)*	2
Alsike clover *(Trifolium hybridum)*	4	Glaucous bluegrass *(Poa glauca)*	3
		Mackenzie's hedysarum *(Hedysarum mackenzii)*	2
Total	38	Total	20

Note: The nutrient requirements for the seed mix are Nitrogen (150 kg N/ha) and Phosphorus (150 kg P_2O_5 per hectare) and Potash (50 kg K_2O per hectare)

7.9 Pre-Final Mine Closure Stages – Temporary Suspension and State of Inactivity

There are essentially two stages prior to final closure: temporary suspension (TS) and state of inactivity (SI). TS means that mining and milling production activities have been suspended, while SI means that mine production and mining operations on site have been suspended indefinitely. The TS may become an SI if the suspension period is longer than planned. Similarly, the SI may turn into a permanent closure if prevailing conditions for resumption of operations are not favourable.

7.9.1 Temporary Suspension and State of Inactivity

TS means that advanced exploration, mining or mine production activities have been suspended due to factors such as low metal prices, or mine-related factors such as ground control problems and labour disputes. On the other hand, SI occurs when mine production and mine operations have been suspended indefinitely.

Victory Nickel recognizes the legitimate concern that government and the public may have with respect to a TS. Generally, Victory Nickel will not be able to definitively state when the Project will reopen after a TS. However, during a TS, Victory Nickel will act as a responsible steward and will demonstrate its commitment to reopening the site by:

- continuing to have the site under the care and maintenance of an on-site caretaker
- continuing to maintain the main access road in a manner that heavy equipment can be brought to the site on short notice to deal with any environmental emergency
- continuing to adequately monitor and maintain buildings and facilities such as the T&WRMF on the site
- ensuring that major fixed equipment and buildings remain essentially intact on site.

The Provincial government may periodically review the temporary closure status of the mine. If the above conditions are not substantially met, then the closure may be deemed “permanent” unless factors exist to reasonably convince the government otherwise. If closure is deemed to be permanent, then the Decommissioning and Closure Plan must be implemented. An updated closure plan to reflect the state of the site may be required.

Access and General Site Measures

During a TS, the site will be staffed or inspected by representatives from Victory Nickel on a 24-hour basis. The main access roads remain open and regularly maintained. Access roads to the TWRMF will be blocked with large rock boulders or equivalent barriers.

All underground corridors will be covered by wooden slats or metal gates, which will be maintained by Victory Nickel. Corridors encased in concrete will remain in place.

Security of Mine Openings and Mine Operating Facilities

All mine openings, with the exception of the pit, will be fenced or gated to restrict access to the mine. Access points to surface openings will be blocked using large boulders (boulder fencing) or equivalent barriers. All other access points to the vertical openings will be secured during the temporary suspension stage.

In the event that a TS stage turns into an SI, all vertical openings (with the exception of the open pit) that are no longer required will be capped in accordance with standard cap design.

Mine Facilities and Equipment

All mine facilities will be locked and trespassing signs will be posted. All unused mining equipment will be left in no-load condition. Equipment that will not be in use for site work by Victory Nickel personnel or its contractors will be stored in appropriate areas.

In the event that the TS becomes an SI, Victory Nickel will attempt to dispose of all non-mining equipment during the SI. Unsold machinery and equipment will be left in no-load condition and will be stored in appropriate areas.

Equipment and Machinery

All equipment and machinery will be kept in safe modes.

Buildings

To prevent inadvertent access, all buildings on site will be locked. Other potential entry points to the buildings, such as windows, will be secured. Where possible ladders or other access to hazardous areas will be removed or made inaccessible. Surface facilities will only be accessible to Victory Nickel personnel, designated agents/representatives or government officials.

In the event that the TS trns into an SI, some of the redundant buildings will be removed and disposed of in an environmentally acceptable manner. All buildings will remain locked and access restricted to designated personnel.

Aboveground and Underground Tanks

The storage tanks will be regularly monitored for leakage to ensure they are operating according to the applicable regulations and licenses.

In the event that the TS turns into an SI, a fuel distribution agent or a licensed waste management contractor will pump out the contents of all storage tanks that were not used during the TS and disposed of appropriately. Tanks that will not be reused will be removed and offered for sale or scrap, following appropriate procedures and protocols.

Waste Management

All mine wastes will be handled, stored, managed and disposed of in a proper manner during the TS. As there will be no tailings and waste rock generated during this phase, the main waste sources will be from the mobile equipment such as spent fuels, domestic waste and other minor waste streams. A waste management plan will be developed during the operational phase to deal with the site waste. The wastes stored during the operational phase and the TS will be disposed of in an environmentally-sound manner, either locally or at a licensed waste management facility. Sludge from active water treatment will be deposited in the tailings facility.

Non-hazardous solid wastes (garbage) will be disposed of in an acceptable manner as per Solid Waste Regulations. Victory Nickel also may apply for a license to burn some of the waste materials on site through a Burning Permit.

Pipelines, Power Lines and Power Supply

All out of service, above-ground pipelines, except for the water lines, will be cut into usable sections and offered for sale or disposed of in a proper manner. Out of service pipelines in the underground corridors will be left in place. Any underground power lines associated with the demolished buildings will be disconnected and abandoned in situ.

Tailings and Waste Rock Management Facility

The management System for the Tailings and Waste Rock Maintenance Facility (TWRMF) includes tailings and waste rock impoundment and ancillary facilities. These ancillary facilities include a tailings dam, diversion ditches and collection ditches, a spillway and a seepage recovery system. The tailings are co-disposed of with ultramafic rock as shown in the Site Plan (Figure 1-2).

Tailings Dams

All dams will be maintained in a safe condition pursuant to Dam Safety Guidelines. with spillways left open to ensure natural drainage. A geotechnical inspection protocol will be developed for the TS, SI and ultimate closure. The inspection protocols will be in line with the TWRMF Operating, Maintenance and Surveillance (OMS) program. Three levels of surveillance to monitor the TWRMF:

- daily visual inspection of the TWRMF by site personnel;
- annual geotechnical inspection of the TWRMF by a geotechnical engineer;
- dam safety review will be completed as per Dam Safety Guidelines.

Instrumentation will be in place to assess the geotechnical behaviour of the TWRMF. The instrumentation will include but not be limited to the following:

- electric wire and standpipe piezometers to measure pore pressure in the tailings upstream of the dam
- embankment movement points and settlement pins to measure surface deformation of the dam(s)
- weirs at the toe of the dam to estimate seepage through the dam
- survey levels on the decant system (e.g. towers) to measure pond water levels.

Meteorological data (temperature, rainfall, snow pack, etc.) will continue to be collected to confirm design assumptions and to establish monitoring frequency during the operational and closure phases.

Tailings Pond

The tailings pond will be regularly monitored to ensure that the TWRMF integrity is not compromised. The same inspection protocol will be used for the tailings management system to provide early warning measures for the facility. To minimize acid generation, adequate water cover shall be provided to the PAG rock.

Contingency Measures

Should these measures be insufficient to meet water quality objectives, Victory Nickel will review implementation of the contingency measures detailed in the next section.

Water quality of the collection system and discharges to the receiving environment will be monitored in accordance with the MMER, CCME Guidelines (for aquatic environment) or Site Specific Water Quality Objectives (SSQO) and Water License operating standards. If there is any significant degradation of water quality, Victory Nickel will investigate and develop contingency measures that will best achieve water quality improvements. Contingency measures intended to address upset conditions are detailed below. The measures to reduce water inputs into the water management system will include but not be limited to the following:

- reduction of clean or contaminated surface water input to the TWRMF by construction of additional diversion systems to allow more rapid flows of watershed runoff
- maintenance of the existing diversion corridors and, if required, enlargement thereof to increase water handling capacity
- monitoring of all sensitive areas.

Any bare or denuded areas will be reseeded and shrubs will be planted; areas that appear to be nutrient-deficient will be re-fertilizated. It is expected that shrubs and tree growth will occur naturally within the re-vegetated areas. All major re-vegetation tasks will occur after roads and structures are removed.

Monitoring Program

The permit-related monitoring program would continue during the TS phase. The program will be adjusted to account for the non-operational main waste stream for tailings slurry. The permit and non-permit related waste streams will be assessed in terms of their physical and chemical characteristics. For any parameters that exceed the stipulated thresholds, Victory Nickel will develop contingency measures to ensure that the receiving environment is protected.

Operations, Maintenance and Surveillance

During operations, the site will develop an Operation, Maintenance and Surveillance (OMS) manual to deal with operations facets of the TWRMF.

The preparation of an OMS Manual for the TWRMF will be one of the major components of an overall site management framework, with linkages to other aspects of the operation. It also falls under the tailings management framework suggested by the Mining Association of Canada (MAC) in 1998. The framework includes the integration of environmental and safety considerations into each stage of the life cycle of a tailings facility.

The objective of an OMS Manual is to have one lead document which will provide basic information and procedures required for the safe operation, maintenance and surveillance of the TWRMF. It will also provide reference information to enable access to pertinent technical information.

The OMS Manual will define and describe:

- roles and responsibilities of personnel assigned to the facility
- procedures and processes for managing change including to TS and SI states
- key components of the facility
- procedures required to operate, maintain and monitor performance of the facility to ensure that it functions according to its design and meets regulatory and corporate policy obligations and links to emergency planning and response
- requirements for analysis and documentation of the performance of the facility (MAC, 2003).

7.9.2 Water Management System During Temporary Suspension and State of Inactivity

7.9.2.1 Water Management System during Temporary Suspension

A schematic of the site water management system during the temporary suspension (TS) of operations is given in Figure 7-1. As the name implies, the state of Temporary Suspension is typically temporary in nature. Temporary suspension does not occur under normal operating conditions. Due to the temporary nature of the state of Temporary Suspension, only production related facilities at the site such as the mill complex (mill operations, mill thickener, concentrate thickener in the mill), Frac Sand Plant, the thickener of the Frac Sand Plant, and Other Operations will be suspended. During Temporary Suspension, recycling of water from the Polishing Pond will also cease, but the mine site and open pit will still be dewatered as was done during site operations.

Continued dewatering of the site will permit a timely start-up after the temporary suspension of site operations is lifted and normal operations resume.

All other components of the water management system that will not be shut down will be as was described previously for the Year 1 to Year 8 operational period.

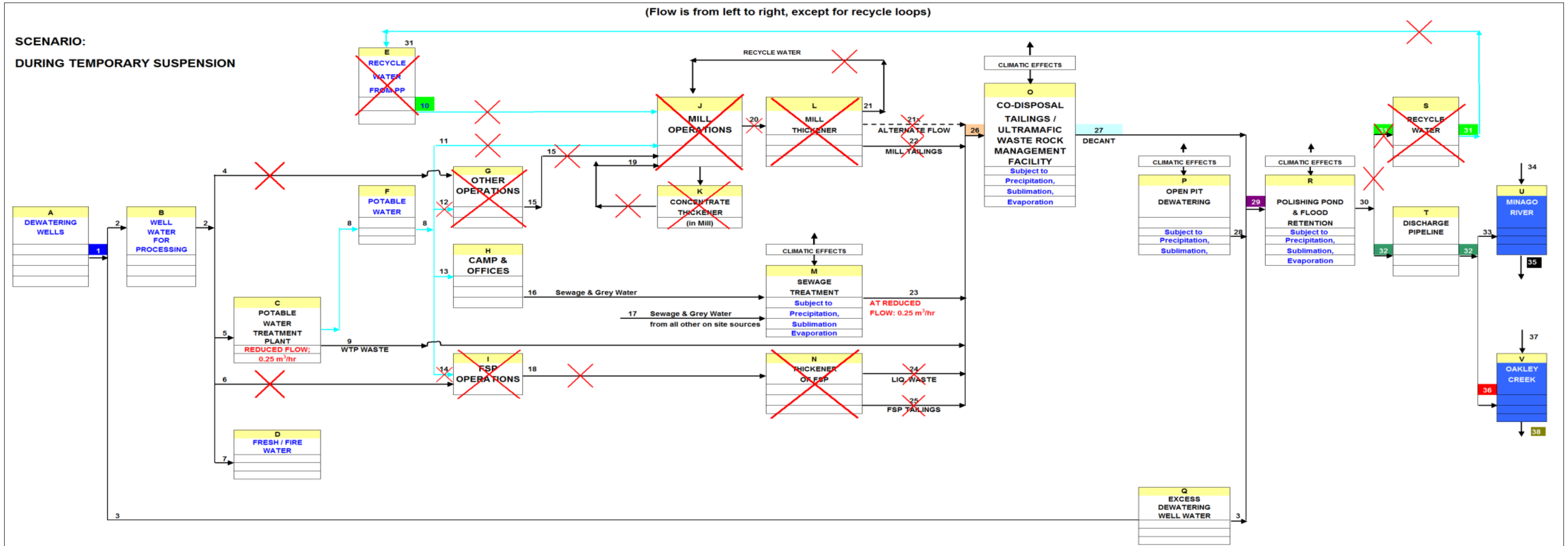
In the water balance model, it was assumed that the state of Temporary Suspension will occur at the end of Year 4.

7.9.2.2 Water Management System during a State of Inactivity

A schematic of the site water management system during a State of Inactivity (SI) is given in Figure 7-2. The State of Inactivity does not occur under normal operating conditions. During the State of Inactivity, all process related operations will cease and the mill complex (mill operations, mill thickener, concentrate thickener in the mill), Frac Sand Plant, the thickener of the Frac Sand Plant, and Other Operations will be shut down. Recycling of water from the Polishing Pond to the mill will also cease and dewatering of the open pit will be significantly reduced. As illustrated in Figure 7-2, only one out of the twelve dewatering wells will be operating to supply water for the remaining activities at Minago. Dewatering of the open pit mine will also cease.

All other components of the water management system that will not be shut down will be as was described for the Year 1 to Year 8 operational period.

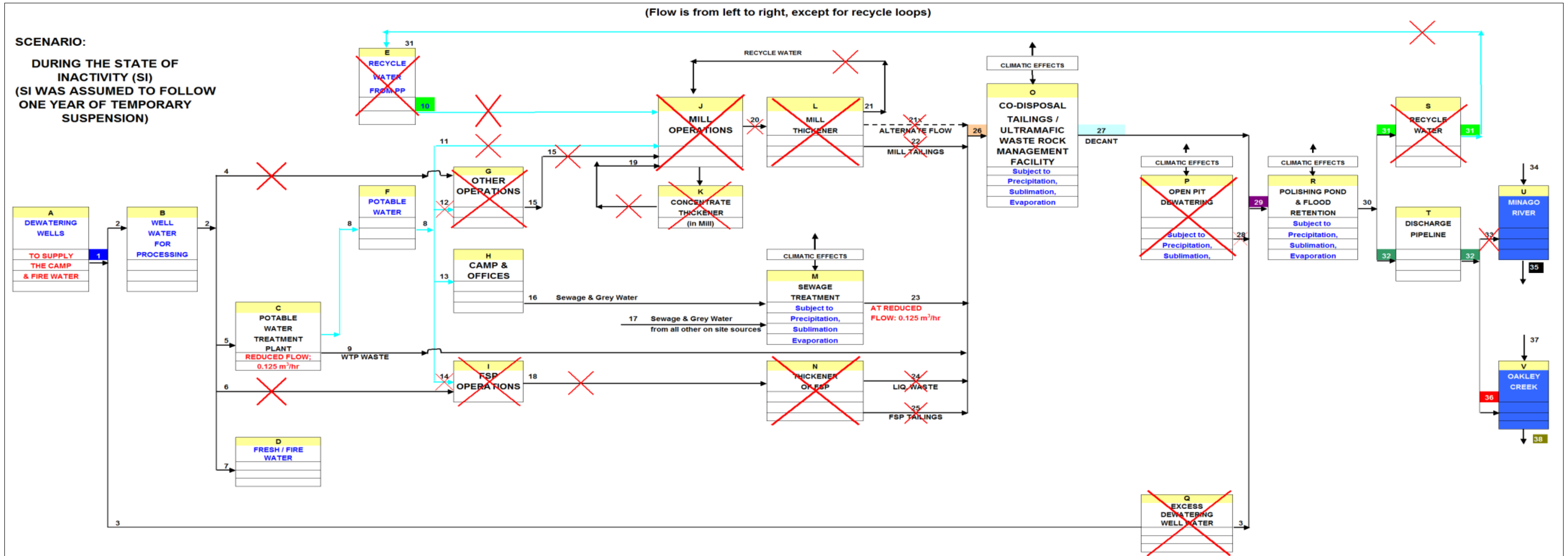
In the Minago water balance model, the State of Inactivity was assumed to have occurred after one year of Temporary Suspension at the end of Year 5.



SYSTEM OF LINEAR EQUATIONS (FOR FLOWS)

DEWATERING WELLS	Q1 = Q2+Q3
PROCESS WATER	Q2 = Q4 + Q5 + Q6 + Q7
RECYCLED WATER FROM FINAL POLISHING POND	Q10 = Q31
TMF INFLOW	Q26 = Q9+Q21x+Q22+Q23+Q24+Q25
TMF DECANT	Q27
POLISHING POND INFLOW	Q29 = Q3+Q27+Q28
DISCHARGED WATER	Q32
MINAGO RIVER DOWNSTREAM	Q35 = Q33+Q34
OAKLEY CREEK DOWNSTREAM	Q38 = Q36+Q37

Figure 7-1 Water Management System during Temporary Suspension



SYSTEM OF LINEAR EQUATIONS (FOR FLOWS)

DEWATERING WELLS	Q1 = Q2+Q3
PROCESS WATER	Q2 = Q4 + Q5 + Q6 + Q7
RECYCLED WATER FROM FINAL POLISHING POND	Q10 = Q31
TMF INFLOW	Q26 = Q9+Q21x+Q22+Q23+Q24+Q25
TMF DECANT	Q27
POLISHING POND INFLOW	Q29 = Q3+Q27+Q28
DISCHARGED WATER	Q32
MINAGO RIVER DOWNSTREAM	Q35 = Q33+Q34
OAKLEY CREEK DOWNSTREAM	Q38 = Q36+Q37

Figure 7-2 Water Management System during a State of Inactivity

7.9.2.3 Water Balance during the State of Inactivity

A Water Balance Model (WBM) was developed to estimate average elemental concentrations in flows that will be part of the working mine. The water balance was developed based on expected baseline inputs and outputs. Inputs and outputs are related to three main aspects including dewatering well water and its uses and discharges (chemistry and flow); mine waste (chemistry and flow); and climatic conditions (rainfall, snowfall, sublimation, and evaporation). General key assumptions of the water balance model were already summarized in Section 2.9 as part of the introduction of the water balance model. For water balance calculations presented below, it was assumed that the State of Inactivity occurred at the end of Year 5 after one year of Temporary Suspension. Key assumptions for the State of Inactivity at the end of Year 5 are as follows:

- **Key Input Parameters and Considerations for The State of Inactivity (SI)**

  1. State of Inactivity was assumed to have occurred after one year of Temporary Suspension at the end of Year 5. SI means that mine production and mining operations on site have been suspended indefinitely.
  2. No tailings will be deposited into the TWRMF.
  3. Only deposited Ni tailings will leach at the maximum leaching rate measured during kinetic testing in the subaqueous leach column surface water.
  4. Operations will have ceased at the Nickel Processing Plant and Frac Sand Plant and related appurtenances.
  5. One dewatering well will be running, but only to supply the camp and site activities with water.
  6. On-site potable water consumption was assumed to be 3 m^3/day (~ 300 L/person/day for 10 people).
  1. TWRMF will have a water cover of a nominal thickness of 0.5 m. Excess supernatant from the TWRMF will be discharged to the Polishing Pond.
  2. During the winter months (Nov. to Apr.), none of the Polishing Pond water will be discharged. During the remainder of the year (May to October), 100% of the Polishing Pond water will be discharged to the Oakley Creek.

- **Key Input Parameters and Considerations for Temporary Suspension (TS) at the end of Year 4:**

  3. All operations will have ceased at the Mill and Frac Sand Plant and related appurtenances at the end of Year 4. TS means that advanced exploration, mining or mine production activities have been suspended due to factors such as low metal prices, or mine related factors such as ground control problems and labour disputes.
  4. No more tailings will be deposited into the TWRMF.
  5. Only deposited Ni tailings will leach at the maximum leaching rate measured during kinetic testing in the subaqueous leach column surface water.
  6. Dewatering wells will be running as usual during regular operations.
  7. On-site potable water consumption was assumed to be 6 m^3/day (~ 300 L/person/day for 20 people).
  8. Excess groundwater from the dewatering wells will be discharged to the Polishing Pond all year round.
  9. TWRMF will have a water cover of a nominal thickness of 0.5 m. Excess supernatant from the TWRMF will be discharged to the Polishing Pond.
  10. During the winter months (Nov. to Apr.), 65% of the Polishing Pond water will be discharged to the Minago River and 35% will be stored in the Polishing Pond. During the remainder of the year (May to October), 70% of the Polishing Pond water will be discharged to the Minago River and 30% will be discharged to the Oakley Creek.

7.9.2.4 Water Balance Modeling Results during Temporary Suspension and a State of Inactivity

Estimated flowrates during Temporary Suspension and the State of Inactivity are listed in Table 7-7and the corresponding water management diagrams are shown in Figure 7-1and Figure 7-2, respectively.

During the Temporary Suspension of operations, the Polishing Pond discharge to Minago River (Q33) in relation to the Minago River streamflow (Q34) will be 11% in May, 20% in the summer months (June to October) and 38% in the winter months (November to April). In absolute quantities, discharge to Minago River will range from 26,000 m^3/day to 95,000 m^3/day during the Temporary Suspension of operations.

During the Temporary Suspension of operations, the projected Polishing Pond discharge to Oakley Creek (Q36) to the Oakley Creek streamflow (Q37) will be 0% in the winter months (Nov. to Apr.), 12% in May, and 32% in the summer months (June to October). In absolute quantities, discharge to Oakley Creek will range from 0 m^3/day to 40,715 m^3/day during the Temporary Suspension of operations.

During the State of Inactivity, the projected Polishing Pond discharge to Minago River (Q33) in relation to the Minago River streamflow (Q34) will be 0% year round. During the State of Inactivity, the projected Polishing Pond discharge to Oakley Creek (Q36) in relation to the Oakley Creek streamflow (Q37) will be 0% in the winter months (Nov. to Apr.), 7% in May, and 11% in the summer months (June to October). In absolute quantities, discharge to Oakley Creek will range from 0 m^3/day to 24,830 m^3/day during the State of Inactivity.

Table 7-8 presents projected parametric concentrations for the Polishing Pond outflow (Q30), Minago downstream (Q35), and Oakley Creek downstream (Q38) during Temporary Suspension and the State of Inactivity. Additional results for Q26 (TWRMF Inflow), Q27 (TWRMF Decant), and Q29 (Polishing Pond Inflow) are given in The Environmental Impact Statement (Victory Nickel Inc., 2010).

During Temporary Suspension, the projected outflow from the Polishing Pond will meet MMER requirements at all times. During Temporary Suspension, the projected water quality in Minago

Table 7-7 Projected Flow Rates during Temporary Suspension and State of Inactivity

FLOW		TS after Year 4			SI after one year TS		
		Tailings only; max.tailings leaching rate	Tailings only; max.tailings leaching rate	Tailings only; max.tailings leaching rate	Tailings only; max.tailings leaching rate	Tailings only; max.tailings leaching rate	Tailings only; max.tailings leaching rate
		NOVEMBER TO APRIL	MAY	JUNE TO OCTOBER	NOVEMBER TO APRIL	MAY	JUNE TO OCTOBER
		m^3/day	m^3/day	m^3/day	m^3/day	m^3/day	m^3/day
UNIT EVAPORATION	UNIT LAKE EVAPORATION	0	18	14	0	18	14
UNIT PPT (U-PPT)	UNIT PRECIPITATION	0	41	21	0	41	21
Q1	FLOW FROM DEWATERING WELLS	31,999	31,999	31,999	2,666	2,667	2,667
Q2	WELL WATER FOR PROCESSING	6	6	6	3	3	3
Q3	EXCESS WATER FROM DEWATERING WELLS	31,993	31,993	31,993	2,663	2,664	2,664
Q4	GROUNDWATER TO OTHER OPERATIONS	0	0	0	0	0	0
Q5	GROUNDWATER TO WATER TREATMENT	6	6	6	3	3	3
Q6	GROUNDWATER TO FRAC SAND PLANT	0	0	0	0	0	0
Q7	GROUNDWATER FOR FIRE FIGHTING	0	0	0	0	0	0
Q8	POTABLE WATER	6	6	6	3	3	3
Q9	WATER TREATMENT PLANT WASTE	0	0	0	0	0	0
Q10	RECYCLE WATER FROM FPP	0	0	0	0	0	0
Q11	POTABLE WATER TO MILL	0	0	0	0	0	0
Q12	POTABLE WATER TO OTHER OPERATIONS	0	0	0	0	0	0
Q13	POTABLE WATER TO OFFICES & CAMP	6	6	6	3	3	3
Q14	POTABLE WATER TO FRAC SAND PLANT	0	0	0	0	0	0
Q15	FLOW FROM OPERATIONS TO MILL	0	0	0	0	0	0
Q16	SEWAGE & GREY WATER FROM CAMP AND OFFICES	6	6	6	3	3	3
Q17	SEWAGE & GREY WATER FROM ALL OTHER ON SITE SOURCES	0	0	0	0	0	0
Q19	FLOW FROM CONCENTRATE THICKENER IN MILL TO MILL	0	0	0	0	0	0
Q20	FLOW FROM MILL TO MILL THICKENER	0	0	0	0	0	0
Q21	RECYCLE WATER FROM MILL THICKENER	0	0	0	0	0	0
Q21x	ATERNATE FLOW FOR RECYCLE WATER FROM MILL THICKENER	0	0	0	0	0	0
Q22	MILL TAILINGS SLURRY	0	0	0	0	0	0
Q23	SEWAGE TREATMENT OUTFLOW	0	63	13	0	43	10
Q24	LIQ. WASTE FROM FSP	0	0	0	0	0	0
Q25	SLURRY FROM FSP	0	0	0	0	0	0
Q26	TWRMF INFLOW	0	63	13	0	43	10
Q - Liquid PPT on TWRMF	PPT on TWRMF	0	8,930	4,694	0	8,930	4,694
Q - Retained Water in Tailings Voids	Q - Retained Water in Tailings Voids	0	0	0	0	0	0
Q - TWRMF Supernatant	TWRMF Supernatant	6,103	40,461	8,725	6,103	40,440	8,722
Q27	TWRMF Decant	0	5,025	1,592	0	5,005	1,589
Q - Pit Dewatering	OPEN PIT DEWATERING	8,000	8,000	8,000	0	0	0
Q - Precipitation on Pit	Precipitation minus Sublimation on Open Pit	0	7,723	4,059	0	7,723	4,059
Q28	TOT. OPEN PIT DEWATERING	8,000	15,723	12,059	0	0	0
Q29	POLISHING POND INFLOW	39,993	134,018	45,644	2,663	23,133	4,252
Q - Precipitation on Polishing Pond	Precipitation minus Sublimation ON POLISHING POND	0	3,049	1,602	0	3,049	1,602
Q - Evaporation from Polishing Pond	EVAPORATION FROM POLISHING POND	0	1,355	1,063	0	1,355	1,063
Q30	POLISHING POND OUTFLOW	39,993	135,712	46,183	2,663	24,827	4,791
Q31	RECYCLE FROM FINAL POLISHING POND	0	0	0	0	0	0
Q32	DISCHARGE PIPELINE	25,996	135,712	46,183	0	24,827	4,791
Q33	DISCHARGE TO MINAGO	25,996	94,998	32,328	0	0	0
Q34	MINAGO UPSTREAM	69,120	864,000	164,160	69,120	864,000	164,160
Q35	MINAGO DOWNSTREAM	95,116	958,998	196,488	69,120	864,000	164,160
Q36	DISCHARGE TO OAKLEY CREEK	0	40,713	13,855	0	24,827	4,791
Q37	OAKLEY CREEK UPSTREAM	0	345,600	43,200	0	345,600	43,200
Q38	OAKLEY CREEK DOWNSTREAM	0	386,313	57,055	0	370,427	47,991
FLOW RATIOS:							
Q33 / Q34	RATIO OF DISCHARGE TO MINAGO TO FLOW IN MINAGO	38%	11%	20%	0%	0%	0%
Q36 / Q37	RATIO OF DISCHARGE TO OAKLEY CK TO FLOW IN OAKLEY CK	0%	12%	32%	0%	7%	11%

Table 7-8 Projected Effluent Concentrations in Flows during Temporary Suspension and the State of Inactivity

SCENARIO: FLOW			WATER QUALITY PARAM.	ESTIMATED AVERAGE CONCENTRATION: TS after Year 4: Tailings only; max.tailings leaching rate, NOVEMBER TO APRIL (mg/L)	TS after Year 4: Tailings only; max.tailings leaching rate, MAY (mg/L)	TS after Year 4: Tailings only; max.tailings leaching rate, JUNE TO OCTOBER (mg/L)	SI after one year TS: Tailings only; max.tailings leaching rate, NOVEMBER TO APRIL (mg/L)	SI after one year TS: Tailings only; max.tailings leaching rate, MAY (mg/L)	SI after one year TS: Tailings only; max.tailings leaching rate, JUNE TO OCTOBER (mg/L)	REGULATIONS: Metal Mining Liquid Effluents (2002), Monthly Mean	Metal Mining Liquid Effluents (2002), Grab Sample	Manitoba Water Quality Standards, Objectives, and Guidelines (Williamson, 2002): TIER II Water Quality Objectives, assuming hardness = 150 mg/L $CaCO_3$	Manitoba Water Quality Standards, Objectives, and Guidelines (Williamson, 2002): Freshwater	Canadian Water Quality Guidelines for the Protection of Aquatic Life (CCME, 2007)
Q30	POLISHING POND OUTFLOW	RC30	Al	0.009	0.028	0.024	0.009	0.097	0.138				0.005 - 0.1	0.005
Q30	POLISHING POND OUTFLOW	RC30	Sb	0.00003	0.00023	0.00023	0.00003	0.00091	0.00146					
Q30	POLISHING POND OUTFLOW	RC30	As	0.001	0.001	0.001	0.001	0.002	0.003	0.5	1	0.15 mg/L (4-Day, 3-Year) [A]	Tier II	0.005
Q30	POLISHING POND OUTFLOW	RC30	Cd	0.00001	0.00004	0.00004	0.00001	0.00023	0.00036			0.00302 [B]	Tier II	0.000017 or $10^{\{0.86[\log(hardness)]-3.2\}}$
Q30	POLISHING POND OUTFLOW	RC30	Cr	0.0010	0.0015	0.0014	0.0010	0.0032	0.0043			0.10331 [C]	Tier II	
Q30	POLISHING POND OUTFLOW	RC30	Co	0.00008	0.00049	0.00042	0.00008	0.00178	0.00255					
Q30	POLISHING POND OUTFLOW	RC30	Cu	0.0005	0.0021	0.0019	0.0005	0.0089	0.0137	0.3	0.6	0.01266 [D]	Tier II	0.002
Q30	POLISHING POND OUTFLOW	RC30	Fe	0.005	0.089	0.071	0.005	0.337	0.466				0.3	0.3
Q30	POLISHING POND OUTFLOW	RC30	Pb	0.00003	0.00052	0.00056	0.00003	0.00350	0.00597	0.2	0.4	0.0039 [E]	Tier II	0.001
Q30	POLISHING POND OUTFLOW	RC30	Mo	0.0007	0.0014	0.0014	0.0007	0.0054	0.0087				0.073	
Q30	POLISHING POND OUTFLOW	RC30	Ni	0.001	0.020	0.016	0.001	0.085	0.121	0.5	1	0.07329 [F]	Tier II	0.025
Q30	POLISHING POND OUTFLOW	RC30	Se	0.0002	0.0006	0.0006	0.0002	0.0018	0.0029				0.001	0.001
Q30	POLISHING POND OUTFLOW	RC30	Zn	0.005	0.007	0.007	0.005	0.021	0.033	0.5	1	0.16657 [G]	Tier II	0.03
Q35	MINAGO DOWNSTREAM	RC35	Al	0.011	0.014	0.014	0.012	0.012	0.012				0.005 - 0.1	0.005
Q35	MINAGO DOWNSTREAM	RC35	Sb	0.00004	0.00007	0.00008	0.00005	0.00005	0.00005					
Q35	MINAGO DOWNSTREAM	RC35	As	0.0007	0.0006	0.0007	0.0006	0.0006	0.0006	0.5	1	0.15 mg/L (4-Day, 3-Year) [A]	Tier II	0.005
Q35	MINAGO DOWNSTREAM	RC35	Cd	0.000014	0.000019	0.000021	0.000017	0.000017	0.000017			0.00302 [B]	Tier II	0.000017 or $10^{\{0.86[\log(hardness)]-3.2\}}$
Q35	MINAGO DOWNSTREAM	RC35	Cr	0.00044	0.00035	0.00042	0.00023	0.00023	0.00023			0.10331 [C]	Tier II	
Q35	MINAGO DOWNSTREAM	RC35	Co	0.00006	0.00009	0.00011	0.00005	0.00005	0.00005					
Q35	MINAGO DOWNSTREAM	RC35	Cu	0.001	0.001	0.001	0.001	0.001	0.001	0.3	0.6	0.01266 [D]	Tier II	0.002
Q35	MINAGO DOWNSTREAM	RC35	Fe	0.052	0.071	0.070	0.069	0.069	0.069				0.3	0.3
Q35	MINAGO DOWNSTREAM	RC35	Pb	0.00005	0.00010	0.00014	0.00006	0.00006	0.00006	0.2	0.4	0.0039 [E]	Tier II	0.001
Q35	MINAGO DOWNSTREAM	RC35	Mo	0.00028	0.00025	0.00034	0.00013	0.00013	0.00013				0.073	
Q35	MINAGO DOWNSTREAM	RC35	Ni	0.001	0.003	0.004	0.001	0.001	0.001	0.5	1	0.07329 [F]	Tier II	0.025
Q35	MINAGO DOWNSTREAM	RC35	Se	0.00023	0.00028	0.00030	0.00024	0.00024	0.00024				0.001	0.001
Q35	MINAGO DOWNSTREAM	RC35	Zn	0.002	0.002	0.002	0.001	0.001	0.001	0.5	1	0.16657 [G]	Tier II	0.03

Table 7-8 (Cond.'d) Projected Effluent Concentrations in Flows during Temporary Suspension and the State of Inactivity

SCENARIO: FLOW			WATER QUALITY PARAM.	ESTIMATED AVERAGE CONCENTRATION						REGULATIONS				
				TS after Year 4			SI after one year TS			Metal Mining Liquid Effluents (2002)		Manitoba Water Quality Standards, Objectives, and Guidelines (Williamson, 2002)		Canadian Water Quality Guidelines for the Protection of Aquatic Life
				Tailings only; max.tailings leaching rate	Tailings only; max.tailings leaching rate	Tailings only; max.tailings leaching rate	Tailings only; max.tailings leaching rate	Tailings only; max.tailings leaching rate	Tailings only; max.tailings leaching rate			TIER II Water Quality Objectives		
				NOVEMBER TO APRIL	MAY	JUNE TO OCTOBER	NOVEMBER TO APRIL	MAY	JUNE TO OCTOBER	Monthly Mean	Grab Sample	assuming hardness = 150 mg/L $CaCO_3$	Freshwater	(CCME, 2007)
				(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)					
Q38	OAKLEY CREEK DOWNSTREAM	RC38	Al	0.0000	0.0053	0.0079	0.0000	0.0090	0.0162				0.005 - 0.1	0.005
Q38	OAKLEY CREEK DOWNSTREAM	RC38	Sb	0.000000	0.000054	0.000081	0.000000	0.000092	0.000177					
Q38	OAKLEY CREEK DOWNSTREAM	RC38	As	0.0000	0.0004	0.0005	0.0000	0.0005	0.0007	0.5	1	0.15 mg/L (4-Day, 3-Year) [A]	Tier II	0.005
Q38	OAKLEY CREEK DOWNSTREAM	RC38	Cd	0.000000	0.000016	0.000020	0.000000	0.000027	0.000047			0.00302 [B]	Tier II	0.000017 or $10^{\{0.86[\log(hardness)]-3.2\}}$
Q38	OAKLEY CREEK DOWNSTREAM	RC38	Cr	0.0000	0.0004	0.0006	0.0000	0.0005	0.0007			0.10331 [C]	Tier II	
Q38	OAKLEY CREEK DOWNSTREAM	RC38	Co	0.0000	0.0001	0.0001	0.0000	0.0002	0.0003					
Q38	OAKLEY CREEK DOWNSTREAM	RC38	Cu	0.0000	0.0004	0.0006	0.0000	0.0007	0.0015	0.3	0.6	0.01266 [D]	Tier II	0.002
Q38	OAKLEY CREEK DOWNSTREAM	RC38	Fe	0.0000	0.0545	0.0556	0.0000	0.0697	0.0920				0.3	0.3
Q38	OAKLEY CREEK DOWNSTREAM	RC38	Pb	0.0000	0.0001	0.0002	0.0000	0.0003	0.0006	0.2	0.4	0.0039 [E]	Tier II	0.001
Q38	OAKLEY CREEK DOWNSTREAM	RC38	Mo	0.0000	0.0002	0.0004	0.0000	0.0005	0.0010				0.073	
Q38	OAKLEY CREEK DOWNSTREAM	RC38	Ni	0.0000	0.0024	0.0041	0.0000	0.0059	0.0122	0.5	1	0.07329 [F]	Tier II	0.025
Q38	OAKLEY CREEK DOWNSTREAM	RC38	Se	0.0000	0.0003	0.0003	0.0000	0.0003	0.0005				0.001	0.001
Q38	OAKLEY CREEK DOWNSTREAM	RC38	Zn	0.0000	0.0013	0.0022	0.0000	0.0020	0.0039	0.5	1	0.16657 [G]	Tier II	0.03

Notes:

August 2008 groundwater chemistry was assumed in the modeling.

A Arsenic limits: 0.15 mg/L for averaging duration 4 days (4-Day, 3-Year or 7Q10 Design Flow); 0.34 mg/L for averaging duration 1 hr (1-Day, 3-Year or 1Q10 Design Flow)

B Cadmium limit: [e{0.7852[ln(Hardness)]-2.715}]×[1.101672-{ln(Hardness)(0.041838)}] for 4 days averaging duration.
[e{1.128[ln(Hardness)]-3.6867}]×[1.136672-{ln(Hardness)(0.041838)}] for 1 hour averaging duration.

C Chromium limi Chromium III: [e{0.8190[ln(Hardness)]+0.6848}]×[0.860] for 4 days averaging duration.
Chromium III: [e{0.8190[ln(Hardness)]+3.7256}]×[0.316] for 1 hour averaging duration.
Chromium VI: 0.011 mg/L for averaging duration 4 days (4-Day, 3-Year or 7Q10 Design Flow); 0.016 mg/L for averaging duration 1 hr (1-Day, 3-Year or 1Q10 Design Flow)

D Copper limits: [e{0.8545[ln(Hardness)]-1.702}]×[0.960] for 4 Days hour averaging duration.
[e{0.9422[ln(Hardness)]-1.700}]×[0.960] for 1 hour averaging duration.

E Lead limits: [e{1.273[ln(Hardness)]-4,705}]×[1.46203 -{ln(Hardness)(0.145712)}] for 4 Days averaging duration.
[e{1.273[ln(Hardness)]-1.460}]×[1.46203 -{ln(Hardness)(0.145712)}] for 1 hour averaging duration.

F Nickel limits: [e{0.8460[ln(Hardness)]+0.0584}]×[0.997] for 4 Days averaging duration.
[e{0.8460[ln(Hardness)]+2.255}]×[0.998] for 1 hour averaging duration.

G Zinc limits: [e{0.8473[ln(Hardness)]+0.884}]×[0.976] for 4 Days averaging duration.
[e{0.8473[ln(Hardness)]+0.884}]×[0.978] for 1 hour averaging duration.

Polishing Pond

The water quality in the polishing pond will be monitored to ensure that all discharges to the receiving environment meet the MMER discharge criteria (MMER (2002)). The MMER discharge criteria are presented in Table 7-9.

Table 7-9 MMER End-of-Pipe Effluent Discharge Criteria

Contaminant of Concern	Maximum Authorized Monthly Mean Concentration	Maximum Authorized Concentration in a Composite Sample	Maximum Authorized Concentration in a Grab Sample
Arsenic	0.50 mg/L	0.75 mg/L	1.00 mg/L
Copper	0.30 mg/L	0.45 mg/L	0.60 mg/L
Lead	0.20 mg/L	0.30 mg/L	0.40 mg/L
Nickel	0.50 mg/L	0.75 mg/L	1.00 mg/L
Zinc	0.50 mg/L	0.75 mg/L	1.00 mg/L
TSS	15.00 mg/L	22.50 mg/L	30.00 mg/L
Radium 226	0.37 Bq/L	0.74 Bq/L	1.11 Bq/L

During TS and SI, the influent to the polishing pond will be lower than the operational inputs to the plant. This is due to the fact that sources of effluents such as the process plant will be eliminated. Victory Nickel will develop an OMS manual for the polishing pond in order to ensure that the discharges to the receiving environment meet discharge criteria. The sludge from the polishing pond will be redirected to the TWRMF. Victory Nickel will ensure that stringent sludge handling, storage and disposal measures are implemented and are in line with the Regulations under the MB Environment Act.

7.9.3 Chemicals and Waste Management

Hazardous Materials and Lubricants

Victory Nickel will maintain the appropriate permits to ensure compliance with conditions under the Environment Act and applicable regulations, such as the Storage Tanks Regulations, for the storage and handling of petroleum products and other hazardous substances.

Chemicals

All unused chemicals that have short shelf lives will be returned to suppliers/manufacturers; all other chemicals will be disposed of in an environmentally-sound manner. In the event that the TS becomes an SI, no chemicals will be stored at the site, with the exception of those required for incidental uses.

Fuels

Fuel supplies for equipment will remain on-site and diesel fuel tanks will remain in service during this stage. Victory Nickel will comply with the requirements under the Environment Act pertaining to storage and handling of petroleum products.

Explosives

All unused explosives and blasting agents will be returned to the suppliers by the explosive contractor. If considered impractical, then, the explosives will be destroyed in a safe manner consistent with the Explosives Act by the Explosive contractor.

Chemical Wastes

All chemical wastes will be handled, stored and disposed of according to the appropriate regulations under the Manitoba Government, (MBG) Environment Act and Special Waste Regulation. The appropriate regulations include but are not limited to the Contaminated Site Regulation, Special Waste Regulation, Solid Waste Regulation, Storage Tank Regulation and Spills Regulation.

8. FINAL CLOSURE AND ABANDONMENT

This section presents a detailed discussion of the planned decommissioning and closure measures for the various facilities on the Minago Property. The discussion is centred on the mine features that require action upon closure of the operation.

VNI plans to adopt a surface reclamation policy, which runs concurrently with mining and tailings management operations. This policy is cost-effective, and allows rapid reinstatement of decommissioned and other related mine components into the surrounding environment.

Mine reclamation and closure are conventionally planned to meet legislative requirements. All decommissioning, closure and reclamation activities will be properly supervised and documented to ensure that all works are constructed and installed according to design plans and as per industry practice and legal requirements.

8.1 Minago Pit

The Minago Pit will be completely flooded after all decommissioning activities in the Minago Open pit have been completed.

8.1.1 Equipment and Materials

All materials with marketable value will be removed from the pit workings. Materials without any marketable value, which are non-hazardous, such as piping, wood, and concrete, etc., will be left in place. Electric installation and cables will be removed. Mobile equipment such as mine trucks, drills and shovels will be removed from the pit. Equipment that cannot be sold will be disposed of in a proper environmentally –sound manner.

8.1.2 Explosives and Chemicals

All explosives, detonators and accessories will be removed and returned to suppliers by the explosive contractor. Any remaining explosives that cannot be returned to suppliers will be disposed of in accordance with the Explosive Act by the explosive contractor.

8.1.3 Pit Slope Stabilization

During the operational phase, pit slopes will be constructed in a stable manner. Therefore, pit walls should not require special treatment such as "scaling" to remove loose rock during the closure phase.

8.1.4 Drainage Control

Once all mining operations have ceased and a decision has been reached to close the Minago Mine, the dewatering wells will be turned off and the Minago Pit will be allowed to flood naturally. The Minago Pit will only be flooded after all other required decommissioning works have been completed.

8.1.5 Surface Openings

All minor horizontal openings that may cause safety problems will be capped with dolomitic waste rock and the cap will be shaped to form a 2:1 (H:V) slope to ensure stability. Any waste rock piled outside the openings will be re-graded, scarified and re-vegetated.

8.2 Waste Rock Dumps

Waste rock from the mine will be end-dumped at a designated area – either the TWRMF (ultramafic rock will be co-disposed of with tailings), dolomitic dump and country rock dump. The material quantities expected at closure are given in Table 681.

Table 8-1 Projected Quantities of Various Materials at the End of Mine Life

Material Quantities at Closure		Density (t/m^3)	Volume (in-situ m^3)	Volume (swelled m^3)
Swell Value	30% Tonnes (kt)			
Ore	25,166	2.612	9,634,697	12,525,106
Frac Sand	14,847	2.400	6,186,065	8,041,885
Waste Rock	122,005	2.702	45,148,004	58,692,405
Ultramafic Waste	35,659	2.590	13,767,708	17,898,020
Overburden Material	11,217	1.856	6,044,945	7,858,428
Limestone	111,032	2.790	39,797,437	51,736,668
Total Waste (Rock Dump)	268,695		98,713,149	128,327,093
Overall Total	319,924		120,578,855	156,752,512

Waste rock dumps will be left in stable conditions and where possible they will be revegetated. Victory Nickel will explore the possibility of marketing the limestone rock for construction.

8.3 Tailings and Waste Rock Management Systems

The long-term physical stability of the tailings embankment and the geo-chemical stability of the ultramafic waste rock are the key items that have been addressed in this closure plan. The key physical stability issues are associated with potential design flood and seismic events. The only chemical stability issues associated with the waste rock in the TWRMF is the fact that these materials are PAG as described above.

8.3.1 Physical Stability

The design earthquake selected for the tailings dam was based on the Canadian Dam Safety Guidelines (CDA 1999). The tailings impoundment is classified as a Significant/High Consequence Facility, the annual probability of exceedance of horizontal peak ground acceleration is chosen as 0.001, corresponding to a return period of 1,000 years. For the seepage recovery dam, the annual probability of exceedance of horizontal peak ground acceleration is selected as 0.0021, corresponding to a return period of 475 years, as no tailings are stored behind the dam.

8.3.2 Flood

Selected design flood criteria for water management for the surface water diversion ditches, starter dam and staged raised emergency spillway, tailings dam closure spillway, seepage collection ditches and seepage recovery pond spillway are 100, 200, 10000, 100 and 100 years, respectively. The above design criteria are therefore, expected to be adequate to protect the integrity of the TWRMF that might be caused by flood events.

8.3.3 Chemical Stability

The ultramafic waste rock that will be stored in the TWRMF has the potential to generate acid (PAG). If left uncontrolled, the discharge will have a detrimental effect on the environment. In order to control ARD/ML, a water cover was selected as the design basis for the TWRMF. Therefore, the TWRMF is designed as a water–retention structure and a wet balance is to be maintained in the impoundment during the operational, TS, SI and closure phases. The minimum water cover depth required within the impoundment to limit oxygen ingress and hence prevent the onset of ARD, is a function of the site water balance considering direct precipitation, run-in to the pond, pond evaporation and seepage losses. A minimum water depth capable to prevent de-saturation of the tailings during a 1:100 year dry-year hydrological event has been selected as the design criteria. In general, the minimum water cover could be expected to be approximately 0.5 m. As the submerged beach will slope towards the centre of the pond, there could be in the order of 2 metres of water cover at the lowest point. During operation, the Project will develop a tailings and coarse waste rock deposition plan to ensure that all wastes are submerged.

During TS, SI and closure phases, best efforts will be made to ensure a water cover is maintained to limit the formation of ARD. The water cover will address the chemical stability problems associated with the geochemical nature of the tailings and coarse waste rock. The tailings pond natural catchment area will be maintained to provide the required water balance. During operation, Victory Nickel will undertake a sensitivity analysis on the water balance for the tailings impoundment after mine closure to explore the condition of water during dry year or other return periods.

8.3.4 Tailings Embankments

During the TS and SI, the tailings embankments will be maintained and inspected as per the TWRMF OMS manual. The site will develop an OMS to ensure the structural integrity of the embankments is protected. The embankments will be maintained at all stages to provide water cover for the mitigation of ARD/ML.

8.3.5 Dust Control

Redundant components associated with the TWRMF, will be decommissioned and re-contoured; where needed, a nominal 300 mm cover of soil will be placed over the areas to control dust and provide a growth medium for re-vegetation. The soil will consist of locally available overburden with sufficient amounts of fines for seeding and planting

8.3.6 Interceptor Ditches

Redundant interceptor ditches associated with the TWRMF will be breached and regraded to restore the ground to erosion resistant drainage patterns.

8.3.7 TWRMF Pond Decant System

The decant system and it accessories will be maintained and inspected during the TS and SI. However, the decant system will be removed during closure and post closure phases, and supernatant water will gravity-flow to the polishing pond from the spillway. The TWRMF will be inspected during the initial stage of closure, expected years 1-3) and post-closure expected years 4 to 6 phases to ensure that it operates as per design criteria.

8.3.8 Tailings Pipelines

During the TS and SI stages, the high density polyethylene (HDPE) tailings pipelines will be left in place and will be maintained to ensure that they are operable when operations resume.

During the closure and post closure phases, the HDPE pipelines will be removed and stored on site for future use and those sections that are of poor quality will be disposed of in a proper manner. All drop boxes will be removed.

8.3.9 Spillway

The spillway is designed to allow the safe passage of flood water without overtopping the tailings dam under extreme design hydrological events. The spillway will be maintained during the TS, SI and closure phase to ensure that it performs as per design intent and criteria. The spillway approach channel to the polishing pond will be maintained to ensure the coarse-grained material used to provide cover to prevent local re-suspension of tailings solids is in working order. The spillway crest and side slopes will be covered by a riprap.

8.3.10 Seepage Recovery Ditch

The seepage recovery pond will be maintained and inspected on a regular basis during the TS, SI, and closure and post-closure phases.

8.4 Overall Approach to the TWRMF Management

The overall operation of the tailings management system during the operational phase, TS, SI, closure and post closure stages will be reviewed periodically by a competent person to ensure that the TWRMF component are functioning as per design criteria and intent. In addition, prior to decommissioning, a comprehensive plan for decommissioning will be developed and submitted to the Government of Manitoba for review and approval and all subsequent decommissioning activities will be carried out according to the approved plan.

8.5 Water Management System during Closure

During the closure period, site and infrastructure decommissioning and site reclamation will take place and all processing facilities and appurtenances will be shut down. Water management during the closure period is illustrated in Figures 8-1 and 8-2. The first stage of the closure period is illustrated in Figure 8-1 and the second stage of the closure period is illustrated in Figure 8-2.

The following components will operate during the first stage of closure: dewatering wells, potable water treatment plant (at an appropriate rate based on on-site personnel), sewage treatment system, TWRMF, and the Polishing Pond. All of these components, with the exception of the dewatering wells, will be the same as was described for the Year 1 to Year 8 operational period. The dewatering wells will be used to install a 1.5 m high water cover on top of the TWRMF.

All water management components for the second stage of closure will be the same as for the first stage except for the dewatering wells. All dewatering wells will be decommissioned in the second stage of closure.

Water will be discharged from the Polishing Pond via a spillway to the Oakley Creek basin for ultimate discharge to Oakley Creek.

During the closure phase, the Tailings and Ultramafic Waste Rock Management Facility (TWRMF) will be reclaimed as a permanent pond. The access road will remain in place. Reclamation goals are a stabilized surface and a native plant community to provide wildlife habitat. The TWRMF embankments will be modified to ensure long-term saturation of the tailings and the ultramafic waste rock and to provide a spillway for ultimate passive decanting of the TWRMF at closure. The spillway will have been installed with an invert elevation approximately 1.5 m above the deposited tailings. The spillway will be installed before the closure phase and will allow controlled discharge of TWRMF supernatant (Q27) that is in excess of the 1.5 m high water cover.

- **Key Input Parameters and Considerations for Closure:**

  The closure period was broken down into two stages (first and second) for which the assumptions are summarized below.

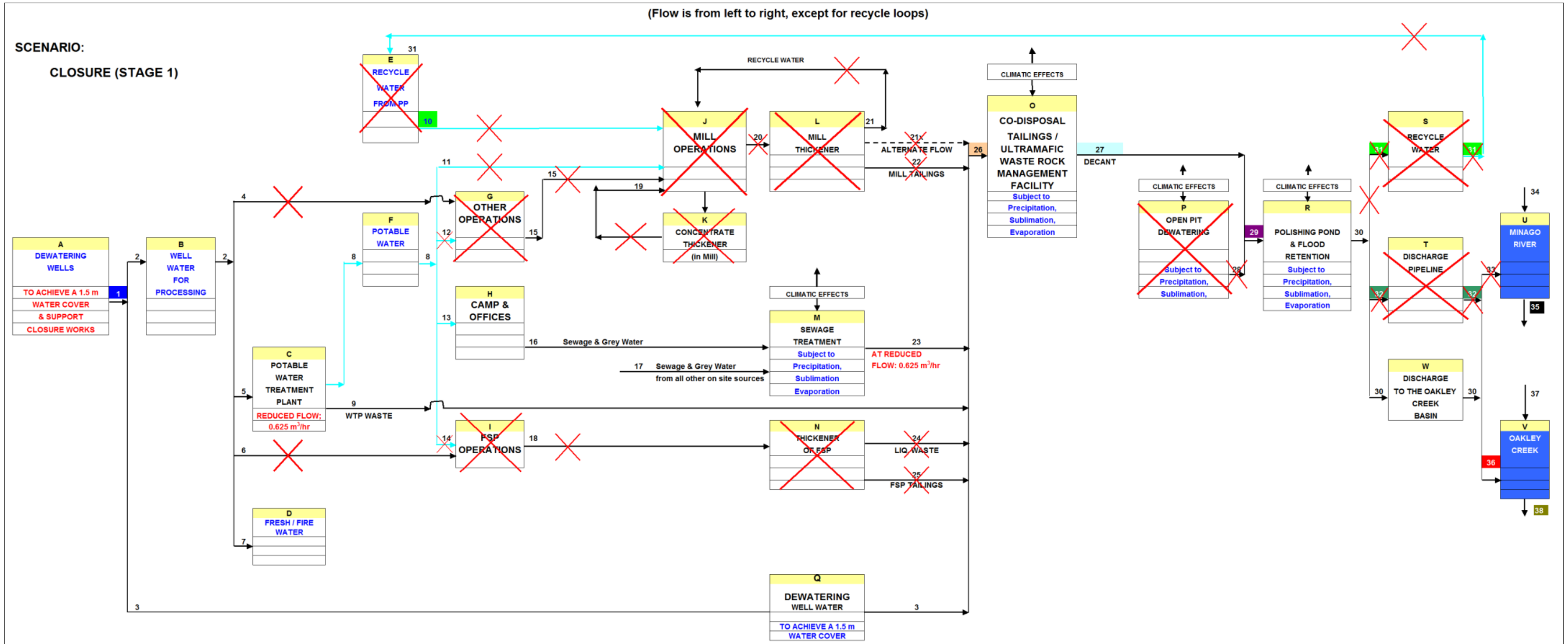
  <u>Considerations for the First Stage of Closure (Figure 8-2:</u>

  1. All operations will have ceased at the Mill and Frac Sand Plant and related appurtenances.
  2. Open pit dewatering will have ceased.
  3. Water will be pumped from the dewatering wells to the TWRMF to provide a 1.5 m high water cover.

4. Only the deposited Ni tailings will leach at the maximum leaching rate measured during kinetic testing in the subaqueous leach column surface water.
5. On-site potable water consumption was assumed to be 15 m^3/day (~ 300 L/person/day for 30 people).
6. Polishing Pond supernatant will be discharged to the Oakley Creek basin via a spillway for ultimate discharge to Oakley Creek.

Considerations for the Second Stage of Closure (Figure 6-2):

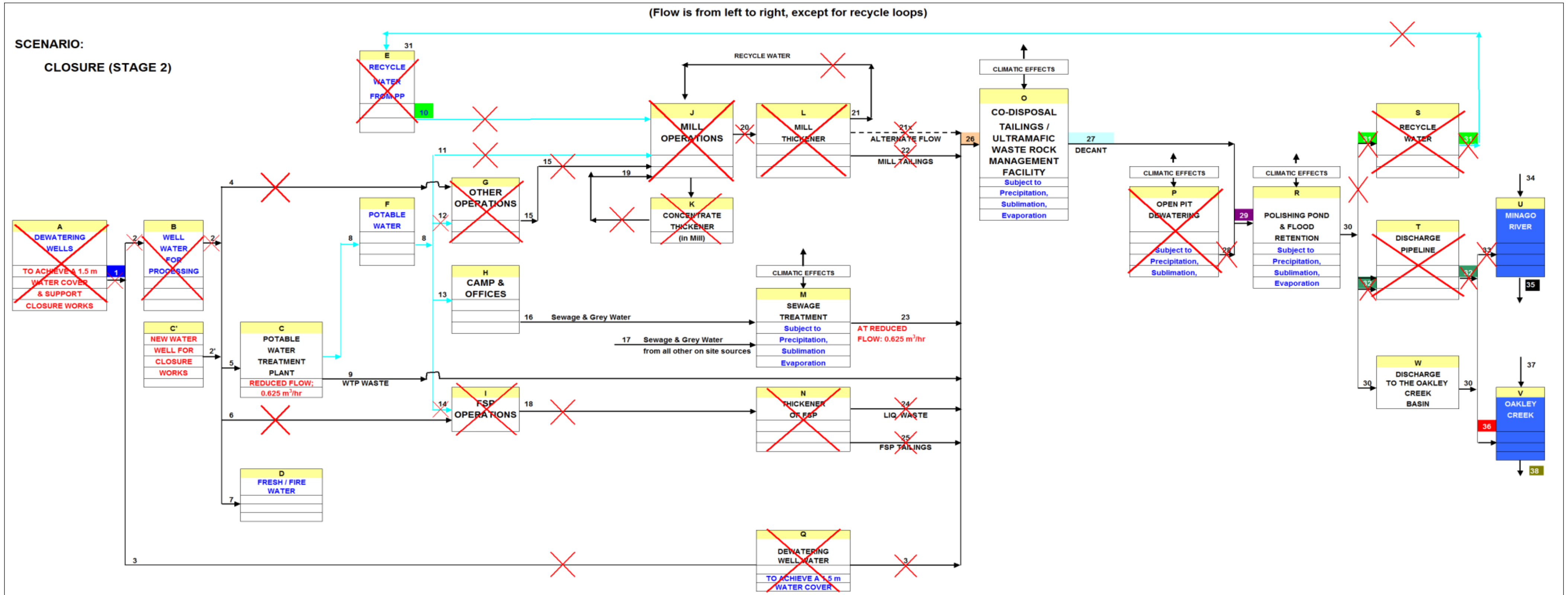
All Input Parameters and Considerations are as for first stage of closure except for the dewatering wells. The dewatering wells will be decommissioned, once a water cover of 1.5 m height will have been installed on top of the TWRMF.



SYSTEM OF LINEAR EQUATIONS (FOR FLOWS)

DEWATERING WELLS	Q1 = Q2+Q3
PROCESS WATER	Q2 = Q4 + Q5 + Q6 + Q7
RECYCLED WATER FROM FINAL POLISHING POND	Q10 = Q31
TMF INFLOW	Q26 = Q3+Q9+Q21x+Q22+Q23+Q24+Q25
TMF DECANT	Q27
POLISHING POND INFLOW	Q29 = Q27+Q28
DISCHARGED WATER	Q32
MINAGO RIVER DOWNSTREAM	Q35 = Q33+Q34
OAKLEY CREEK DOWNSTREAM	Q38 = Q36+Q37

Figure 8-1 Water Management System during First Stage of Closure



SYSTEM OF LINEAR EQUATIONS (FOR FLOWS)

DEWATERING WELLS	Q1 = Q2+Q3
PROCESS WATER	Q2 = Q4 + Q5 + Q6 + Q7
RECYCLED WATER FROM FINAL POLISHING POND	Q10 = Q31
TMF INFLOW	Q26 = Q3+Q9+Q21x+Q22+Q23+Q24+Q25
TMF DECANT	Q27
POLISHING POND INFLOW	Q29 = Q27+Q28
DISCHARGED WATER	Q32
MINAGO RIVER DOWNSTREAM	Q35 = Q33+Q34
OAKLEY CREEK DOWNSTREAM	Q38 = Q36+Q37

Figure 8-2 Water Management System during Second Stage of Closure

8.5.1 Water Balance Results during Closure

Estimated flowrates during the first and second stages of the closure period are listed in Table 8-2. The water balance during the first stage of Closure is illustrated in Figure 8-1and the second stage of Closure is illustrated in Figure 8-2.

During the first stage of Closure, a water cover will be installed on top of the TWRMF and no discharges to the receiving environment will occur from the TWRMF nor from the pipeline discharge system. After closure, water from the Polishing Pond will be discharged into a cross-ditch to report to the Oakley Creek. The major cross-ditch will report to the ditch at Highway 6 and to the Oakley Creek through the low lying marsh.

The Polishing Pond discharge to Minago River (Q33) in relation to the Minago River streamflow (Q34) will be 0% during the second stage of Closure (after the installation of a water cover on top of the tailings).

The Polishing Pond discharge to Oakley Creek (Q36) in relation to the Oakley Creek streamflow (Q37) will be 0% in the winter months (Nov. to Apr.), 2% in May, and 5% in the summer months (June to October). In absolute quantities, discharge to Oakley Creek will range from 0 m^3/day to 5,500 m^3/day during the second stage of Closure.

Table 8-3 presents projected parametric concentrations during the two stages of Closure for the Polishing Pond outflow (Q30), Minago downstream (Q35), and Oakley Creek downstream (Q38). Additional results for Q26 (TWRMF Inflow), Q27 (TWRMF Decant), Q29 (Polishing Pond Inflow) are given in the EIS (Victory Nickel Inc., 2010).

During the first and second stages of Closure, the projected outflow from the Polishing Pond will meet MMER requirements at all times. During both stages of Closure, the projected water quality in Minago River and Oakley Creek downstream of the mixing zones meets the Manitoba Freshwater guidelines for the protection of aquatic life for all parameters.

Table 8-2 Projected Concentrations in Flows around the Minago Site during Closure

		Year 11			Year 12		
		Closure (Stage 1)	Closure (Stage 2)	Closure (Stage 2)	Closure (Stage 2)		
		Tailings only; max.tailings leaching rate	Tailings only; max.tailings leaching rate	Tailings only; max.tailings leaching rate	Tailings only; max.tailings leaching rate	Tailings only; max.tailings leaching rate	Tailings only; max.tailings leaching rate
		NOVEMBER TO APRIL	MAY	JUNE TO OCTOBER	NOVEMBER TO APRIL	MAY	JUNE TO OCTOBER
FLOW		m^3/day	m^3/day	m^3/day	m^3/day	m^3/day	m^3/day
UNIT EVAPORATION	UNIT LAKE EVAPORATION	0	18	14	0	18	14
UNIT PPT (U-PPT)	UNIT PRECIPITATION	0	41	21	0	41	21
Q1	FLOW FROM DEWATERING WELLS	12,000	0	0	0	0	0
Q2	WELL WATER FOR PROCESSING	15	15	15	15	15	15
Q3	EXCESS WATER FROM DEWATERING WELLS	11,985	0	0	0	0	0
Q4	GROUNDWATER TO OTHER OPERATIONS	0	0	0	0	0	0
Q5	GROUNDWATER TO WATER TREATMENT	15	15	15	15	15	15
Q6	GROUNDWATER TO FRAC SAND PLANT	0	0	0	0	0	0
Q7	GROUNDWATER FOR FIRE FIGHTING	0	0	0	0	0	0
Q8	POTABLE WATER	15	15	15	15	15	15
Q9	WATER TREATMENT PLANT WASTE	0	0	0	0	0	0
Q10	RECYCLE WATER FROM FPP	0	0	0	0	0	0
Q11	POTABLE WATER TO MILL	0	0	0	0	0	0
Q12	POTABLE WATER TO OTHER OPERATIONS	0	0	0	0	0	0
Q13	POTABLE WATER TO OFFICES & CAMP	15	15	15	15	15	15
Q14	POTABLE WATER TO FRAC SAND PLANT	0	0	0	0	0	0
Q15	FLOW FROM OPERATIONS TO MILL	0	0	0	0	0	0
Q16	SEWAGE & GREY WATER FROM CAMP AND OFFICES	15	15	15	15	15	15
Q17	SEWAGE & GREY WATER FROM ALL OTHER ON SITE SOURCES	0	0	0	0	0	0
Q19	FLOW FROM CONCENTRATE THICKENER IN MILL TO MILL	0	0	0	0	0	0
Q20	FLOW FROM MILL TO MILL THICKENER	0	0	0	0	0	0
Q21	RECYCLE WATER FROM MILL THICKENER	0	0	0	0	0	0
Q21x	ATERNATE FLOW FOR RECYCLE WATER FROM MILL THICKENER	0	0	0	0	0	0
Q22	MILL TAILINGS SLURRY	0	0	0	0	0	0
Q23	SEWAGE TREATMENT OUTFLOW	0	125	22	0	125	22
Q24	LIQ. WASTE FROM FSP	0	0	0	0	0	0
Q25	SLURRY FROM FSP	0	0	0	0	0	0
Q26	TWRMF INFLOW	11,985	125	22	0	125	22
Q - Liquid PPT on TWRMF	PPT on TWRMF	0	8,930	4,694	0	8,930	4,694
Q - Retained Water in Tailings Voids	Q - Retained Water in Tailings Voids	0	0	0	0	0	0
Q - TWRMF Supernatant	TWRMF Supernatant	18,088	110,112	23,000	18,308	110,112	23,000
Q27	TWRMF Decant	0	3,806	1,601	0	3,806	1,601
Q - Pit Dewatering	OPEN PIT DEWATERING	0	0	0	0	0	0
Q - Precipitation on Pit	Precipitation minus Sublimation on Open Pit	0	7,723	4,059	0	7,723	4,059
Q28	TOT. OPEN PIT DEWATERING	0	0	0	0	0	0
Q29	POLISHING POND INFLOW	0	3,806	1,601	0	3,806	1,601
Q - Precipitation on Polishing Pond	Precipitation minus Sublimation ON POLISHING POND	0	3,049	1,602	0	3,049	1,602
Q - Evaporation from Polishing Pond	EVAPORATION FROM POLISHING POND	0	1,355	1,063	0	1,355	1,063
Q30	POLISHING POND OUTFLOW	0	5,499	2,140	0	5,499	2,140
Q31	RECYCLE FROM FINAL POLISHING POND						
Q32	DISCHARGE PIPELINE						
Q33	DISCHARGE TO MINAGO						
Q34	MINAGO UPSTREAM						
Q35	MINAGO DOWNSTREAM						
Q36	DISCHARGE TO OAKLEY CREEK	0	5,499	2,140	0	5,499	2,140
Q37	OAKLEY CREEK UPSTREAM	0	345,600	43,200	0	345,600	43,200
Q38	OAKLEY CREEK DOWNSTREAM	0	351,099	45,340	0	351,099	45,340
FLOW RATIOS:							
Q33 / Q34	RATIO OF DISCHARGE TO MINAGO TO FLOW IN MINAGO	0%	0%	0%	0%	0%	0%
Q36 / Q37	RATIO OF DISCHARGE TO OAKLEY CK TO FLOW IN OAKLEY CK	0%	2%	5%	0%	2%	5%

Table 8-3 Projected Concentrations in Flows around the Minago Site during Closure

SCENARIO:			ESTIMATED AVERAGE CONCENTRATION						REGULATIONS				
			Closure (Stage 1)	Closure (Stage 2)	Closure (Stage 2)	Year 12 - Closure (Stage 2)			(2002)		TIER II Water Quality Objectives		the Protection of Aquatic Life
			Tailings only; max.tailings leaching rate	Tailings only; max.tailings leaching rate	Tailings only; max.tailings leaching rate	Tailings only; max.tailings leaching rate	Tailings only; max.tailings leaching rate	Tailings only; max.tailings leaching rate					
FLOW		WATER QUALITY PARAM.	NOVEMBER TO APRIL (mg/L)	MAY (mg/L)	JUNE TO OCTOBER (mg/L)	NOVEMBER TO APRIL (mg/L)	MAY (mg/L)	JUNE TO OCTOBER (mg/L)	Monthly Mean	Grab Sample	assuming hardness = 150 mg/L $CaCO_3$	Freshwater	(CCME, 2007)
Q30	POLISHING POND OUTFLOW	Al	0.000	0.062	0.081	0.000	0.093	0.112				0.005 - 0.1	0.005
Q30	POLISHING POND OUTFLOW	Sb	0.00000	0.00104	0.00135	0.00000	0.00134	0.00166					
Q30	POLISHING POND OUTFLOW	As	0.000	0.003	0.004	0.000	0.004	0.005	0.5	1	0.15 mg/L (4-Day, 3-Year) [A]	Tier II	0.005
Q30	POLISHING POND OUTFLOW	Cd	0.00000	0.00027	0.00038	0.00000	0.00046	0.00055			0.00302 [B]	Tier II	0.000017 or $10^{(0.86[\log(hardness)]-3.2)}$
Q30	POLISHING POND OUTFLOW	Cr	0.0000	0.0021	0.0027	0.0000	0.0027	0.0033			0.10331 [C]	Tier II	
Q30	POLISHING POND OUTFLOW	Co	0.00000	0.00103	0.00132	0.00000	0.00136	0.00161					
Q30	POLISHING POND OUTFLOW	Cu	0.0000	0.0089	0.0118	0.0000	0.0137	0.0168	0.3	0.6	0.01266 [D]	Tier II	0.002
Q30	POLISHING POND OUTFLOW	Fe	0.000	0.095	0.113	0.000	0.107	0.126				0.3	0.3
Q30	POLISHING POND OUTFLOW	Pb	0.00000	0.00540	0.00748	0.00000	0.00903	0.01113	0.2	0.4	0.0039 [E]	Tier II	0.001
Q30	POLISHING POND OUTFLOW	Mo	0.0000	0.0095	0.0121	0.0000	0.0136	0.0163				0.073	
Q30	POLISHING POND OUTFLOW	Ni	0.000	0.041	0.052	0.000	0.058	0.069	0.5	1	0.07329 [F]	Tier II	0.025
Q30	POLISHING POND OUTFLOW	Se	0.0000	0.0017	0.0023	0.0000	0.0023	0.0029				0.001	0.001
Q30	POLISHING POND OUTFLOW	Zn	0.000	0.031	0.042	0.000	0.048	0.059	0.5	1	0.16657 [G]	Tier II	0.03
Q35	MINAGO DOWNSTREAM	Al										0.005 - 0.1	0.005
Q35	MINAGO DOWNSTREAM	Sb											
Q35	MINAGO DOWNSTREAM	As							0.5	1	0.15 mg/L (4-Day, 3-Year) [A]	Tier II	0.005
Q35	MINAGO DOWNSTREAM	Cd									0.00302 [B]	Tier II	0.000017 or $10^{(0.86[\log(hardness)]-3.2)}$
Q35	MINAGO DOWNSTREAM	Cr									0.10331 [C]	Tier II	
Q35	MINAGO DOWNSTREAM	Co											
Q35	MINAGO DOWNSTREAM	Cu							0.3	0.6	0.01266 [D]	Tier II	0.002
Q35	MINAGO DOWNSTREAM	Fe										0.3	0.3
Q35	MINAGO DOWNSTREAM	Pb							0.2	0.4	0.0039 [E]	Tier II	0.001
Q35	MINAGO DOWNSTREAM	Mo										0.073	
Q35	MINAGO DOWNSTREAM	Ni							0.5	1	0.07329 [F]	Tier II	0.025
Q35	MINAGO DOWNSTREAM	Se										0.001	0.001
Q35	MINAGO DOWNSTREAM	Zn							0.5	1	0.16657 [G]	Tier II	0.03

Table 8-3 (Cont.'d) Projected Concentrations in Flows around the Minago Site during Closure

SCENARIO:			ESTIMATED AVERAGE CONCENTRATION						REGULATIONS				
			Closure (Stage 1)	Closure (Stage 2)	Closure (Stage 2)	Year 12 - Closure (Stage 2)			(2002)		TIER II Water Quality Objectives		the Protection of Aquatic Life
			Tailings only; max.tailings leaching rate	Tailings only; max.tailings leaching rate	Tailings only; max.tailings leaching rate	Tailings only; max.tailings leaching rate	Tailings only; max.tailings leaching rate	Tailings only; max.tailings leaching rate					
		WATER QUALITY	NOVEMBER TO APRIL	MAY	JUNE TO OCTOBER	NOVEMBER TO APRIL	MAY	JUNE TO OCTOBER	Monthly Mean	Grab Sample	assuming hardness = 150 mg/L $CaCO_3$	Freshwater	(CCME, 2007)
FLOW		PARAM.	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)					
Q38	OAKLEY CREEK DOWNSTREAM	Al	0.0000	0.0036	0.0064	0.0000	0.0041	0.0078				0.005 - 0.1	0.005
Q38	OAKLEY CREEK DOWNSTREAM	Sb	0.000000	0.000050	0.000096	0.000000	0.000054	0.000111					
Q38	OAKLEY CREEK DOWNSTREAM	As	0.0000	0.0004	0.0005	0.0000	0.0004	0.0006	0.5	1	0.15 mg/L (4-Day, 3-Year) [A]	Tier II	0.005
Q38	OAKLEY CREEK DOWNSTREAM	Cd	0.000000	0.000017	0.000030	0.000000	0.000020	0.000038			0.00302 [B]	Tier II	0.000017 or $10^{\{0.86[\log(hardness)]-3.2\}}$
Q38	OAKLEY CREEK DOWNSTREAM	Cr	0.0000	0.0003	0.0004	0.0000	0.0003	0.0004			0.10331 [C]	Tier II	
Q38	OAKLEY CREEK DOWNSTREAM	Co	0.0000	0.0000	0.0001	0.0000	0.0001	0.0001					
Q38	OAKLEY CREEK DOWNSTREAM	Cu	0.0000	0.0003	0.0007	0.0000	0.0004	0.0009	0.3	0.6	0.01266 [D]	Tier II	0.002
Q38	OAKLEY CREEK DOWNSTREAM	Fe	0.0000	0.0512	0.0534	0.0000	0.0514	0.0540				0.3	0.3
Q38	OAKLEY CREEK DOWNSTREAM	Pb	0.0000	0.0001	0.0004	0.0000	0.0002	0.0005	0.2	0.4	0.0039 [E]	Tier II	0.001
Q38	OAKLEY CREEK DOWNSTREAM	Mo	0.0000	0.0002	0.0007	0.0000	0.0003	0.0009				0.073	
Q38	OAKLEY CREEK DOWNSTREAM	Ni	0.0000	0.0009	0.0026	0.0000	0.0011	0.0034	0.5	1	0.07329 [F]	Tier II	0.025
Q38	OAKLEY CREEK DOWNSTREAM	Se	0.0000	0.0003	0.0003	0.0000	0.0003	0.0004				0.001	0.001
Q38	OAKLEY CREEK DOWNSTREAM	Zn	0.0000	0.0011	0.0025	0.0000	0.0014	0.0034	0.5	1	0.16657 [G]	Tier II	0.03

Notes:
August 2008 groundwater chemistry was assumed in the modeling.

A Arsenic limits: 0.15 mg/L for averaging duration 4 days (4-Day, 3-Year or 7Q10 Design Flow); 0.34 mg/L for averaging duration 1 hr (1-Day, 3-Year or 1Q10 Design Flow)

B Cadmium limit: [e{0.7852[ln(Hardness)]-2.715}]×[1.101672-{ln(Hardness)(0.041838)}] for 4 days averaging duration.
[e{1.128[ln(Hardness)]-3.6867}]×[1.136672-{ln(Hardness)(0.041838)}] for 1 hour averaging duration.

C Chromium limit Chromium III: [e{0.8190[ln(Hardness)]+0.6848}]×[0.860] for 4 days averaging duration.
Chromium III: [e{0.8190[ln(Hardness)]+3.7256}]×[0.316] for 1 hour averaging duration.
Chromium VI: 0.011 mg/L for averaging duration 4 days (4-Day, 3-Year or 7Q10 Design Flow); 0.016 mg/L for averaging duration 1 hr (1-Day, 3-Year or 1Q10 Design Flow)

D Copper limits: [e{0.8545[ln(Hardness)]-1.702}]×[0.960] for 4 Days hour averaging duration.
[e{0.9422[ln(Hardness)]-1.700}]×[0.960] for 1 hour averaging duration.

E Lead limits: [e{1.273[ln(Hardness)]-4,705}]×[1.46203 -{ln(Hardness)(0.145712)}] for 4 Days averaging duration.
[e{1.273[ln(Hardness)]-1.460}]×[1.46203 -{ln(Hardness)(0.145712)}] for 1 hour averaging duration.

F Nickel limits: [e{0.8460[ln(Hardness)]+0.0584}]×[0.997] for 4 Days averaging duration.
[e{0.8460[ln(Hardness)]+2.255}]×[0.998] for 1 hour averaging duration.

G Zinc limits: [e{0.8473[ln(Hardness)]+0.884}]×[0.976] for 4 Days averaging duration.
[e{0.8473[ln(Hardness)]+0.884}]×[0.978] for 1 hour averaging duration.

8.5.2 Storm Water Management

A general storm water management plan is outlined below.

- The storm water falling on no-process areas including the Dolomite and Country Rock Waste Rock Dumps will report to the natural environment.
- The major facilities such as the Open Pit Mine, TWRMF and Polishing Pond will be isolated with sealed dykes integral with the perimeter roads.
- After closure, water from the Polishing Pond will be discharged into the cross-ditch to report to the Oakley Creek. The major cross-site ditch will report to the ditch at Highway 6 and to the Oakley Creek through the low lying marsh.

8.5.3 Contaminants of Concern (CoC)

All discharges to the receiving environment are expected to meet the MMER guidelines during all stages of the mine development, closure and post closure periods. Table 8-4 summarizes the projected Polishing Pond water quality for the different mine development and closure stages against the MMER guideline limits (Environment Canada, 2002a). On the basis of the projected discharge water quantity for all phases of the operation, there will be no contaminat of concern for this project as all contaminats meet MMER guidelines.

Table 8-4 Water Quality of Polishing Pond Discharges

SCENARIO:		ESTIMATED AVERAGE CONCENTRATION																		REGULATIONS	
		DURING CONSTRUCTION	DURING OPERATIONS							Year 11			Year 12			Year 13				Metal Mining Liquid Effluents (2002)	
			Year 1 through Year 8	Year 9			Year 10			Closure (Stage 1)	Closure (Stage 2)	Closure (Stage 2)	Closure (Stage 2)			POST CLOSURE					
	WATER QUALITY	Maximum	Maximum	NOV. TO APRIL	MAY	JUNE TO OCTOBER	NOV. TO APRIL	MAY	JUNE TO OCTOBER	NOV. TO APRIL	MAY	JUNE TO OCTOBER	NOV. TO APRIL	MAY	JUNE TO OCTOBER	NOV. TO APRIL	MAY	JUNE TO OCTOBER	OVERALL MAXIMUM		
FLOW	PARAM.	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	Monthly Mean	Grab Sample
POLISHING POND OUTFLOW	As	0.001	0.002	0.006	0.005	0.005	0.006	0.006	0.005	0.000	0.003	0.004	0.000	0.004	0.005	0.000	0.005	0.006	0.006	0.5	1
POLISHING POND OUTFLOW	Cu	0.0006	0.0161	0.0393	0.0286	0.0247	0.0261	0.0240	0.0192	0.0000	0.0089	0.0118	0.0000	0.0137	0.0168	0.0000	0.0180	0.0203	0.0393	0.3	0.6
POLISHING POND OUTFLOW	Pb	0.00006	0.00375	0.01304	0.01008	0.01070	0.01318	0.01218	0.01076	0.00000	0.00540	0.00748	0.00000	0.00903	0.01113	0.00000	0.01214	0.01107	0.01318	0.2	0.4
POLISHING POND OUTFLOW	Ni	0.001	0.214	0.447	0.308	0.219	0.190	0.172	0.113	0.000	0.041	0.052	0.000	0.058	0.069	0.000	0.072	0.087	0.447	0.5	1
POLISHING POND OUTFLOW	Zn	0.005	0.023	0.068	0.054	0.058	0.071	0.066	0.059	0.000	0.031	0.042	0.000	0.048	0.059	0.000	0.063	0.062	0.071	0.5	1

8.6 Surface Installations and Materials

At Minago, the industrial complex on surface consists of the following components:

- Mill and Mill Reagent Storage;
- Crusher;
- Maintenance Shop and Offices;
- Administration Building;
- Power Generation;
- Explosive Magazine;
- Diesel Fuel Bay;
- Tailings Storage Facility;
- Frac Sand and Concentrate Storage Area; and
- Waste Rock Dumps.

Closure related issues for infrastructure within the industrial area include public health and safety, removal of buildings, decommissioning and removal of gensets, site stabilization aesthetics, and restoration of disturbed lands. Details of the planned decommissioning activities for the industrial complex at Minago are provided in the following sections.

8.6.1 Equipment and Machinery

All fixed equipment (owned by VNI) with marketable value will be removed from the mine and sold. All major equipment will be sold or dismantled and removed as scrap. All settled dust will be treated if necessary. All minor equipment with the exception of those required for post-mine closure functions will be sold or removed as scrap. All mobile equipment with the exception of those required for post-mine closure functions will be sold or removed as scrap. Any equipment unsold will be disposed of in a proper manner.

All marketable materials will be sold. Materials without any marketable value, which are non-hazardous, such as piping, wood, and concrete, etc., will be left in place. Electric installation cables will be left in place unless it is determined that they contain hazardous materials. All materials that were not sold nor left in place will be disposed of in a proper manner.

8.6.1.1 Underground and Above-ground Storage Tanks

Inventories of materials stored in tanks will be minimized as the end of mine life approaches. The contents of all storage tanks will be pumped out by a qualified agent or a waste contractor for disposal. Tanks will be removed and offered for sale or scrap.

8.6.2 Materials

8.6.2.1 Chemicals

Apart from hydrocarbon products, there should be limited types of chemicals on site at the time of closure. Remaining materials will be removed from the site and returned to the original supplier for credit and reuse, or sold to a third party user subject to the appropriate regulatory requirements. Unused specialized products such as water treatment chemicals (flocculants and coagulants) will be disposed of through a licensed waste disposal firm. It is anticipated that such material will be small in volume at the time of closure. In addition, due to the limited number of products used on site, disposal of any hazardous materials should not be an arduous task at closure.

8.6.2.2 Fuels

Fuel supplies for equipment on site will be required until all decommissioning activities cease. Fuel inventories will be minimized as the end of mine life approaches. Arrangements will be made to return unused fuel to the supplier.

During the closure phase, a site assessment will be undertaken to determine if there are any contaminated areas, especially with hydrocarbons. In the event the assessment finds some contaminated soils, the waste will be isolated and processed for remediation. All fuel storage areas and refuelling stations will be assessed for soil contamination. The contaminated soils will be removed from the area and disposed of in a land farm. The selected disposal method will be in accordance with the Manitoba Environment Act and Special Waste Regulation.

Once decommissioning activities have ceased, all fuel tanks will be emptied of their contents in accordance with the Manitoba Environment Act pertaining to storage and handling of petroleum products. The tanks will either sold or destroyed and buried on site.

8.6.2.3 Lubricants

All marketable lubricants will be sold or returned to the original vendor. All other lubricants will be handled, stored and disposed according to applicable regulations and guidelines such as the Environment Act and and Storage Tanks Regulations.

8.6.2.4 Scrap Metals

All scrap metals will be sold to metal vendors. Unmarketable scrap metal (due to metal price depression) will be disposed of in a proper manner.

8.6.2.5 Refuse

All salvageable material will be sold and removed from the site. Material that has no scrap value will be disposed of on site. Prior to disposal of the material on site, all of the materials will be examined to ensure that all hazardous materials have been removed and disposed of in an approved manner. Any scrap wood will be stockpiled and likely burned, if permitted by the Manitoba government.

8.6.2.6 Warehouse Inventory

Warehouse inventories will be minimized as the end of mine life approaches. Surplus materials in the warehouse at the end of mine life will be sold to vendors. All controlled products stored in the warehouse will be disposed of as per Workplace Hazardous Materials Information Systems (WHMIS) and other requirements.

8.6.2.7 Explosives

Explosive inventories will be minimized as the end of mine life approaches. Any unused explosives and detonation devices, if still on site, will be checked for condition and either returned to the supplier for credit, shipped to another third party user, or destroyed through appropriate procedures. In all cases the explosives will be handled, transported and disposed of in compliance with the Explosive Act. The explosives magazines will be returned to the supplier or to a third party.

8.6.3 Infrastructure: Buildings, Structures and Services

The infrastructure, including buildings, structures and services, will be left in place during the TS and SI stages. However, the redundant infrastructure will be decommissioned and disposed of in an appropriate manner. Closure issues related to infrastructure include public health and safety, site stabilization aesthetics and restoration of disturbed lands.

Site decommissioning will include the removal of all constructed infrastructure materials, with the exception of concrete foundations which will be demolished and buried in situ. This will be accomplished using internal resources and contractor demolition companies. It is expected that there will be salvage value for much of the materials, particularly structural steel and other crushing, grinding and processing equipment from the mill. The residual values of the mining and milling equipment and materials may be used to offset closure costs.

In all cases, concrete foundations and other concrete structures will be broken down to ground level and buried.

Equipment with marketable value will be removed first; the remaining facilities and equipment will be assessed for disposal through demolition and salvage contracts. It is not possible to accurately predict the residual values of the non-reclamation assets at the time of closure; values have instead been assumed based on current market conditions. Milling and mining equipment are expected to carry significant salvage value that can be used to offset closure costs. Material that is not economically salvageable will be buried in an on-site refuse landfill.

At the time of closure, the following infrastructure will remain in place to support post closure care and maintenance.

- local access roads to the base camp and water treatment plant
- reclamation equipment such as trucks, dozer and snowmobile machine
- water management systems
- fuel storage facility

- small power generating facility
- small maintenance workshop
- limited accommodations
- environmental laboratory
- communication system.

The above facilities will be decommissioned when will be no longer required.

8.6.3.1 Concentrator Building (Mill Building)

The concentrator building will be maintained during the TS, SI stages and will be decommissioned during the closure phase.

The ore concentrator (the “mill”) is comprised of the mill building itself, the crusher house, grinding, flotation and dewatering systems, conveyors and truck load out facility. All buildings will be made from steel and constructed on concrete slab flooring. The mill building itself will house what is expected to be the most marketable components from a salvage perspective, especially the crushing and grinding circuits and structural steel, as well as other scaffolding and processing equipment.

Buildings and equipment that are not be salvaged will be demolished and the debris will be hauled for burial in the refuse landfill on site. The concrete foundations will be demolished to ground level and the rubble will be buried in situ after being covered.

8.6.3.2 Maintenance Shop

The maintenance shop will be maintained during the TS and SI stages, and demolished and removed upon closure. Debris will be hauled to the refuse landfill. The foundation will be demolished to ground level and buried on-site with approximately 300 mm of native soil material.

8.6.3.3 The Camp

The 300-person camp will consist of sleeping units, ablution units, communal cafeteria style kitchen and limited indoor recreational facilities. The modular units will be factory-built to minimize construction time on site. Few of the sleeping units will be occupied during the TS and SI phases, since there will be a limited number of people on site for care and maintenance. These will be secured until closure when they will be removed from the property and sold.

8.6.3.4 Explosive Magazines

Explosives magazines will be either returned to suppliers, or shipped to other nearby mines that may use the magazines. Unused explosives will be checked and either returned to the supplier for credit or destroyed through appropriate procedures. Detonation devices will be returned to the supplier for credit. In all cases, the explosives will be handled, transported and disposed of in accordance with the Explosive Act.

8.6.3.5 Miscellaneous Buildings and Structures

Miscellaneous buildings and structures that will not be required during TS and SI stages will be decommissioned and demolished. During the closure phase, all miscellaneous buildings and structures will be demolished and the debris disposed of in an environmentally sound manner.

Fuel tanks will be hauled away and sold. Fuel berks will be re-contoured, the liner removed and hauled to the refuse landfill on site. The back-up diesel generators will be removed for salvage.

8.6.3.6 Roads and Yards (Old Version)

Once the traffic around the site areas is reduced to a point where vehicle access is no longer required, most roads will be decommissioned. This will consist of removing culverts and replacing them with cross-ditches and swales, ripping and scarifying road surfaces and re-vegetating them with the Minago custom revegetation mixture. More details on road decommissioning are provided in .

Access will remain for ATVs or similar transport for monitoring and inspections and with minimal effort vehicle access could be re-established. However, main access roads to the TWRMF and waste rock storage areas will only be partially decommissioned to permit vehicle access in case of emergency. Partial decommissioning will consist of narrowing the road width but leaving existing culverts in place.

8.6.3.7 Powerlines

All power poles that will not be required for the post-closure functions will be removed.

The power transformers and power line will be removed for salvage; power poles will be destroyed or removed for salvage based on their condition. Fencing will be demolished and buried on site.

8.6.3.8 Pipelines

All out of service, above ground pipelines, except for all essential pipelines needed for water management, will be cut into usable sections and offered for sale or disposed of in a proper manner. The high density polyethylene (HDPE) tailings pipelines will be and those sections that are of poor quality will be disposed of in a proper manner.

8.6.3.9 Acid Rock Drainage Control

All acid rock drainage control structures, if required, will be left in place. These structures will be used during the post-closure phase, if required.

8.7 Disturbed Areas

Development of the project will involve the new clearing or other vegetation disturbance detailed in Table 7-3.

At Minago, the types of disturbed sites will include:

- flat sites in or to close to the natural muskeg (poorly drained or saturated and organic);
- flat sites that are poorly drained or saturated, have lower organic matter and plant nutrient contents than the muskeg (laydown areas), and that may also be compacted;
- rocky, well-drained sites with little or no organic matter, little or no plant nutrients, and low water holding capacity such as the waste rock dumps; and
- side slopes of waste rock dumps and the TWRMF with little or no organic matter, little or no plant nutrients, and low water holding capacity.

The only permanent vegetation losses will be the areas occupied by the waste rock and overburden dumps, TWRMF and the pit area. The company will exercise reasonable efforts to revegetate the industrial area, once all buildings have been decommissioned, the waste rock dumps, and all access roads not required during the post closure period . After mine operations cease, the pit area will be flooded, tailings contained in the TWRMF will be submerged under .5 m of water, and the Polishing Pond will be left as wetland.

8.7.1 Tailings Waste Rock Management Facility (TWRMF)

Redundant components associated with the Minago TWRMF will be decommissioned and slopes will be recontoured where needed. A nominal 300 mm soil cover will be placed over all trafficable portions of the TWRMF to control dust and provide a growth medium for re-vegetation. The soil will consist of locally available overburden with sufficient amounts of fines for seeding and planting. Disturbed areas of the TWRMF will be re-vegetated using a custom seed mixture and/or local plant species. A revegetation program will be developed during the operational phase as part of the research program.

8.7.2 Borrow Areas

Borrow areas may create public safety issues related to the slope of the walls of borrow pit areas. To address the physical stability and public safety concerns, the walls of the borrow pits will be stabilized by drilling and blasting (if needed). The flat areas of the borrow areas will be re-vegetated using a custom seed mixture and local plant species. The seed mixture will be developed during the operational phase as part of the research program. Runoff from the borrow areas will be controlled with ditches, sediment fences and settling ponds. The borrow areas will be monitored and the performance results will be evaluated and decision will be made at the time whether these closure measures are satisfactory or not.

8.7.3 Waste Rock Storage Areas

Waste Rock Storage Areas be constructed with 3H:1V side slopes during the operational phase. VNI will develop a construction plan for the waste rock storage areas that will facilitate the reuse of fine waste materials from the Frac Sand Plant and organic matter from peat excavations at the time when these materials are handled for the first time. The fine material and peat will serve as top soil to achieve reclamation of disturbed areas, side slopes, and top portions of the waste rock storage areas.

Slide slopes will be covered with suitable fine waste materials from the Frac Sand Plant, wherever possible. The reuse of waste material from the Frac Sand Plant to cover side slopes of the waste rock storage areas will accomplish two things: efficient waste and materials management and minimization of the effort and resources required during the closure/reclamation stage. Whenever possible, peat from muskeg excavations during the operational phase will also be applied to side slopes of the waste rock storage areas. Excavated peat will be applied to areas that will not be covered by waste rock. The application of fine materials and peat during the operational phase to the slopes of waste rock storage areas will minimize the reclamation activities required at the end of the mine cycle.

At closure, all surfaces of the waste rock storage areas will be reclaimed and revegetated to acceptable standards. Where necessary, slopes will be recontoured prior to the application of top soil and revegetation.

8.7.4 Mine Access Roads

There will be two types of roads at Minago - 8 metre service roads and. 30 metre haul road

8.7.5 Railway Siding

Once the railway siding will no longer be required, it will be decommissioned unless someone wants to take the facility over for further use. The two railside buildings will be removed with the exception of concrete foundations. Concrete foundations will be broken up to ground level and removed from the site. The dismantled materials will be sold to vendors as prevailing market conditions permit and remaining debris will be disposed of in an appropriate manner. Any diesel power gensets will be decommissioned and sold to vendors. Power distribution lines will be removed from the site and salvaged if possible. The disturbed areas will then be reclaimed using the Minago's revegetation shrubs.

9. MONITORING AND MAINTENANCE PROGRAMS

9.1 Water and Effluent Quality Monitoring Program

9.1.1 Effluent Monitoring

9.1.1.1 Chemical Monitoring

Chemical monitoring will be undertaken for during the operational and closure phases, in accordance with permit and MMER requirements. An application for amendment setting out revised program for approval will be submitted to the respective agency. In addition to meeting permit requirements of the day, monitoring will be limited in scope to those parameters given in Schedule 4 of MMER. After MMER, monitoring will continue as per the proposed program for three additional years. During the closure phase chemical monitoring data will be reviewed for continual improvement.

9.1.1.2 Biological Monitoring

Biological monitoring will be undertaken to meet permit and MMER related requirements. Toxicity testing will be part of the biological monitoring program and will continue as required. After MMER, monitoring will continue as per the proposed program for seven additional years.

9.1.1.3 Physical Monitoring

Monitoring programs to assess physical parameters will be undertaken during the operational, closure and post closure phases. In the event of any significant improvement or deficiency during the post closure phase (expected to be years 4-6 after closure), Victory Nickel will apply for an amendment setting out a revised program for approval.

9.1.1.4 Operational and Closure Water Monitoring Programs

Surface water quality in watercourses surrounding the Minago Project was assessed by Wardrop (2007) from May to October 2006, URS (2008g) from May to August 2007, and KR Design Inc. from September 2007 to May 2008. Wardrop (2007) monitored water quality in Oakley Creek and Minago Project River while URS (2008g) and KR Design Inc. regularly monitored water quality in Oakley Creek, Minago Project River, William River, and Hargrave River. One-time assessments of surface water quality were also completed for William Lake, Little Limestone Lake, Russell Lake, and two locations near the confluence of William River and Limestone Bay on Lake Winnipeg. The selected locations for surface water sampling stations were based on:

- a review of topographic maps, orthophoto and drainage features at and surrounding the Project site
- consideration of the simultaneous collection of hydrological data, stream sediment and benthic samples during one or more of the surface water sampling events

- consideration of the selection of representative stations both upstream and downstream of the Project site for the development of long-term sampling stations to monitor long-term trends in surface water quality during the exploration phase of the Project and during potential development, operation and post-closure phases of the Project mine life.

Water samples will be analyzed for field parameters (pH, temperature, conductivity, oxidation-reduction potential (ORP), and dissolved oxygen (DO)), nutrients, major ions, metals, Radium-226, and other physicochemical parameters. Collection methods will conform to the guidelines outlined in the federal Metal Mining Guidance Document for Aquatic Environmental Effects Monitoring (MMER-EEM; Environment Canada 2002).

Potential project effects on water quality in local watersheds during operational and closure may be caused by the following:

- discharge from the polishing pond into the Oakley Creek and the Minago River
- introduction of sediments (total suspended solids) to receiving waters due to runoff from disturbed areas during mine facility construction.

Victory Nickel intends to design its environmental protection programs inan environmentally sensitive manner to ensure that the above effects to not occur. However, in order to assess impacts, Victory Nickel will undertake a regional study during the operation and after closure. The regional study area includes water bodies and watersheds beyond the local project area that reflect the general region to be considered for cumulative effects and that provide suitable reference areas for sampling:

- Minago River downstream and upstream of the polishing pond discharge
- Cross Lake
- William River
- Limestone Bay
- Hargrave River
- Oakley Creek and William River Confluence

Sampling sites were established as outlined in Table 9-1 and Figure 9-1. These sampling sites will also be used during the TS, SI and closure stages.

9.1.1.5 Vegetation Monitoring Programs

The re-vegetated areas will be subjected to:

- annual monitoring of the metal uptake in vegetation
- annual inspection of native plant invasion during the demonstration period and
- annual evaluation of plant growth for the re-vegetated areas.

Success of the re-vegetation program will be determined by measuring a number of aspects including growth, survival, density and diversity of perennial species. The assessment will be based on randomly allocated plots located within areas representative of the reclaimed lands. As the results from the monitoring program show improvements during the demonstration period, Victory Nickel will terminate the monitoring programs.

Physical Inspection of the TWRMF

The TWRMF will be inspected by Victory Nickel personnel and competent individuals during the post-closure phase (Year 4 to 6). The details and the inspection and monitoring frequencies are given in Table 9-2.

Table 9-1 Nomenclature and Coordinates of Biophysical Monitoring Stations

Victory Nickel Sample Location (as of Sept. 15, 2007)	UTM (NAD 83)		UTM (NAD 83)		Description
	Northing	Easting	Latitude	Longitude	
HRW1	6028072	495606	54°24.041' N	99°04.051' W	Hargrave River immediately west of Highway 6
MRW1	6005277	488671	54°11.721' N	99°10.420' W	Minago Project River immediately west of Highway 6
MRW2	6001212	472476	54°09.494' N	99°25.290' W	Minago Project River near Habiluk Lake
MRW2x	6001166	472571	54°09.470' N	99°25.206' W	Minago Project River near Habiluk Lake (~ 100 m downstream of MRW2)
MRW3	6007895	494274			Minago Project River downstream of Highway 6 near powerline cut
OCW1	5990510	489322	54°03.762' N	99°09.786' W	Oakley Creek immediately east of Highway 6
OCW2	5990961	487463	54°04.002' N	99°11.492' W	Oakley Creek immediately downstream of north tributary
OCW3	5990892	487230	54°03.965' N	99°11.707' W	Oakley Creek immediately upstream of north tributary
WRW2x	5987162	495416	54°01.963' N	99°04.199' W	William River approx. 6 km upstream of the Oakley Creek confluence
WRW1x	5986554	498523	54°01.637' N	99°01.350' W	William River approx. 100 m downstream of the Oakley Creek confluence
WRAOC	5986647	498452	54°01.685' N	99°01.416' W	William River approx. 50 m upstream of the Oakley Creek
OCAWR	5986744	498457	54°01.738' N	99°01.414' W	Oakley Creek approx. 50 m above William River
WRALSB	5969206	503935	53°52.278' N	98°56.410' W	William River approx. 100 m above Limestone Bay
LSBBWR	5968889	504092	53°52.107' N	98°56.262' W	Limestone Bay approx. 250 m below William River
Little Limestone Lake	5954922	478725			Little Limestone Lake (at end of road)
Russell Lake	5967117	482571			Russell Lake (at end of road)
William River (Winter)	5973774	485141	53°54.730' N	99°13.574' W	William River east of Highway 6
William River at Road	5973791	485078			William River west of Highway 6
William Lake	5973831	479083			William Lake at end of access road
Polishing Pond	TBA	TBA	TBA	TBA	Polishing Pond Outflow to Receiving Environment during Closure

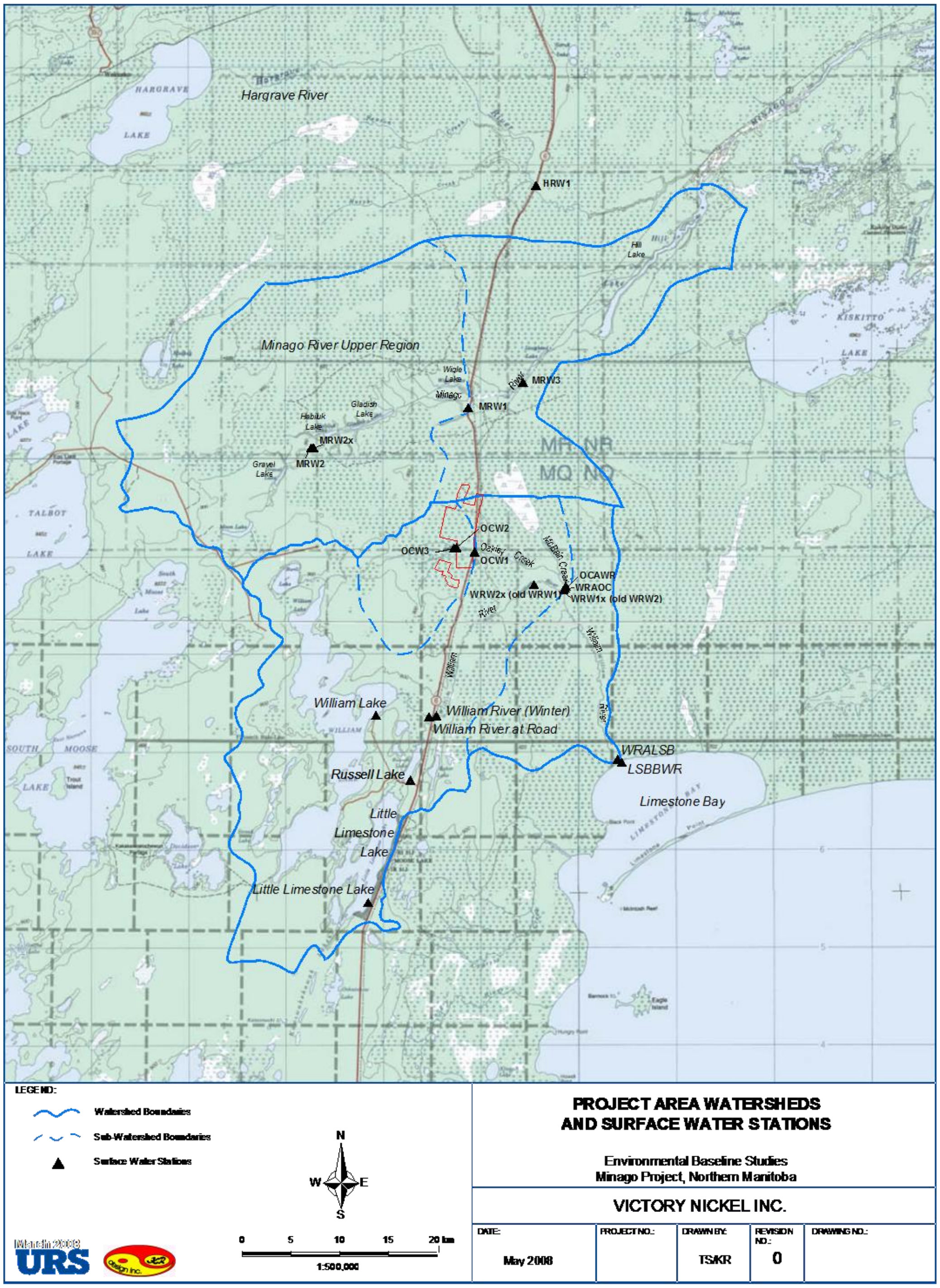


Figure 9-1 Minago Project – Site Watersheds

Table 9-2 Proposed Monitoring Program for the TWRMF for Closure (During the Demonstration Period – Expected to occur in Years 4 to 6)

Criteria or Monitoring Parameter	Monitoring Frequency
Weekly Visual Inspection	Weekly inspection
Annual Inspection by a Competent Person	Annual Inspection
Dam Safety Review	Every 7 Years (CDA Dam Safety Guidelines, 1999)
Instrumentation (Piezometers – Electric and Standpipe)	Monthly
Embankment Movement Points	Annually
Seepage at Toe of the Dam	Weekly
Pond Water Level	Weekly
Crack in Crest of the Dam	Weekly
Distance between Water Pond and Upstream edge of Embankment Crest	Weekly
Storm	Immediately after the storm
Earthquake	Immediately after the Earthquake

9.1.1.6 Water Quality Characterization

The water quality parameters and associated minimum detection limits are given in Table 9-3. The respective QA/QC criteria and procedures for closure will be similar to the operational ones.

Table 9-3 Water Quality Parameters and Detection Limits

Parameter		Detection limit (mg/L)	Analytical Method
Aluminum, total and dissolved	Al	0.001	ICP / ICP MS
Antimony, total and dissolved	Sb	0.00005	ICP / ICP MS
Arsenic, total and dissolved	As	0.00005	ICP / ICP MS
Barium, total and dissolved	Ba	0.00005	ICP / ICP MS
Beryllium, total and dissolved	Be	0.0005	ICP / ICP MS
Bismuth, total and dissolved	Bi	0.0005	ICP / ICP MS
Boron, total and dissolved	B	0.001	ICP / ICP MS
Cadmium, total and dissolved	Cd	0.00005 to 0.02	ICP / ICP MS
Calcium, total and dissolved	Ca	0.05	ICP / ICP MS
Chromium, total and dissolved	Cr	0.0001	ICP / ICP MS
Cobalt, total and dissolved	Co	0.0001	ICP / ICP MS
Copper, total and dissolved	Cu	0.0001	ICP / ICP MS
Iron, total and dissolved	Fe	0.01	ICP / ICP MS
Lead, total and dissolved	Pb	0.00005	ICP / ICP MS
Lithium, total and dissolved	Li	0.001	ICP / ICP MS
Magnesium, total and dissolved	Mg	0.05	ICP / ICP MS
Manganese, total and dissolved	Mn	0.00005	ICP / ICP MS
Mercury (total) , total and dissolved	Hg	0.00005	Cold Oxidation

Parameter		Detection limit (mg/L)	Analytical Method
			(CVAAS)
Molybdenum, total and dissolved	Mo	0.00005	ICP / ICP MS
Nickel, total and dissolved	Ni	0.0001	ICP / ICP MS
Phosphorus, total and dissolved	P	0.05	ICP / ICP MS
Potassium, total and dissolved	K	0.2	ICP / ICP MS
Selenium, total and dissolved	Se	0.0005	ICP / ICP MS
Silicon, total and dissolved	Si	0.05	ICP / ICP MS
Silver, total and dissolved	Ag	0.00001	ICP / ICP MS
Sodium, total and dissolved	Na	2	ICP / ICP MS
Strontium, total and dissolved	Sr	0.0001	ICP / ICP MS
Thallium, total and dissolved	Tl	0.00005	ICP / ICP MS
Tin, total and dissolved	Sn	0.0001	ICP / ICP MS
Titanium, total and dissolved	Ti	0.01	ICP / ICP MS
Vanadium, total and dissolved	V	0.001	ICP / ICP MS
Zinc, total and dissolved	Zn	0.001	ICP / ICP MS
Total alkalinity	$CaCO_3$	1	Titration to pH=4.5
Ammonia	N	0.005	Colorimetry
Nitrate	N	0.005	Ion Exchange Chromatography
Nitrite	N	0.001	Colorimetry
Nitrite + nitrate	N	0.005	Ion Exchange Chromatography
Sulphate	SO_4	0.03	Ion Exchange Chromatography
Total dissolved solids		1 to 5	Filtration/Gravimetric
Total suspended solids		1 to 5	Filtration/Gravimetric
Turbidity		1.0 (NTU)	Nephelometric
Conductivity		1.0 (µS)	Conductivity cell
pH (RelU)		0.1 (ReIU)	Potentiometric
Cyanide (total)	CN	0.005	Distillation/UV Detection
Fluoride	F	0.02	Colorimetry
Chloride	Cl	0.5	Colorimetry

Water quality monitoring program was established as part of the environmental baseline study. These streams will continue to be sampled during the operational and closure phases to determine potential impact(s) over time. The stations that will be sampled during the closure phase are provided in Table 9-4..

Table 9-4 Sediment and Surface Water Monitoring Stations

VICTORY NICKEL Water Quality Monitoring Stations	Description	Water Quality Operational Phase	Water Quality Closure and Post-Closure Phases	Flow		No. of Years of Closure and Post-Closure Phases	Site Attributes
				Operational Phase	Closure and Post-Closure Phases		
HRW1	Hargrave River immediately west of Highway 6	M	Q	Q	Q	6	
MRW1	Minago River immediately west of Highway 6	M	Q	M	Q	6	To meet CCME/MB Tier II Guidelines
MRW2	Minago River near Habiluk Lake	SA	A	SA	A	6	
MRW2X	Minago River near Habiluk Lake (100 m downstream of MRW2)	Q	A	Q	A	6	
MRW3	Minago River downstream of Highway 6 near powerline cut	M	Q	M	Q	6	
OCW1	Oakley Creek immediately east of Highway 6	M	Q	M	Q	6	
OCW2	Oakley Creek immediately downstream of north tributary	M	A	M	A	6	
OCW3	Oakley Creek immediately upstream of north tributary	M	A	M	A	6	
WRW2X	William River approx. 6 km upstream of the Oakley Creek confluence	SA	A	SA	A	6	
WRW1X	William River approx. 100m downstream of the Oakley Creek confluence	M	A	M	A	6	

Table 9-4 Sediment and Surface Water Monitoring Stations (Cont`d.)

VICTORY NICKEL Water Quality Monitoring Stations	Description	Water Quality Operational Phase	Water Quality Closure and Post-Closure Phases	Flow		No. of Years of Closure and Post-Closure Phases	Site Attributes
				Operational Phase	Post-Closure Phase		
WRAOC	William River approx. 50 m upstream of the Oakley Creek	Q	Q	Q	Q	6	
OCAWR	Oakley Creek approx. 50 m above William River	Q	Q	Q	A	6	To meet CCME/MB Tier II Guidelines
WRALSB	William River approx. 100 m above Limestone Bay	Q	Q	Q	Q	3	
LSBBWR	Limestone Bay approx. 250 m below William River	Q	Q	Q	Q	1	
Little Limestone Lake	Little Limestone Lake (at end of road)	A	A	A	A	1	
Russell Lake	Russell Lake (at end of road)	A	A	A	A	1	
William River (Winter)	William River east of Highway 6	A	A	A	A	1	
William River At Road	William River east of Highway 6	A	Q	Q	Q	6	
William Lake	William Lake at end of access road	A	A	A	A	1	
Polish Pond	Polish Pond Outflow	M	M	M	Q	6	To meet MMER Guidelines

A= Annually, Q= Quarterly, SA= Semi Annually

9.1.1.7 TWRMF Monitoring and Surveillance Programs

Surveillance is essential to ensure satisfactory performance of the TWRMF and all of its components beyond the operational phase. The monitoring and surveillance programs are designed to track performance indicators in relation to pre-determined safe thresholds.

A successful surveillance program will help identify potential problems before they become major problems. Design or performance criteria of the TWRMF surveillance program will continue to evolve as the facility's design or performance criteria changes in, site conditions and/or the operation it is accommodating.

The TWRMF surveillance program will consist of both routine and event-driven activities. The basis is the combination of all the regular inspections assisted by the eyes of site personnel to ensure continued integrity and performance of the facility.

External consultants will also inspect the facility as part of a regular program of expert review.

9.1.1.7.1 Monitoring and Trigger Levels

A number of behaviours and events will help to predict the performance and expected behaviour of the facility. Visual performance indicators are the first and easiest type to identify an emergency condition of the facility. The first level of routine observations includes indicators such as:

- seepage through the dam
- turbidity of water in Oakley Creek downstream of the facility
- seepage through the spillways
- water or tailings flowing down the embankment indicating a possible broken pipeline
- failure or breach of the embankment.

Routine surveys will ensure the TWRMF will perform below established action trigger levels. The routine surveys are as detailed below:

- measurements of water through the closure spillway
- water pond setbacks from perimeter embankment in the impoundment areas
- checking for settlement or holes in embankment crest or benches
- checking for holes on the surface of the tailings indicating possible piping of material to outside
- crack measurements
- closure spillway performance – flow rates, metals loading
- pore pressures in the tailings, embankment and foundation areas during construction and closure phases

- surface movement monuments - displacements of perimeter embankment
- seepage flow rate and water chemistry
- piezometer pore pressures – from downloaded data.

Threshold levels or maximum allowable values will be established for all monitoring instrumentation (e.g., piezometers, crack extensometers and displacement monuments) on the embankment slopes. If these values are exceeded, geotechnical consultants and the government will be notified to determine corrective actions.

The proposed schedule for reviewing and updating the surveillance, instrumentation, OMS and dam safety and emergency preparedness plan for the TWRMF is provided in Table 9-5.

Table 9-5 Proposed Schedule for Reviewing and Updating the TWRMF Dam Safety Programs

Program	Significant Consequence Dam as per CDA Classification
Site Surveillance (a)	Weekly
Formal Inspection (b)	Semi Annually or Annually
Instrumentation	As per OMS Manual *
Test Operation of Outlet Facilities, Spillway and Mechanical Components	Annually
Emergency Preparedness Plan	Update Communications Directory Semi Annually or as needed
Operation, Maintenance & Surveillance Plan	Review on a regular basis or when needed
Dam Safety Review (c)	Every 7- 10 Years (d)

* Operation, Maintenance, and Surveillance Manual.
(a) Site surveillance may consist of visual inspections and/or monitoring of automated data acquisition systems. Reduced frequencies of visual inspections may be determined by seasonal conditions.
(b) Formal inspections are intended as more thorough inspections performed by the appropriate representative of the owner responsible for safety surveillance.
(c) A Dam Safety Review involves collection of all available dam records, field inspections, detailed investigations and possibly laboratory testing. It then proceeds with a check of structural stability and operational safety of the dam, beginning with a reappraisal of basic features and assumptions. The level of detail required in a Dam Safety Review should be commensurate with the importance and complexity of the dam, as well as the consequences of failure.
(d) Dam owners must conduct an annual review of conditions downstream of their dam and notify a dam safety officer if the downstream consequence classification level increases.

The proposed monitoring program for the Project is provided in Table 9-4. The monitoring frequency will be reviewed on an annual basis and adjusted as necessary to reflect site conditions and observations made over the previous year.

The monitoring program for the TWRMF is given in Table 9-2. Table 9-5 gives the proposed schedule for reviewing and updating the TWRMF safety programs. The monitoring frequency will be reviewed on an annual basis and adjusted as necessary to reflect site conditions and observations made over the previous year.

10. POST CLOSURE SITE CONFIGURATION

10.1 Final Topography

Apart from the waste rock dumps, Tailings and Waste Rock Storage Facility (TWRSF), Overburden Dump and the polishing pond which will be constructed above ground and the pit that will be excavated below ground, the final topography will depict pre-mining era.

10.2 Final Land Use

The land will become a wilderness at the conclusion of the operations. Trapping and hunting activities are expected to improve after mine closure. The land capability will not be significantly affected by the operations.

10.3 Final Vegetation Cover

The final vegetation cover will consist of the planted green alders and the existing plant species which is predominantly shrubs.

10.4 Water Management during the Post Closure Period

Water management during the post closure period is illustrated in Figure 10-1. In the post closure period, all mining facilities and infrastructure will have been decommissioned with the exception of the TWRMF and the Polishing Pond.

In the post closure phase, the TWRMF will have been decommissioned and reclaimed as much as possible.

- **Key Input Parameters and Considerations for Post Closure (Figure 10-1):**
  1. All decommissioning activities of mining facilities and infrastructure will have been completed.
  2. Only the deposited Ni tailings will leach at the maximum leaching rate measured during kinetic testing in the subaqueous leach column surface water.
  3. TWRMF supernatant in excess of the 1.5 m water cover will be discharged to the Polishing Pond via a spillway.
  4. Polishing Pond supernatant will be discharged to the Oakley Creek basin via a spillway for ultimate discharge to Oakley Creek.

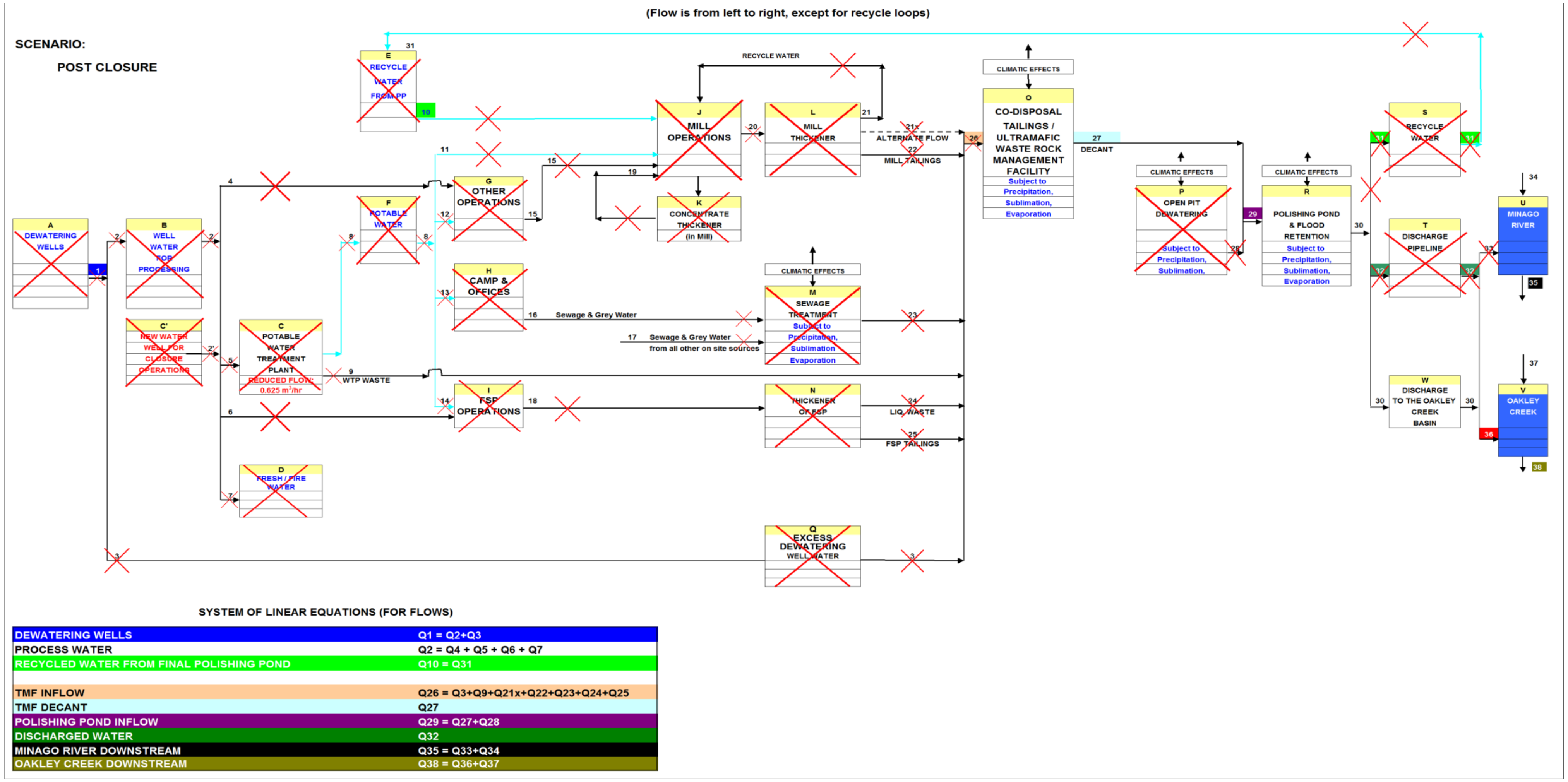


Figure 10-1 Post Closure Water Management System

10.4.1 Water Balance Results during Post Closure

During the Post Closure period, all discharge pipeline systems to Minago River and Oakley Creek will have been dismantled and excess water from the TWRMF (Q27 = TWRMF Decant) will be discharged via a spillway to the Polishing Pond for subsequent discharge to the receiving environment – the Oakley Creek basin and ultimately Oakley Creek. The active and inactive water balance components during the Post Closure period are illustrated in Figure 10-1.

Projected flowrates during the post closure period are listed in Table 10-1. Projected Polishing Pond outflow rates range from 0 m^3/day in the winter months (Nov. to Apr.) to 2,117 m^3/day in the period from June to October to 5,375 m^3/day in May.

The projected parametric concentrations for the Polishing Pond outflow (Q30), Minago downstream (Q35), and Oakley Creek downstream (Q38) are given in Table 10-2. Additional results for Q26 (TWRMF Inflow), Q27 (TWRMF Decant), Q29 (Polishing Pond Inflow) are given in the EIS (Victory Nickel Inc., 2010).

During the Post Closure, the projected outflow from the Polishing Pond will meet MMER requirements at all times. During the Post Closure period, the projected water quality in Oakley Creek downstream of the mixing zones will meet the Manitoba Freshwater guidelines for the protection of aquatic life for all parameters.

Table 10-1 Projected Flow Rates during Post Closure

FLOW		Year 13 - Post Closure Tailings only; max.tailings leaching rate NOVEMBER TO APRIL m^3/day	Year 13 - Post Closure Tailings only; max.tailings leaching rate MAY m^3/day	Year 13 - Post Closure Tailings only; max.tailings leaching rate JUNE TO OCTOBER m^3/day
UNIT EVAPORATION	UNIT LAKE EVAPORATION	0	18	14
UNIT PPT (U-PPT)	UNIT PRECIPITATION	0	41	21
Q1	FLOW FROM DEWATERING WELLS	0	0	0
Q2	WELL WATER FOR PROCESSING	0	0	0
Q3	EXCESS WATER FROM DEWATERING WELLS	0	0	0
Q4	GROUNDWATER TO OTHER OPERATIONS	0	0	0
Q5	GROUNDWATER TO WATER TREATMENT	0	0	0
Q6	GROUNDWATER TO FRAC SAND PLANT	0	0	0
Q7	GROUNDWATER FOR FIRE FIGHTING	0	0	0
Q8	POTABLE WATER	0	0	0
Q9	WATER TREATMENT PLANT WASTE	0	0	0
Q10	RECYCLE WATER FROM FPP	0	0	0
Q11	POTABLE WATER TO MILL	0	0	0
Q12	POTABLE WATER TO OTHER OPERATIONS	0	0	0
Q13	POTABLE WATER TO OFFICES & CAMP	0	0	0
Q14	POTABLE WATER TO FRAC SAND PLANT	0	0	0
Q15	FLOW FROM OPERATIONS TO MILL	0	0	0
Q16	SEWAGE & GREY WATER FROM CAMP AND OFFICES	0	0	0
Q17	SEWAGE & GREY WATER FROM ALL OTHER ON SITE SOURCES	0	0	0
Q19	FLOW FROM CONCENTRATE THICKENER IN MILL TO MILL	0	0	0
Q20	FLOW FROM MILL TO MILL THICKENER	0	0	0
Q21	RECYCLE WATER FROM MILL THICKENER	0	0	0
Q21x	ATERNATE FLOW FOR RECYCLE WATER FROM MILL THICKENER	0	0	0
Q22	MILL TAILINGS SLURRY	0	0	0
Q23	SEWAGE TREATMENT OUTFLOW	0	0	0
Q24	LIQ. WASTE FROM FSP	0	0	0
Q25	SLURRY FROM FSP	0	0	0
Q26	TWRMF INFLOW	0	0	0
Q - Liquid PPT on TWRMF	PPT on TWRMF	0	8,930	4,694
Q - Retained Water in Tailings Voids	Q - Retained Water in Tailings Voids	0	0	0
Q - TWRMF Supernatant	TWRMF Supernatant	18,308	109,987	22,978
Q27	TWRMF Decant	0	3,681	1,579
Q - Pit Dewatering	OPEN PIT DEWATERING	0	0	0
Q - Precipitation on Pit	Precipitation minus Sublimation on Open Pit	0	7,723	4,059
Q28	TOT. OPEN PIT DEWATERING	0	0	0
Q29	POLISHING POND INFLOW	0	3,681	1,579
Q - Precipitation on Polishing Pond	Precipitation minus Sublimation ON POLISHING POND	0	3,049	1,602
Q - Evaporation from Polishing Pond	EVAPORATION FROM POLISHING POND	0	1,355	1,063
Q30	POLISHING POND OUTFLOW	0	5,375	2,117
Q31	RECYCLE FROM FINAL POLISHING POND			
Q32	DISCHARGE PIPELINE			
Q33	DISCHARGE TO MINAGO			
Q34	MINAGO UPSTREAM			
Q35	MINAGO DOWNSTREAM			
Q36	DISCHARGE TO OAKLEY CREEK	0	5,375	2,117
Q37	OAKLEY CREEK UPSTREAM	0	345,600	43,200
Q38	OAKLEY CREEK DOWNSTREAM	0	350,975	45,317
FLOW RATIOS:				
Q33 / Q34	RATIO OF DISCHARGE TO MINAGO TO FLOW IN MINAGO	0%	0%	0%
Q36 / Q37	RATIO OF DISCHARGE TO OAKLEY CK TO FLOW IN OAKLEY CK	0%	2%	5%

Water balance models for all mine development phases were developed for three periods of the year: May; June to October; and November to April. These periods were chosen to represent average conditions during the freshet, summer, and winter. Contaminant loadings and estimated elemental concentrations in the various flows of the Minago water balance model, presented below, were compared to Manitoba Water Quality Standards, Objectives and Guidelines (Williamson, 2002) (Tier II and Tier III Freshwater Quality). Estimated elemental concentrations are also listed against the Canadian Guidelines for the Protection of Aquatic Life (CCME, 2007) and Metal Mining Effluent Regulations (Environment Canada, 2002a). Parametric concentrations were estimated for aluminum (Al), antimony (Sb), arsenic (As), cadmium (Cd), chromium (Cr), cobalt (Co), copper (Cu), iron (Fe), lead (Pb), molybdenum (Mo), nickel (Ni), selenium (Se), and zinc (Zn).

Water balance results are listed in terms of applicable equations to determine the guideline limits based on hardness as well as for a hardness of 150 mg/L as $CaCO_3$. The hardness level of 150 mg/L $CaCO_3$ was chosen as comparison for results obtained with the Minago water balance model based on water quality results obtained to date. The average hardness was 192.2 mg/L $CaCO_3$, the median hardness was 193 mg/L $CaCO_3$, and the weighted average hardness was 173.1 mg/L $CaCO_3$.

Table 10-2 Projected Concentrations in Flows around the Minago Site during Post Closure

SCENARIO:			Year 13 - POST CLOSURE			REGULATIONS				
			Tailings only; max.tailings leaching rate	Tailings only; max.tailings leaching rate	Tailings only; max.tailings leaching rate	(2002)		TIER II Water Quality Objectives		the Protection of Aquatic Life
		WATER QUALITY	NOVEMBER TO APRIL	MAY	JUNE TO OCTOBER	Monthly Mean	Grab Sample	assuming hardness = 150 mg/L $CaCO_3$	Freshwater	(CCME, 2007)
FLOW		PARAM.	(mg/L)	(mg/L)	(mg/L)					
Q30	POLISHING POND OUTFLOW	Al	0.000	0.119	0.114				0.005 - 0.1	0.005
Q30	POLISHING POND OUTFLOW	Sb	0.00000	0.00161	0.00222					
Q30	POLISHING POND OUTFLOW	As	0.000	0.005	0.006	0.5	1	0.15 mg/L (4-Day, 3-Year) [A]	Tier II	0.005
Q30	POLISHING POND OUTFLOW	Cd	0.00000	0.00060	0.00054			0.00302 [B]	Tier II	0.000017 or $10^{\{0.86[\log(hardness)]-3.2\}}$
Q30	POLISHING POND OUTFLOW	Cr	0.0000	0.0031	0.0040			0.10331 [C]	Tier II	
Q30	POLISHING POND OUTFLOW	Co	0.00000	0.00159	0.00191					
Q30	POLISHING POND OUTFLOW	Cu	0.0000	0.0180	0.0203	0.3	0.6	0.01266 [D]	Tier II	0.002
Q30	POLISHING POND OUTFLOW	Fe	0.000	0.118	0.131				0.3	0.3
Q30	POLISHING POND OUTFLOW	Pb	0.00000	0.01214	0.01107	0.2	0.4	0.0039 [E]	Tier II	0.001
Q30	POLISHING POND OUTFLOW	Mo	0.0000	0.0171	0.0224				0.073	
Q30	POLISHING POND OUTFLOW	Ni	0.000	0.072	0.087	0.5	1	0.07329 [F]	Tier II	0.025
Q30	POLISHING POND OUTFLOW	Se	0.0000	0.0029	0.0035				0.001	0.001
Q30	POLISHING POND OUTFLOW	Zn	0.000	0.063	0.062	0.5	1	0.16657 [G]	Tier II	0.03
Q35	MINAGO DOWNSTREAM	Al							0.005 - 0.1	0.005
Q35	MINAGO DOWNSTREAM	Sb								
Q35	MINAGO DOWNSTREAM	As				0.5	1	0.15 mg/L (4-Day, 3-Year) [A]	Tier II	0.005
Q35	MINAGO DOWNSTREAM	Cd						0.00302 [B]	Tier II	0.000017 or $10^{\{0.86[\log(hardness)]-3.2\}}$
Q35	MINAGO DOWNSTREAM	Cr						0.10331 [C]	Tier II	
Q35	MINAGO DOWNSTREAM	Co								
Q35	MINAGO DOWNSTREAM	Cu				0.3	0.6	0.01266 [D]	Tier II	0.002
Q35	MINAGO DOWNSTREAM	Fe							0.3	0.3
Q35	MINAGO DOWNSTREAM	Pb				0.2	0.4	0.0039 [E]	Tier II	0.001
Q35	MINAGO DOWNSTREAM	Mo							0.073	
Q35	MINAGO DOWNSTREAM	Ni				0.5	1	0.07329 [F]	Tier II	0.025
Q35	MINAGO DOWNSTREAM	Se							0.001	0.001
Q35	MINAGO DOWNSTREAM	Zn				0.5	1	0.16657 [G]	Tier II	0.03

Table 10-2 (Cont.'d) Projected Concentrations in Flows around the Minago Site during Post Closure

SCENARIO:			Year 13 - POST CLOSURE			REGULATIONS				
			Tailings only; max.tailings leaching rate	Tailings only; max.tailings leaching rate	Tailings only; max.tailings leaching rate	(2002)		TIER II Water Quality Objectives		the Protection of Aquatic Life
FLOW		WATER QUALITY PARAM.	NOVEMBER TO APRIL (mg/L)	MAY (mg/L)	JUNE TO OCTOBER (mg/L)	Monthly Mean	Grab Sample	assuming hardness = 150 mg/L $CaCO_3$	Freshwater	(CCME, 2007)
Q38	OAKLEY CREEK DOWNSTREAM	Al	0.0000	0.0044	0.0079				0.005 - 0.1	0.005
Q38	OAKLEY CREEK DOWNSTREAM	Sb	0.000000	0.000058	0.000136					
Q38	OAKLEY CREEK DOWNSTREAM	As	0.0000	0.0005	0.0006	0.5	1	0.15 mg/L (4-Day, 3-Year) [A]	Tier II	0.005
Q38	OAKLEY CREEK DOWNSTREAM	Cd	0.000000	0.000022	0.000037			0.00302 [B]	Tier II	0.000017 or $10^{\{0.86[\log(hardness)]-3.2\}}$
Q38	OAKLEY CREEK DOWNSTREAM	Cr	0.0000	0.0003	0.0005			0.10331 [C]	Tier II	
Q38	OAKLEY CREEK DOWNSTREAM	Co	0.0000	0.0001	0.0001					
Q38	OAKLEY CREEK DOWNSTREAM	Cu	0.0000	0.0004	0.0011	0.3	0.6	0.01266 [D]	Tier II	0.002
Q38	OAKLEY CREEK DOWNSTREAM	Fe	0.0000	0.0515	0.0542				0.3	0.3
Q38	OAKLEY CREEK DOWNSTREAM	Pb	0.0000	0.0002	0.0005	0.2	0.4	0.0039 [E]	Tier II	0.001
Q38	OAKLEY CREEK DOWNSTREAM	Mo	0.0000	0.0004	0.0011				0.073	
Q38	OAKLEY CREEK DOWNSTREAM	Ni	0.0000	0.0013	0.0043	0.5	1	0.07329 [F]	Tier II	0.025
Q38	OAKLEY CREEK DOWNSTREAM	Se	0.0000	0.0003	0.0004				0.001	0.001
Q38	OAKLEY CREEK DOWNSTREAM	Zn	0.0000	0.0016	0.0035	0.5	1	0.16657 [G]	Tier II	0.03

Notes:
August 2008 groundwater chemistry was assumed in the modeling.

A Arsenic limits: 0.15 mg/L for averaging duration 4 days (4-Day, 3-Year or 7Q10 Design Flow); 0.34 mg/L for averaging duration 1 hr (1-Day, 3-Year or 1Q10 Design Flow)

B Cadmium limit [e{0.7852[ln(Hardness)]-2.715}]×[1.101672-{ln(Hardness)(0.041838)}] for 4 days averaging duration.
[e{1.128[ln(Hardness)]-3.6867}]×[1.136672-{ln(Hardness)(0.041838)}] for 1 hour averaging duration.

C Chromium limi Chromium III: [e{0.8190[ln(Hardness)]+0.6848}]×[0.860] for 4 days averaging duration.
Chromium III: [e{0.8190[ln(Hardness)]+3.7256}]×[0.316] for 1 hour averaging duration.
Chromium VI: 0.011 mg/L for averaging duration 4 days (4-Day, 3-Year or 7Q10 Design Flow); 0.016 mg/L for averaging duration 1 hr (1-Day, 3-Year or 1Q10 Design Flow)

D Copper limits: [e{0.8545[ln(Hardness)]-1.702}]×[0.960] for 4 Days hour averaging duration.
[e{0.9422[ln(Hardness)]-1.700}]×[0.960] for 1 hour averaging duration.

E Lead limits: [e{1.273[ln(Hardness)]-4,705}]×[1.46203 -{ln(Hardness)(0.145712)}] for 4 Days averaging duration.
[e{1.273[ln(Hardness)]-1.460}]×[1.46203 -{ln(Hardness)(0.145712)}] for 1 hour averaging duration.

F Nickel limits: [e{0.8460[ln(Hardness)]+0.0584}]×[0.997] for 4 Days averaging duration.
[e{0.8460[ln(Hardness)]+2.255}]×[0.998] for 1 hour averaging duration.

G Zinc limits: [e{0.8473[ln(Hardness)]+0.884}]×[0.976] for 4 Days averaging duration.
[e{0.8473[ln(Hardness)]+0.884}]×[0.978] for 1 hour averaging duration.

11. POST-CLOSURE REVIEWS AND CONSULTATIONS

To meet MMER end of commercial operation notification requirements, Victory Nickel will notify MMER authorization officer in writing with respect to the closure no later than 90 days after the end of commercial operation. In addition to the MMER notification requirements, Victory Nickel will also meet the Chief Inspector's and other agencies' notification requirements.

A mechanism will be established to ensure that communication between government agencies, communities of interest and Victory Nickel is clear and consistent. In order to foster better communication, Victory Nickel will establish pre and post-closure review protocols. The objective of the pre and post-closure consultation will be to review the planned closure reclamation and decommissioning programs together with post-closure environmental monitoring, acid rock mitigation measures and maintenance programs. The issues to be discussed during the consultation process include but are not limited to the following:

- review compliance issues
- review post-closure effluent discharge criteria as per MMER and permit requirements
- review post-closure monitoring and reporting programs
- review decommissioning, closure and reclamation cost estimates
- review of permitting monitoring and reporting requirements
- review MMER monitoring and reporting requirements and
- termination/revision of various permits and licenses.

All post-closure work will be reviewed annually following implementation to assess the success of the remediation measures. Any trend indicating an adverse change in the projected environmental quality will trigger a review of management strategy, and changes will implemented as required. An annual report will be prepared to summarize the activities.

A three-year test/demonstration period is proposed after which Victory Nickel will prepare a final report summarizing all monitoring results, and assess the performance of the closure plan. A three-year demonstration period required under MMER for closed out mines will be part of the proposed ten year demonstration.

11.1 Ministry of Innovation, Energy and Mines

The Ministry of Innovation, Energy and Mines (IEM) will be updated on a regular basis about the progress of the post closure implementation.

11.2 Public and First Nations

The public and First Nations will be consulted when developing the Closure Plan and the implementation of the plan.

12. ENVIRONMENTAL AND SOCIOECONOMIC IMPACT ASSESSMENT OF CLOSURE

12.1 Air Quality

Air quality in the mine area will be affected mainly by fugitive dust from access roads, and to a lesser degree from haul roads, crushing and conveying systems.

As all mine components will be decommissioned and disturbed areas rehabilitated as such, it is anticipated that, there will be no long term air quality problems.

12.2 Surface Water

Surface water quality is expected to improve as there will be no additional disturbances and contaminants created. Discharge water quality will meet the MMER and the permit discharge criteria of the day.

12.3 Fisheries

Victory Nickel will ensure that the immediate aquatic habitat will not be adversely affected during and after closure.

12.4 Vegetation and Soils

It is anticipated that metal uptake in soils and vegetation will be reduced significantly, since there will be no additional pollutants discharged into the receiving environment. Aspects such as fugitive dust will be eliminated or reduced by the application of vegetative cover on various site components.

However, vegetation in reclaimed areas will require temporary maintenance; it is expected that these areas will become maintenance-free during the demonstration period.

12.5 Wildlife

Over time, decreased industrial and human activities and the enhancement of the
through recontouring and vegetative covers will bring wildlife population to the original levels.

12.6 Land Capability, Uses and Conditions

12.6.1 Land Use

The land will become undeveloped wilderness at the conclusion of the Project. Trapping and hunting capabilities are expected to improve after mine closure.

12.6.2 Land Capability

12.6.2.1 Forestry

Forest capability within the project area is poor. Presently, there are no economic stands of timber within the project area and it is expected to be the same after closure.

12.6.2.2 Industrial

Limited industrial activity will continue after mine closure. However, this will be limited in nature to remediation activities that will be required to ensure site discharges satisfy water quality criteria.

12.6.2.3 Agriculture

Presently, the site is not suitable for agricultural land uses and it is anticipated to remain the same at closure.

12.6.2.4 Heritage Resources

There are known archaeological sites within the project area and Victory Nickel will ensure that these sites are protected during the operational and closure phases.

12.7 Post-Closure Site Management and Schedule

The closure phase will commence with cessation of mining and milling activities. Once all mineable ore reserves have been processed, the mill and concentrator will be flushed out and the tailings facility will be put on a closure a wet closure mode. During the active decommissioning phase which is expected to last approximately 3 years, the number of personnel required will vary depending on site activities. However, during this period it is expected that all major decommissioning and reclamation tasks will be completed and the number of personnel will decline significantly. The anticipated personnel requirements are given in Table 13-12. Following the three year period will be the demonstration period scheduled to last three years (expected to occur in Years 4-6). The length of the demonstration period may vary depending on whether the decommissioning, closure and reclamation objectives are met at the time. The duration may be extended to ensure that the reclamation objectives are achieved.

The length of the demonstration period and the nature of site management and monitoring will be partially guided by the Certificate of Approval or other permit requirements, the performance of physical structures remaining on site and the ability to achieve and demonstrate fulfilment of long-term compliance requirements. Once overall closure performance has been demonstrated for all aspects of decommissioning, closure and reclamation, maintain licenses or permit requirements will be examined, and stakeholder communities will be consulted for their input.

12.7.1 Organization, Site Access and Security

A number of personnel will be required on site to implement the various decommissioning, closure and reclamation tasks. The tasks will entail closure of the pit and related components, decommissioning of the TWRMF, salvage and removal of infrastructure, equipment and reagents, removal of redundant access corridors and reclamation and re-vegetation of disturbed lands. The majority of these activities will be undertaken on a seasonal basis (May–October) and directed by the on-site person responsible for decommissioning and reclamation of the site. A portion of the camp will remain operational to accommodate site personnel.

During the initial closure stage, the site will continue to require security personnel and procedures; the caretaker will remain on-site following the seasonal closure of the site. Security personnel will be no longer be required once decommissioning activities have been completed on the property.

Prior to undertaking closure activities, as part of a comprehensive environmental site assessment, areas of suspected oil, chemical or other contaminant spills will be tested to confirm locations and extent of clean-up.

Victory Nickel plans to complete the majority of the closure works during the first three years following initiation of closure. During this period, the mine workings and other mine related appurtenances will be decommissioned. Closure measures related to the TWRMF will be limited in scope to the facility and related appurtenances. The tailings line from the mill to the TWRMF will be removed; tailings line from the TWRMF to the Settling Pond will be left in place until the end of the demonstration period.

The mill and infrastructure decommissioning will take place during the first three years following initiation of closure. The number of personnel will be reduced once decommissioning of these components is completed.

Some of the buildings may be left in place if the Communities of Interest (COI) so request, subject to satisfactory stewardship arrangements being made.

The main access road and property security gate will be maintained during the implementation of the closure phase. Access to the site will be required for personnel and truck haulage to and from the site.

Once decommissioning, closure and reclamation activities meet the respective objectives, the site will be declared as permanently closed.

12.7.1.1 Supervision and Documentation of Work

All decommissioning, closure and reclamation (DCR) works will be properly supervised and documented to ensure that works are planned and performed according to their design and that the work is properly carried out as per industry practice and legal requirements. The project manager or the construction supervisor will supervise all the closure works. Daily inspection protocols will be developed to ensure that construction is carried out in accordance with construction design specifications. The works will be conducted in accordance with the environmental, health and safety requirements at the time.

For the TWRMF, closure designs and construction plans for earthen works will be prepared and submitted to the Manitoba government and other COI for their review and approval prior to construction. A competent person following standard quality control and assurance procedures would also inspect and document the construction works. As-built plans and drawings will be completed and the results of the closure work will be reported in a final as-built report. The reports will be submitted to the Manitoba government upon completion of the construction program.

Upon completion of the DCR works, a final site plan report will be prepared to document the facilities remaining on site. The plan will detail the locations of buried concrete structures, scrap and landfill disposal areas.

12.7.2 Site Records

All DCR works will be documented. The open pit records will be retained by Victory Nickel and other records will be archived. Those records (plans or drawings) that are required for mine safety reasons will be submitted to the Mines Branch offices. As -built reports for structures completed for closure and the final site report will be retained for record and submitted to respective government agencies.

12.7.3 Compliance Monitoring and Reporting

Environmental, Health and Safety (EHS) compliance monitoring will be enforced and will be adjusted to address construction issues of concern. EHS inspections will be instituted to ensure that the work is undertaken as per legal requirements. The inspections will include but not be limited to the following aspects:

- Scheduled inspections of the TWRMF and other site components to monitor environmental performance;
- Scheduled water quality sampling and flow measurements of upstream and downstream creeks and rivers;
- Scheduled receiving environs monitoring programs for benthic invertebrates, stream sediments and fish to monitor downstream environmental quality;
- Scheduled instrumentation monitoring to assess the performance of physical structures such as tailings dams; and
  - Annual geotechnical inspection of the TWRMF, dikes and settling ponds for structural integrity;

During the demonstration period, it is expected that the frequency and the number of stations and parameters to be monitored will be reduced commensurate with the reduced activity. However, this is dependent on Victory Nickel demonstrating that the DCR objectives are being achieved.

It is important to note that it is not proposed that all monitoring will be completely ceased after the demonstration period. On the basis of the results from the monitoring program and discussion with the appropriate regulators during this period, the need for and the frequency of additional site monitoring will be determined at that time. If the results from the monitoring indicate that the site is stable with acceptable geotechnical and EHS performance, then it could be expected that Victory Nickel will propose to decrease the frequency. If the results from the monitoring program indicate that there are concerns with either geotechnical conditions or EHS concerns at the site, then the site will address the problems and/or develop an acceptable surveillance program.

Access to the property for closure monitoring will continue to be via the main access road as it will remain open. The main access road will be maintained by Victory Nickel during the closure phase and possibly during the demonstration period.

Company personnel responsible for the management of the Minago Project would continue to meet with regulatory agencies and the COI on an as needed basis to appraise interested parties of the decommissioning activities and results of post-closure monitoring.

It is expected that Victory Nickel will involve all the key communities of interest in reviewing the performance of the reclamation DCR programs and once the review is completed, the Company will lodge an application to the appropriate authorities to certify that the site is closed and it will no longer be responsible for the site. At that time, Victory Nickel will have fulfilled their closure obligations for the Minago Project.

13. DECOMMISSIONING, CLOSURE AND RECLAMATION SCHEDULE AND COST ESTIMATES

13.1 Decommissioning , Closure and Reclamation Schedule

The Decommissioning, Closure and Reclamation (DCR) schedule will depend on a number of factors including: redundancy nature of the component(s), future use of the component, EHS considerations and cost effectiveness. Table 13-1 gives DCR projections for the closure implementation stage (1 to 3 years following closure) and demonstration period (4 to 6 years following closure implementation stage). It is important to note that once the closure is declared, Victory Nickel will develop a detailed closure plan complete with revised cost estimates and time schedule. The revised DCR plan will be the basis for final closure implementation and setting out the components for the demonstration period.

Table 13-1 Minago Project DCR Schedule

Component or Program	Closure Implementation Stage (Years 1 to 3 Following Closure)	Demonstration Period (Three years Following Closure Implementation Stage): Years 4 to 6
Site Access Corridors that are Redundant	Will be decommissioned and reclaimed during this stage	Performance monitoring will be undertaken
Industrial Area Complex (Mill, Frac Sand, Warehouse, Maintenance Shop, etc.)	Will be decommissioned and removed during this stage	Performance monitoring will be undertaken
Main Access Road	Access road will be blocked to restrict entry.	Access road will be blocked to restrict entry. However, the Access Road may not be completely deactivated if the COI would like to use it in the future and therefore, stewardship will be transferred to COI
Open Pit Mine	Pit will be decommissioned and flooded	Performance monitoring will be undertaken to determine the water quality and discharge points
Co-Disposal Site (TWRMF and Ultramafic Waste Rock)	Will be decommissioned and closed out with a water cover	Will remain to be a water retention dam to provide a wet cover to mitigate ARD. Performance monitoring will be performed during this stage
Personnel Camp	Partial	Limited camp buildings will be left
Water Discharge Line to the Minago Project	Will be deactivated	Water discharge line will be decommissioned and the line removed. The line bed will be blocked to prevent entry
Polishing Pond	Depending on TWRMF water quality the Polishing Pond will be decommissioned and reclaimed during this phase	Performance monitoring will not be required during this period

Component or Program	Closure Implementation Stage (Years 1 to 3 Following Closure)	Demonstration Period (Three years Following Closure Implementation Stage): Years 4 to 6
Oakley Creek	Monitor surface water upstream and downstream of the Oakley Creek watershed	Monitor surface water upstream and downstream of the Oakley Creek watershed
Minago River	Discharge to the Minago River will be staged to allow smooth transition to pre-development base flows. Water quality will be monitored to determine recovery after closure	Monitor water quality to determine the degree of recovery after closure
William River downstream of Oakley Creek	Monitor impacts (if any) and degree of recovery	Monitor impacts (if any) and degree of recovery
Industrial Area – Contaminated Sites	Undertake an assessment and remediation programs	Monitor to determine performance of remediation measures
Hydro Sub Stations	Decommission and leave adequate capacity for the closure implementation period, demonstration period and beyond, if needed	Assess future power requirements
Pit Dewatering Wells	Decommission the Pit Dewatering Wells and remove their appurtenances	Decommission the Pit Dewatering Wells and remove their appurtenances
Waste Rock - Dolomite Waste Rock Dump	Where practical, plant green alder seedlings	Monitor the performance of the revegetated areas of the dump
Waste Rock - Country Rock Dump	Where practical, plant green alder seedlings	Monitor the performance of the revegetated areas of the dump
Overburden Dump	Where practical, plan green alder seedlings	Monitor the performance of the revegetated areas of the dump
Runoff Collection Systems	The site ditches will be left in place	The ditches will be left in place and will be monitored accordingly
Equipment	Set aside reclamation assets and disposed of non reclamation assets	Continue to market non-reclamation assets and assess equipment needs for post-demonstration period, if required.

Component or Program	Closure Implementation Stage (Years 1 to 3 Following Closure)	Demonstration Period (Three years Following Closure Implementation Stage): Years 4 to 6
Water Supply Systems	To be decommissioned, if not required	To be decommissioned if not already done so
Reclamation Maintenance	Assess requirements for reclamation maintenance	Assess requirements for reclamation maintenance
Decommissioning, Closure and Reclamation (DCR) Cost Estimates	Continue to review the DCR cost estimates	Continue to review the DCR cost estimates
Monitoring Programs	Update monitoring programs to reflect prevailing environmental constraints	Update monitoring programs to reflect prevailing environmental constraints
Comprehensive DCR Performance	Plan for a comprehensive DCR performance assessment	Undertake DCR performance assessment. Obtain Certificate of Closure if all requirements are met or exceeded

13.2 Reclamation and Decommissioning Cost Estimates

13.3 Closure Cost Estimates

The costs of site rehabilitation have been developed using of market prices for similar work recently completed or quoted on other sites. Using rates for the demolition of buildings solicited from local contractors, typical demolition unit rates were evaluated. For the Minago Project, unit rates between $10 and $30 per square metre for demolition were used. Other unit rates for associated work were also solicited from Contractors with experience on similar projects. Tables 13-3 to 13-8 summarizes the reclamation, decommissioning, monitoring, closure and post-closure costs.

Site decommissioning, closure and reclamation personnel requirements are given below in Table 13-2.

The demolition costs have been estimated assuming that salvaged material is the property of the contractor after the removal of process equipment.

Table 13-2 Site Decommissioning, Closure and Reclamation Personnel Requirements (Seasonal and Permanent)

Personnel	Post-Closure Year 1	Post-Closure Year 2	Post-Closure Year 3	Long Term Care and Maintenance: Years 4 to 6
Seasonal				
Project Manager	1	1	1	-
Construction Supervisor	1	1	1	-
Equipment Operators	6	2	2	-
Equipment Mechanics/Welders/Electricians	3	2	1	-
General Labourers	4	2	1	-
Catering Staff	2	1	1	-
Total Seasonal	17	9	7	
Semi - Permanent				
Environmental Coordinator/Monitor/Technician	2	2	2	2
Off Season Site Security/Caretaker	1	1	1	
Total Permanent	3	3	3	2

Note: Although some of the above personnel will be Victory Nickel Staff, the Closure costing presented in this report reflects costs for third party contractors.
Seasonal: May to October of each year (Six months – 10 hr Shifts)

Table 13-3 Estimated Closure Costs for the TWRMF

	Description	Cost
1	**Tailing Management System**	
1.1	**Construct Spillway Exit Channel to the Pond**	
	Supply and Place Geotextile	$8,000
	Supply and Place Riprap	$11,550
	Design of Spillway and Channel	$11,500
	Construct Spillway Exit	$14,800
	Site Supervision of Spillway and	$-
	Channel	$6,400
	Sub Total	**$52,250**
1.2	**Tailings Pipeline (4 km)**	
	Remove Pipeline from mill to TWRMF	$40,530
	Seeding and Fertilizer Application	$4,240
	Sub Total	**$44,770**
1.3	**Pipeline to Minago River**	
	Remove Pipeline(10 km)	$98,440
	Seeding and Fertilizer Application	$7,950
	Sub Total	**$106,390**
	Estimates Closure Costs for the TWRMF	**$203,410**

Table 13-4 Estimated Demolition Costs for Site Buildings

	Description	Cost
2.1	Concentrator Building	$243,000
2.2	229 kV Substation &Switch Yard - Pre-Engineered Prefab Type 1 Building	$840
2.3	Fire Pumphouse Building Prefab Type 2	$560
2.4	Site Fuelling Pump House Prefab Type 2	$560
2.5	Tailings Water Pumphouse - Prefab Type 2	$560
2.6	Modular Accommodations/Dry/ Laundry/Kitchen Type 3 Fabric Portable	$184,960
2.7	Explosive Plant and Magazine (Belongs to the Explosive Contractor)	$0-
2.8	Frac Sand Process Building Prefab Type 2	$108,000
2.9	Truck Unloading Building Prefab Type 2	$4,875
2.1	Frac Sand Vehicle Building - Type 2	$6,875
2.11	Frac Sand Rail Loadout - Type 1	$9,375
2.12	Process Water Pumphouse Type 2	$1,060
2.13	Fresh Water Pumphouse Type 2	$1,060
2.14	Crusher Building Type 4	$8,250
2.15	Emergency Services Building Type 2	$5,775
2.16	Unheated Warehouse Type 2	$23,675
2.17	Core Shack Type 1	$4,650
2.18	General Maintenance Building Type 3	$243,000
2.19	Miscellaneous Buildings	$2,170
2.2	Removal of Contaminated Debris for Disposal	$100,000
	Estimated Demolition Costs for Site Buildings	**$949,245**

Table 13-5 Estimated Costs for Miscellaneous Site Components

	Description	Cost
3.1	**Sub Stations, Genset and Power Lines**	
	Remove salvageable equipment	$17,850
	Salvage and remove powerline and poles	$25,000
	Dismantle Building – Manpower	$11,680
	Dismantle Building – Equipment	$7,440
	Concrete Demolition	$7,440
	Reslope, contour and bury	$5,400
	Misc. Supplies & Tools	$1,500
	Scrap haul to landfill- Grand Rapids	$6,000
	Subtotal	**$82,310**
3.2	**Water Supply**	
	Remove salvageable equipment - pipeline/pumps	$4,600
	Remove pipeline	$38,600
	Subtotal	**$43,200**
3.3	**Industrial Reagents, Fuels & Waste**	
	Industrial Reagents	$25,000
	Waste Fuels	$20,000
	Hazardous Wastes	$20,000
	Subtotal	**$65,000**
3.4	**Fuel Storage Facilities and Site Remediation**	
	Site Wide Spill Clean Up and Removal of Fuel Storage Facilities	$100,000
	Subtotal	**$100,000**
3.5	**Demolition Overheads**	
	Supervision	$80,000
	Mob/Demob	$30,000
	Office/Admin Costs	$5,000
	Subtotal	**$115,000**
	Estimated Costs to Dismantle Structures and Services	**$405,510**

Table 13-6 Land Reclamation and Re-vegetation

	Description	Cost
4	**Land Reclamation and Re-vegetation**	
4.1	**Industrial Area**	
	Stabilize Slopes - Erosion Barrier (Est)	$6,000
	Revegetate - fertilize (4.2 ha)	$5,565
	Mulch Application	$6,000
	Subtotal	**$17,565**
4.2	**Service and Haul Roads within the Project Area (40 ha)**	
	Road Barriers/Gates	$15,000
	Scarify	$14,080
	stabilize slopes - erosion barriers	$50,000
	Revegetate - fertilizer application	$53,000
	Application cost	$3,180
	Subtotal	**$135,260**
4.3	**Polishing Pond**	
	Revegetate - seed Fertilizer (Assume 20% of 75 ha - footprint) - application cost	$19,875
	Subtotal	**$19,875**
4.4	**Outer Slope of TWRSF(Est. 10.8 ha)**	
	Mulch Application	$16,200
	Seeding and Fertilizer Application	$14,310
	Subtotal	**$30,510**
4.5	**Disturbed Sites - Industrial Site, Refuse Areas, Borrow Areas (approximately 20 ha)**	
	Recountour refuse, borrow, industrial areas	$21,000
	Bury debris	$21,000
	Revegetate – seed/fertilizer application	$26,500
	Mulph application	$30,000
	Sub Total	**$99,700**
4.6	Country Rock Dump (301.40 ha) (Green Alders)	$301,400
	Mulch Application (Assume 25% of 301.4 ha)	$113,025
	Subtotal	**$414,425**
4.7	Overburden Dump (25% of 300 ha)	$75,000
	Subtotal	**$75,000**
4.8	Landfill Reclamation	$30,000
	Subtotal	**$30,000**
	Estimated Cost in Land Reclamation	**$822,335**

Table 13-7 Estimated Costs for Post-Closure Site Management Protection Programs

	Description	Cost
5	**Post-Closure Site Management**	
5.1	**Organization, Security and Overhead Costs**	
	Pre-closure planning and Org	$52,800
	Project manager	$105,600
	Camp cost	$354,090
	Construction Supervision, Operators, Mechanics, General Labour and Catering Staff	$1,782,000
	Pre-closure site environmental assessment	$100,000
	Post-closure environmental	
	clean-up Confirmation	
	Assessment	$100,000
	vehicles for security, environmental Group	
	and manager	$288,000
	miscellaneous office/supply/	
	miscellaneous costs	$120,000
	Subtotal	**$2,902,490**
5.2	**Supervision and Documentation of Work**	
	Site Environmental monitoring, documentation, reviews and close-out	$567,600
5.3	**Compliance Monitoring and Reporting**	
	Water Quality Monitoring (WQM	$180,000
	WQM – Helicopter	$60,000
	WQM – Post Closure	$75,000
	Post Closure - Helicopter	$75,000
	Geotechnical Inspections (PC)	$90,000
	Geotechnical Inspections (DCI)	$90,000
	Biological Monitoring (BM)	$60,000
	Lab Analysis (BM)	$75,000
	Professional Fees	$60,000
	Lab Analysis (CI)	$150,000
	Compliance with Environmental Monitoring	$150,000
	Subtotal	**$1,065,000**

Table 13-7 Land Reclamation and Revegetation (cont'd)		
5.4	**Post Closure Maintenance**	
	Post Closure Maintenance	$45,000
	Subtotal	**$45,000**
5.5	**Water Management**	
	Clean-up of Contaminants of Concern	$300,000
	Subtotal	**$300,000**
	Estimated Cost for Post Closure Site Management	**$4,880,090**

Overall closure costs are summarized in Table 13-8.

Table 13-8 Closure Cost Summary

Component	Cost
Estimated cost for TWRMF closure	$203,410
Estimated demolition costs for site buildings	$949,245
Estimated costs for closure of miscellaneous site components	$405,510
Estimated costs for land reclamation	$822,335
Estimated costs for post closure site management & environmental protection	$4,8800,090
Total	**$7,260,590**

13.4 Financial Assurance

Manitoba Mine Closure Regulation 67/99 requires that financial assurance be provided for the anticipated reclamation costs. On the basis of the "Recommended Schedule" of annual amounts to be provided for the closure cost of $7,260, 590, the annual instalments are calculated and are given in Table 13-9. Victory Nickel will negotiate the required financial assurance with the MB Government at the appropriate time.

Table 13-9 Annual Financial Assurance Installments for the Minago Project – 8 Year Mine Life

	Year							
	1	2	3	4	5	6	7	8
Annual Amounts to be Paid Per $1 of Financial Assurance	0	0.028	0.03	0.102	0.173	0.3	0.367	0
Financial Assurance	$ 7,260,590.00	$ 7,260,590.00	$ 7,260,590.00	$ 7,260,590.00	$ 7,260,590.00	$ 7,260,590.00	$ 7,260,590.00	$ 7,260,590.00
Annual Installments	$ -	$ 203,296.52	$ 217,817.70	$ 740,580.18	$ 1,256,082.07	$ 2,178,177.00	$ 2,664,636.53	$ -
Total			$ 7,260,590.00					

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