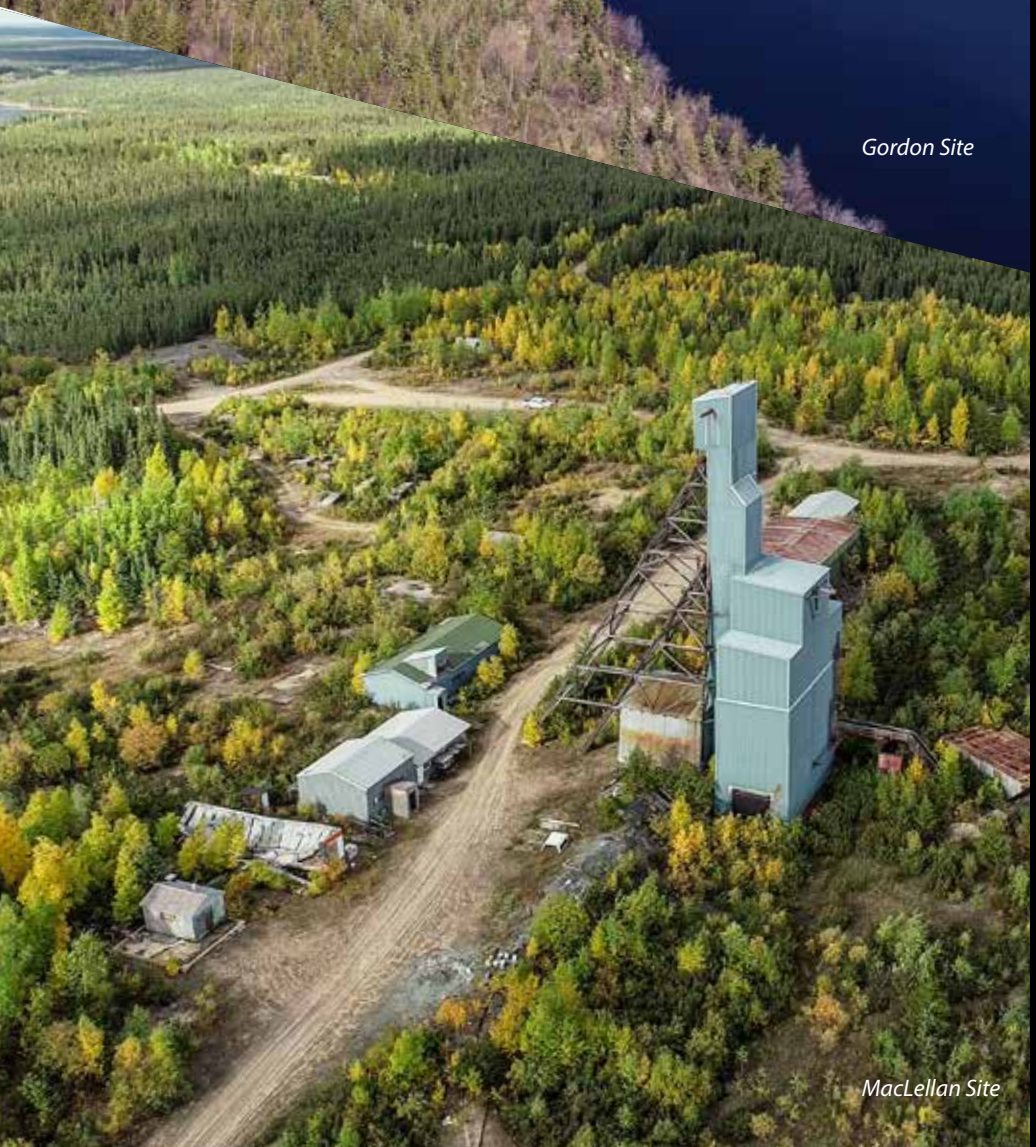

Gordon Site


MacLellan Site

LYNN LAKE GOLD PROJECT

ENVIRONMENTAL IMPACT STATEMENT

MAY 2020

VOLUME 3:

EIS

ALAMOS GOLD INC.

Stantec

ALAMOS GOLD INC.

Lynn Lake Gold Project Environmental Impact Statement Chapter 20 - Summary of Potential Effects, Mitigation and Residual Effects

Stantec

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May 25, 2020

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LIST OF APPENDICES

Acronyms and Abbreviations

AAQC	ambient air quality criteria
BMP	best management practices
CWQG-FAL	Canadian Water Quality Guidelines – Freshwater Aquatic Life
CEMI	Centre for Excellence in Mining Innovation
DARD	Department of Agriculture and Resource Development
DIDO	drive-in-drive-out
ECCC	Environment and Climate Change Canada
EIS	environmental impact statement
EMS	emergency medical services
EPCM	Engineering, Procurement and Construction Management
EPP	environmental protection plan
FDAV	forest damage appraisal and valuation
FIFO	fly-in-fly-out
FTA	Federal Transit Administration
GCDWQ	Guidelines for Canadian Drinking Water Quality
GW3	Ontario Ministry of Environment Aquatic Protection Criteria
HCN	hydrogen cyanide
HCRPP	Heritage and Cultural Resource Protection Plan
HRB	Heritage Resources Branch
HRIA	heritage resource impact assessment
in/s	inches per second
kg	kilograms
km	kilometre

km/h	kilometers per hour
LAA	local assessment area
m	metre
MCC	Manitoba Conservation and Climate
MDMER	Metal and Diamond Mining Effluent Regulations
MHSAL	Manitoba Health Seniors and Active Living
mm	millimeter
ms	milliseconds
mm/s	millimetres per second
MSD	Manitoba Sustainable Development (now Manitoba Conservation and Climate)
MWQSOG	Manitoba Water Quality Standards Objectives and Guidelines
MRSA	mine rock storage area
NRHA	Northern Regional Health Authority
PDA	Project Development Area
PM	particulate matter
PR	provincial road
RAA	regional assessment area
RAP	restricted activity period
ROW	right-of-way
SO^2	sulphur dioxide
SOCC	Species of Conservation Concern
TDR	technical data report
TMF	tailings management facility
TMR	technical modelling report

TRLU	traditional resources and land use
TSP	total suspended particles
VC	valued component
VdB	vibration velocity in decibel scale
WRAP	Western Regional Air Partnership

20.0 SUMMARY OF POTENTIAL EFFECTS, MITIGATION AND RESIDUAL EFFECTS

This chapter provides a summary of potential environmental effects, mitigation and residual effects associated with all phases of the Project. It also provides a summary of potential cumulative effects, a summary of the effects of the environment on the Project (Chapter 21), and a summary of potential accidents and malfunctions (Chapter 22).

20.1 SUMMARY OF CHANGES TO THE ENVIRONMENT, POTENTIAL EFFECTS, MITIGATION AND RESIDUAL EFFECTS

Chapters 6 to 19 of the EIS provide an assessment of Project-related effects by valued components (VCs). The assessment included:

- A description of potential Project environmental effects and pathways.
- The identification of mitigation measures to avoid or reduce potential environmental effects.
- The characterization of residual Project environmental effects after mitigation.
- The assessment of potential cumulative environmental effects.
- The determination of the significance of Project residual environmental effects and cumulative effects.

Table 20A-1 presents a summary of potential environmental effects, residual environmental effects, and their significance by VC (Appendix 20A) for routine Project-related effects during all Project phases. Beneficial effects are also summarized in the table. The summary table further indicates which VCs are considered 'environmental effects' under areas of federal jurisdiction (as defined in section 5 of CEAA 2012).

Under section 5(1)(a) of CEAA 2012, an EA is required to consider changes that may be caused to the following components of the environment that are within federal jurisdiction (i.e., within the legislative authority of Parliament):

i. fish, as defined in section 2 of the *Fisheries Act;*

ii. aquatic species, as defined in section 2(1) of *Species at Risk Act*; and

iii. migratory birds, as defined in section 2(1) of the *Migratory Birds Convention Act*.

An assessment for these components is provided in Chapter 10 (Fish and Fish Habitat), Chapter 11 (Vegetation and Wetlands), and Chapter 12 (Wildlife and Wildlife Habitat).

Under section 5(1)(b) of CEAA 2012, an EA is required to consider changes that may be caused to the environment that would occur on federal lands, in another province, or outside of Canada. Project activities

and components described within the scope of this EIS are not expected to result in changes to the environment that would occur on federal lands in another province, or outside of Canada. The nearest parcel of federal land is associated with Black Sturgeon Reserve, approximately 2.8 km west of the nearest point of the Gordon site access road.

Under section 5(1)(c) of CEAA 2012, environmental effects that are to be taken into account in relation to a designated project are, with respect to Indigenous peoples, an effect occurring in Canada of any change that may be caused to the environment on:

- Health and socio-economic conditions
- Physical and cultural heritage
- Current use of lands and resources for traditional purposes
- Any structure, site, or thing that is of historical, archaeological, paleontological, or architectural significance.

An assessment for these components is provided in Chapter 13 (Labour and Economy), Chapter 14 (Community Services, Infrastructure, and Wellbeing), Chapter 15 (Land and Resource Use), Chapter 16 (Heritage Resources), Chapter 17 (Current Use of Lands and Resources for Traditional Purposes by Indigenous Peoples), Chapter 18 (Human Health), and examined in detail in Chapter 19 (Indigenous Peoples).

Under section 5(2)(a) of CEAA 2012, an EA is required to consider additional changes that may be caused to the environment and that are directly linked or necessarily incidental to a federal authority's exercise of a power or performance of a duty or function that would permit the carrying out, in whole or in part, of the designated project.

The primary federal regulatory approvals necessary to conduct the Project include a *Fisheries Act* authorization for work that may result in serious harm to fish (Chapter 10), an application for works affecting or interfering with navigable waterways under the *Canadian Navigable Waters Act* (Chapter 15), a license certificate or permit for working with explosives under the *Explosives Act*, and for transporting and handling dangerous goods and hazardous materials under the *Transportation of Dangerous Goods Act* (Chapter 1). The Project is not anticipated to require an amendment to Schedule 2 of the *Metal and Diamond Mining Effluent Regulations* (MDMER) for the deposition of tailings into water frequented by fish. Following discussions with DFO and ECCC in September 2016, the preliminary TMF design was revised to avoid the potential deposition of mine rock or mine tailings into watercourses or waterbodies frequented by fish.

An assessment of these components further to section 5(2)(a) of CEAA 2012 is provided in Chapters 1, 6, 7, 8, 9, 10, 11, 12, and 15.

Under section 5(2)(b) of CEAA 2012, an EA is also required to consider the effects of changes to the environment that are directly linked or necessarily incidental to a federal authority's exercise of a power or performance of a duty or function that would permit the carrying out, in whole or in part, of the designated

project (other than those addressed in the context of section 5 (1)(c) related to Indigenous people) if any of the following are affected:

- Health and socio-economic conditions
- Physical and cultural heritage
- Any structure, site or thing that is of historical, archaeological, paleontological, or architectural significance.

An assessment of these components is provided in Chapter 13 (Labour and Economy), Chapter 14 (Community Services, Infrastructure and Well-being), Chapter 16 (Heritage Resources), and Chapter 18 (Human Health).

The changes to the environment that are linked to federal decisions on the Project include those related to the *Fisheries Act* (Chapter 10), *Canadian Navigable Waters Act* (Chapter 15) with potential changes to socio-economic conditions listed above. These changes are in addition to those addressed in section 5(1)(c) which are discussed in Chapter 19.

20.1.1 Summary of Residual Effects

Project residual effects were determined for 14 VCs including: atmospheric environment, acoustic environment, groundwater, surface water, fish and fish habitat, vegetation and wetlands, wildlife and wildlife habitat, labour and economy, community services, infrastructure and well-being, land and resource use, heritage resources, current use of lands and resources for traditional purposes, human health, and Indigenous peoples. The summary of this assessment is included in Table 20A-1, Appendix A1.

Based on the results of the environmental assessment, including implementing the identified mitigation measures, the Project as planned will not result in significant adverse residual environmental effects.

20.1.2 Summary of Cumulative Effects

The Project residual effects, as described in Chapters 6 to 19, may interact cumulatively with residual environmental effects from other physical activities (past, present, and future reasonably foreseeable). The assessment of cumulative effects is initiated with a determination of whether two conditions exist:

- The Project has residual environmental effects on the VC, and
- The residual effects could act cumulatively with residual effects of other past, present, or reasonably foreseeable future physical activities.

Past and present physical activities include mineral development, mineral exploration, water and waste projects, residential and community development, infrastructure development, traditional land and resource use, and recreation activities.

Taking into account the findings of the environmental assessment, including implementing the identified mitigation measures, it has been concluded that the Project as planned will not result in significant adverse cumulative effects.

20.1.3 Summary of Effects of the Environment on the Project

Chapter 21 describes potential effects of the environment on the Project. The Project is being designed and engineered in consideration of environmental conditions, including climate, climate change, geologic hazards (seismic activity, erosion, landslides and subsidence), and forest fires by applying industry standards and best management practices, and implementing appropriate operational procedures and mitigation measures.

There are no environmental attributes that, during the Project, are anticipated to have the potential to result in:

- A substantial change to the Project construction schedule (e.g., a delay resulting in the construction period being extended by a construction season).
- A substantial change to the Project operation schedule (e.g., an interruption in servicing such that annual production targets cannot be met).
- Substantial damage to the Project infrastructure resulting in increased safety risk.
- Substantial damage to the Project infrastructure resulting in repairs that could not be technically or economically implemented.

Therefore, the residual effects of the environment on the Project during construction, operation, and decommissioning of the Project are likely to be not significant.

20.1.4 Summary of Potential Accidents and Malfunctions

Chapter 22 describes potential environmental effects associated with Project-related accidents and malfunctions. In the unlikely event of a major industrial accident or malfunction involving a large-scale release into the environment (e.g., major TMF failure with discharges of tailings into local waterbodies and other habitats outside the PDA, or spill from vehicle malfunction or collision into a waterbody), there is a potential for significant residual adverse effects to surface water and fish and fish habitat. Chapter 9, Section 9.1.6 and Chapter 10, Section 10.1.6 contain significance definitions. In the event of a TMF failure, it is anticipated that surface water quality would result in a measurable change such that water quality guidelines are exceeded to an extent that toxicological effects to fish and aquatic life are expected to occur at the community or population level. A significant effect may also occur in the unlikely event of major accident resulting in a loss of life (i.e., vehicle accident). However, mitigation and conformity with industry standards (e.g., dam design and monitoring and emergency response and contingency planning) make a significant effect unlikely to occur. This determination of significance has been made with a high level of confidence for the most commonly expected accidents and malfunctions such as small to medium sized spills contained within the confines of the mine facility and easily cleaned up. A moderate level of confidence has been

assigned for larger scale and far less likely events such as a TMF failure or tanker spill outside the confines of the mine. This lower level of confidence is based on the qualitative assessment of the fate and behavior associated with a major accident event and the many variables that would determine the ultimate scale and nature of the effects. Given this lower level of predictability, a worst-case assumption has been made in the determination of significance. The likelihood of a TMF dam failure, while understood to be extremely low, will be quantified during detailed Project design. Alamos will develop contingency planning and implement engineering and quality controls during the design, construction, and operational phases to mitigate adverse environmental effects. Alamos will design critical components of mine infrastructure to relevant design codes and criteria so that risk falls within acceptable ranges for lifecycle performance.

20.2 SUMMARY OF MITIGATION, MONITORING AND FOLLOW-UP COMMITMENTS

Table 20B-1 provides a summary of key mitigation measures and commitments made by the Proponent for each VC identified for the Project (Appendix 20B). Chapter 23 outlines the Environmental Management Program (EMP) Framework under which mitigation measures, environmental protection measures, and follow-up and monitoring commitments identified in the EIS will be implemented and managed.

Appendix 20A SUMMARY OF POTENTIAL ENVIRONMENTAL EFFECTS, RESIDUAL EFFECTS AND SIGNIFICANCE

Table 20A-1 Summary of Potential Environmental Effects, Residual Effects and Significance

Potential Effect	Mitigation Measures	Residual Effect	Area of Federal Jurisdiction CEAA, 2012	Project Activity	Residual Effects								Significance of Residual Effect
					Direction	Magnitude	Geographic Extent	Duration	Timing	Frequency	Reversibility	Ecological and Socio-economic Context	
Valued Component: Atmospheric Environment													
Change in Air Quality • Atmospheric dispersion of air emissions from Project equipment and activities during operation	**Construction and Operation** • Enclosure of the mill feed storage area and crushing plant conveyors and the fine ore stockpile to reduce fugitive dust emissions. Particulate emissions from the enclosed conveyors and fine ore stockpile are assumed negligible. • Use of dust collection/control systems (e.g., baghouse) at the primary crusher and the processing plant gold room to reduce particulate matter (PM) emissions. Use of a wet scrubber at the secondary crusher. The dust collection efficiencies of the dust collectors and wet scrubber are considered in the calculation for PM emissions. • Optimization of haul roads and infrastructure to reduce transportation and haul distances. • Optimization of the tailings management facility (TMF) to reduce the area of exposed dry surfaces to reduce the potential for windblown dust emissions. • Enclosed leaching and adsorption processes at the ore milling and processing plant to reduce fugitive hydrogen cyanide (HCN) emissions due to volatilization losses. • Limited concentration of wad-cyanide (after cyanide detoxification) in water discharge to the TMF to 10 mg/L to reduce fugitive HCN emissions from the TMF pond. • Engines and exhaust systems will be properly maintained to keep construction and mining equipment in good working condition. • The concentration of sulphur in diesel fuel shall not exceed 15 mg/kg, as per the Sulphur in Diesel Fuel Regulations (ECCC 2002) that came into effect in 2006 for on-road vehicles and in 2010 for off-road equipment. This sulphur concentration is used in the emissions quantification for the Project.	**Gordon Site** Maximum predicted 1-hour average nitrogen dioxide (NO_2), carbon monoxide (CO) and sulphur dioxide (SO_2) concentrations are greater than the ambient air quality criteria (AAQC) but these occurrences are only predicted to occur on the Project boundary, are limited to a maximum of two hours per year and are not near sensitive receptors. Maximum predicted 24-hour total suspended particles (TSP) and particulate matter (PM_{10}) concentrations are greater than the AAQC outside the Project Boundary due primarily to fugitive dust emissions, and therefore, an ambient air quality monitoring program will be implemented to monitor ambient TSP, PM_{10} and $PM_{2.5}$ concentrations during construction and operation. **MacLellan Site** Maximum predicted 1-hour average NO_2 concentrations are greater than the AAQC, but these occurrences are only predicted to occur on the Project Boundary, are limited to a maximum of one hour per year and are not near sensitive receptors. Maximum predicted 24-hour TSP and PM_{10} concentrations are greater than the AAQC outside the Project Boundary due primarily to fugitive dust emissions, and therefore, an ambient air quality monitoring program will be implemented to monitor ambient TSP, PM_{10} and $PM_{2.5}$ concentrations during construction and operation.	5(2)(a)	C	A	L	LAA	ST	A	IR	R	D	Not significant
				O	A	L/M/H	LAA	MT	A	IR	R	D	Not significant
				D	A	N	LAA	LT	A	IR	R	D	Not significant

Legend Key: Project Activity: C – Construction; O – Operation; D – Decommissioning; **Direction:** P – Positive; A – Adverse; **Magnitude:** N – Negligible; L – Low; M – Moderate; H – High; **Geographic Extent:** PDA – Project Development Area; LAA – Local Assessment Area; RAA – Regional Assessment Area; **Duration:** ST – Short-term; MT – Medium-term; LT – Long-term; **Timing:** A – Applicable; N/A – Not Applicable; **Frequency:** S – Single; IR – Irregular; R – Regular; C – Continuous; **Reversibility:** R – Reversible; I – Irreversible; **Ecological/Socio-economic Context:** D – Disturbed; U – Undisturbed; R – Resilient: NR – Not Resilient

Table 20A-1 Summary of Potential Environmental Effects, Residual Effects and Significance

Potential Effect	Mitigation Measures	Residual Effect	Area of Federal Jurisdiction CEAA, 2012	Project Activity	Residual Effects								Significance of Residual Effect
					Direction	Magnitude	Geographic Extent	Duration	Timing	Frequency	Reversibility	Ecological and Socio-economic Context	
Change in Air Quality continued	• Haul trucks and vehicle idling times will be reduced to the extent possible. • Cold starts will be limited to the extent possible. • On-site haul roads and access roads will be maintained in good condition, with regular inspections to monitor loose dust on the roads to reduce dust "track out" onto public roads. • During dry periods, water will be applied to haul roads and access roads to reduce dust emissions. The application of water will be limited to non-freezing temperatures to avoid icing that can present a safety hazard. Watering is most effective immediately after application, and repeated watering several times a day might be required, depending on surface and meteorological conditions. A 75% control efficiency due to watering is applied to the quantified PM emissions from haul roads and access roads for the Project based on the Western Regional Air Partnership Fugitive Dust Handbook (WRAP 2006). Chemical dust suppressants will be applied to haul roads as an alternative option to watering. While chemical dust suppressants can be more effective at controlling fugitive dust than watering, they are also more expensive and can have adverse effects. Therefore, chemical dust suppression will be applied on an as-needed basis during high wind conditions or if measured ambient PM concentrations are in exceedance of the Manitoba Ambient Air Quality Criteria and if an increase of watering is determined ineffective or unfeasible at the time. Examples of suppressants include chlorides, petroleum products, liquid polymer emulsions, and agglomerating chemicals. These suppressants, if required, will be applied, as per the manufacturer's recommendations, to preclude unintended environmental effects.	see above									

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					Direction	Magnitude	Geographic Extent	Duration	Timing	Frequency	Reversibility	Ecological and Socio-economic Context	
Change in Air Quality continued	• Haul truck speed on the on-site haul roads will be limited to 35 km/h (loaded) and 40 km/h (empty). Vehicle speed on the access roads will be limited to 40 km/h. • Track-out of material to PR 391 will be reduced by dust sweeping and truck wheel washing stations prior to entering onto PR 391. • Surfaces of topsoil and overburden stockpiles will be stabilized during extended periods between usage, by means of vegetating or covering the exposed surfaces.	see above											
Change in Atmospheric Greenhouse Gases (GHG) • GHG emissions from Project equipment and activities during construction and operation	• Mitigation measures associated with ambient air quality to reduce combustion emissions are also applicable to the mitigation of GHG emissions.	**Gordon Site** The Project GHG emissions during construction and operation represent a small contribution to provincial and national GHG emissions. On an annual basis, the Gordon site construction contributes approximately 0.11% and 0.003% to provincial and national GHG emission totals, respectively. The Gordon site operation contributes approximately 0.17% and 0.005% to the provincial and national emission totals, respectively. **MacLellan Site** The Project GHG emissions during construction and operation represent a small contribution to provincial and national GHG emissions. On an annual basis, the MacLellan site construction contributes approximately 0.44% and 0.013% to provincial and national GHG emission totals, respectively. The MacLellan site operation contributes approximately 0.32% and 0.01% to the provincial and national emission totals, respectively. Note: *Geographic extent during construction and operation is not applicable as the effect is determined at the provincial, national, and global scales. Geographic extent during decommissioning is not applicable because the effect is global.	**5(2)(a)**	**C**	**A**	**L**	**N/A***	**ST**	**N/A**	**C**	**I**	**D**	**Not significant**
				O	**A**	**L**	**N/A***	**MT**	**N/A**	**C**	**I**	**D**	**Not significant**
				D	**A**	**N**	**N/A***	**LT**	**N/A**	**IR**	**I**	**D**	**Not significant**

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					Direction	Magnitude	Geographic Extent	Duration	Timing	Frequency	Reversibility	Ecological and Socio-economic Context	
Valued Component: Nosie and Vibration													
Change in Noise Level • Noise emissions from Project equipment and activities, including pile driving, ore movement, and equipment operation	**Construction and Operation** • Where possible, large stationary machinery (i.e., crushers) will be located inside buildings. • Fully enclosed conveyor between buildings in processing plant. • Large transportation trucks will be used to reduce the number of trips. • Mobile equipment will have exhaust mufflers. • Work camp building walls and roof will be noise-insulated panels. • Work camp building will include air conditioning system such that double pane windows and insulated doors can be closed during the summer season. • Reduce heavy fleet idling when not operating, where practical.	**Gordon and MacLellan Sites** Noise effects from construction and operation of the Project will comply with the Health Canada Noise Guidance (Health Canada 2017).	5(2)(a)	C	A	L-M	RAA	ST	N/A	C	R	D	Not significant
				O	A	L-M	RAA	MT	N/A	C	R	D	
				D	A	L-M	RAA	ST	N/A	C	R	D	
Change in Vibration Level • Vibration from activities such as pile driving, compacting, and haul truck traffic • Blast-related ground-borne vibration and air overpressure	**Construction and Operation** • Highest explosive per time delay that do not exceed 207.9 kg • Only one hole/delay will be fired in the blast • Minimum time delay between holes in blasts will not be less than 8 milliseconds. • The reduced blast charge of 43 kg can be increased if the distance between the blast and closest receptor ID 76 and ID 73 is more than 1,430 m and 2,170 m (distance based on receptor location to pit boundary), respectively. • The reduced blast charge of 43 kg can be increased if monitoring results indicate air overpressure level below 120 dBL at ID 76 and ID 73. • Engagement with Marcel Colomb First Nation to discuss the potential of a seasonal mitigation approach, which relaxes the reduced blast charge of 43 kg during off-season period when trapping activities at receptors (ID 76 and ID 73) is not expected.	**Gordon and MacLellan Sites** Vibration effects from construction and operation of the Project will comply with the FTA vibration guidance.	5(2)(a)	C	A	N-L	LAA	ST	N/A	R	R	D	Not significant
				O	A	N-M	RAA	MT	N/A	R	R	D	
				D	A	N-L	LAA	ST	N/A	R	R	D	

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					Direction	Magnitude	Geographic Extent	Duration	Timing	Frequency	Reversibility	Ecological and Socio-economic Context	
Change in Vibration Level continued	Specific mitigation measures for the work camp with the MacLellan site are as follows: • The reduced blast charge of 85 kg can be implemented initially to achieve the overpressure level of 125 dBL at the work camp. • Reduced blast charge of 85 kg can be increased if monitoring results indicate air overpressure level below 125 dBL at work camp and there is no annoyance complaints. • Reduced blast charge of 85 kg can be increased if the distance between the blast work camp is more than 800 m. • Blasting will be scheduled during shift change (e.g. less worker sleeping and more local activities) to reduce potential annoyance at the work camp.	see above											
Valued Component: Groundwater													
Change in Groundwater Quantity and/or Flow • Project activities will result in changes in groundwater recharge and changes to groundwater levels and flow. A decrease in groundwater levels may result in loss of yield to dug or drilled wells, reducing their ability to meet water supply requirements. • As a pathway to surface water and wetlands, a decrease in groundwater levels and changes in the natural groundwater flow could affect discharge to nearby surface water bodies (assessed in Chapter 9) and water levels within wetlands (assessed in Chapter 11).	**Construction, Operation and Decommissioning/ Closure** • Limit construction footprint (i.e., PDA) to the extent possible to reduce the potential for reductions in groundwater recharge and limit the number of watersheds overprinted by the PDA. • Use standard management practices throughout the Project, including drainage control and excavation and open pit dewatering. • Intercept groundwater flowing into the open pit prior to discharge at the pit wall and return water generated from pumping groundwater interceptor wells to Gordon and Farley Lakes to offset a reduction in groundwater discharge. The groundwater interceptor wells are an integral part of the open pit dewatering strategy and are therefore included in the effects assessment as mitigation. • Install contact water and seepage collection ditches around the perimeter of the MRSA to mitigate the migration of seepage. • Use standard construction methods, such as seepage cutoff collars, where trenches extend below the water table to mitigate preferential flow paths.	**Note: * means Gordon site; ** means Maclellan site** **Gordon site*** The main adverse residual environmental effect on groundwater quantity and flow identified in this assessment is the lowering of the water table as a consequence of dewatering the open pit. This effect will be most notable during the construction and operation, and to a lesser extent during closure as the open pit fills and groundwater levels recover. At the Gordon and MacLellan sites, there are no known groundwater users located within the LAA/RAA. Groundwater discharge to surface water features will be affected by the dewatering of the open pit and the mounding of the water table in and around the TMF. Potential effects to surface water features and wetlands as a result of a reduction in groundwater discharge and/or levels are further assessed in Chapters 9 and 11, respectively. There are no known groundwater users within the area of drawdown in the LAA/RAA, and no new groundwater users will be permitted within the PDA, or within lands leased by Alamos within the LAA/RAA. **MacLellan Site**** As above.	√ **5(2)(a)**	**C***	**A**	**H**	**PDA & LAA/ RAA**	**MT**	**A**	**C**	**R**	**D**	**Not significant**
					C**	**A**	**H**	**PDA & LAA/ RAA**	**MT**	**A**	**C**	**R**	**D**	
					O*	**A**	**H**	**PDA & LAA/ RAA**	**MT**	**A**	**C**	**I**	**D**	
					O**	**A**	**L**	**PDA & LAA/ RAA**	**MT**	**A**	**C**	**I**	**D**	
					D	**A**	**L**	**LAA/ RAA**	**LT**	**A**	**C**	**I**	**D**	

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					Direction	Magnitude	Geographic Extent	Duration	Timing	Frequency	Reversibility	Ecological and Socio-economic Context	
Change in Groundwater Quantity and/or Flow continued	• Install contact water and seepage collection ditches around the perimeter of the mine rock storage area (MRSA) and TMF (at MacLellan) to mitigate the migration of seepage from this mine infrastructure. The seepage collection is an integral component of the MRSA and TMF design and are therefore included in the effects assessment as mitigation.	see above											
Change in Groundwater Quality • Changes in groundwater levels and flow direction and recharge or infiltration from the Project activities may alter groundwater quality in dug or drilled wells, reducing their ability to meet water supply requirements without treatment. • As a pathway to surface water and wetlands, recharge or infiltration from Project activities may result in changes to groundwater quality discharging to surface water.	**Construction, Operation and Decommissioning/ Closure** • Limit construction footprint (i.e., PDA) to the extent possible to reduce the potential for reductions in groundwater recharge and limit the number of watersheds overprinted by the PDA. • Intercept groundwater flowing into the open pit prior to discharge at the pit wall and return the water generated from pumping groundwater interceptor wells to Gordon and Farley lakes to offset a reduction in groundwater discharge • Design of the MRSA to increase the amount of runoff and reduce the amount of infiltration through the MRSA, thereby reducing the recharge and loading to groundwater. • Installation of contact water collection ditches around the overburden storage area, ore stockpile, and new MRSA to collect toe seepage and groundwater recharge from these Project components. • Installation of contact water collection ditches around the overburden storage area, ore stockpile, MRSA, and TMF to collect toe seepage and groundwater recharge from these Project components.	**Gordon and MacLellan sites** The main residual environmental effect on groundwater quality identified in this assessment is the increase in concentration of indicator parameters above the drinking water guidelines and/or GW3 along the groundwater flow path from the MRSAs and TMF to the ultimate receiver relative to baseline conditions. This effect will be most notable later in mine life and into closure because the predicted mean advective travel times of seepage from the Project components through the aquifer are generally decades to centuries. The effect is confined mainly to the PDA, with a portion of the groundwater flow paths from the MRSAs and TMF extending into the LAA/RAA. Typical in northern Manitoba, groundwater naturally exceeds a number of water quality objectives (e.g., hardness). For parameters with baseline concentrations that exceed the health-based standards specified in the GCDWQ or MWQSOG (drinking water), the determination of significance will be such that the quality of those parameters for an existing water supply well will not be further impaired by the Project. No groundwater users are known within the area of influence of Project components with the groundwater recharge from the MRSAs and TMF discharging to surface water. The effect of the groundwater quality discharging to surface water features is evaluated in Chapter 9.	**5(2)(a)**	**C**	**P**	**M**	**PDA & LAA/ RAA**	**ST**	**A**	**C**	**I**	**D**	**Not significant**
				O	**A**	**M**	**PDA & LAA/ RAA**	**LT**	**A**	**C**	**I**	**D**	
				D	**A**	**M**	**PDA & LAA/ RAA**	**LT**	**A**	**C**	**I**	**D**	

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Table 20A-1 Summary of Potential Environmental Effects, Residual Effects and Significance

Potential Effect	Mitigation Measures	Residual Effect	Area of Federal Jurisdiction CEAA, 2012	Project Activity	Residual Effects								Significance of Residual Effect
					Direction	Magnitude	Geographic Extent	Duration	Timing	Frequency	Reversibility	Ecological and Socio-economic Context	
Valued Component: Surface Water													
Change in Surface Water Quantity • Change in lake levels and stream flows due to diversion, extraction, storage, or discharge of surface water during development, operation, and closure of the open pits, TMF, MRSAs, and associated mine infrastructure.	**Construction, Operation and Decommissioning/Closure** • Reusing process water to the extent feasible between the TMF and the processing facility. • Constructing water management structures to collect, divert, and release non-contact water to the environment and to collect, store, and re-use contact water in the processing plant. • Limiting construction footprint (i.e., PDA) to the extent possible. • Grading perimeter and access roads of open pits to divert runoff away from the open pits to reduce contact water. • Maintaining access roads by periodically regrading and ditching to improve water flow. • Maintaining existing drainage patterns with the use of culverts. Inspection of culverts periodically to remove accumulated material and debris to avoid erosion, flooding, habitat damage, property damage, and mobilization of sediment. • Collecting runoff and groundwater seepage from underground/open pit dewatering, overburden, and ore stockpiles, TMF, and MRSAs. • Designing for collection, storage, and reuse of contact water (runoff and seepage), only discharging excess water after reuse and treatment, as necessary. • Balancing timing of recycling from sources to relieve storage pressures on contact water collection ponds. • Constructing perimeter runoff and contact water collection ditches to collect overland flow, toe seepage, and groundwater recharge, and to divert non-contact away from the Project components. • Intercepting groundwater flowing into the open pit thereby reducing volume of contact water and reducing the potential dewatering of Gordon and Farley lakes.	**Note: * means Gordon site; ** means MacLellan site** **Gordon Site*** At the Gordon site, high magnitude changes in water quantity are predicted due to changes in monthly streamflow exceeding 30% in several small watercourses within the PDA (QF01, QF02, QF03, QF05) and downstream in the LAA (QF07, QF08) during the construction and operation phases of the Project. Changes in these watercourses begin during the construction phase with the development of mine infrastructure within the PDA and the subsequent reduction in effective catchment area resulting in adverse changes in streamflow (i.e. flow reduction) at QF01 and QF02. It should be noted that these two creeks are ephemeral in nature and that the predicted flow changes are less than 10 L/s. The operation of the interceptor wells and dewatering of the legacy pits during the construction phase produces positive changes in streamflow (i.e. flow increases) at QF03, QF05, QF07, and QF08. These changes are anticipated to continue through operations and are also related to the interceptor wells and dewatering associated with the new pit. The timing of changes in streamflow is predicted to occur continuously during most months throughout the year, and ranges from low to high magnitude changes. Once mining is complete, the interceptor wells will cease operation and the open pit will be allowed to fill. During pit filling, flow changes in QF03, QF05, QF07, and QF08 range from negligible to moderate, with the magnitude varying by location and month. Once the open pit has filled, QF05 (Farley Creek) is anticipated to have negligible to moderate magnitude changes in average monthly streamflows and QF07 has negligible to low magnitude changes in winter. Mean annual flow changes are negligible at these locations. When the open fit has filled, changes to surface water quantity will become stable and irreversible, while changes in streamflow at QF01 and QF02 are stable and irreversible from the construction phase onwards. Changes in surface water quantity will not extend beyond the LAA as changes to mean annual discharge are negligible by QF05 (Farley Creek).	5(2)(a)	C*	A	H	LAA	ST	N/A^	C	R	D	Not significant
				C**	A	N	LAA	ST	N/A	C	R	D	
				O*	A	H	LAA	MT	N/A	C	R	D	
				O**	A	N	LAA	MT	N/A	C	R	D	
				D*	A	N	LAA	LT	N/A	C	I	D	
				D**	A	N	LAA	LT	N/A	C	I	D	

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Change in Surface Water Quantity continued	• Pumping excess water to collection ponds as needed. Design contact water collection ditches to convey the 1:25-year storm event and with positive gradients to limit standing water and maintain positive flow. • Designing contact-water collection ponds with active water storage that considers ice thickness during winter. • Designing collection pond inlets and outlets to reduce water velocities/ scour and meet sedimentation requirements. • Designing and operating the TMF with no discharge to the environment during operation through reclaiming and recycling surplus water from the TMF to meet mill demand during operation. • Refilling open pits with contact water at closure to return groundwater levels to near baseline conditions. • Implementing Project-specific environmental management and monitoring programs: Surface Water Monitoring and Management Plan, Groundwater Monitoring Plan, Wildlife Monitoring and Management Plan (which includes beaver activity management) and Conceptual Closure Plan.	Predicted changes in water quantity are associated with watercourses and waterbodies that have either previously been or potentially continue to be influenced by historical anthropogenic disturbance, including the historical Farley Lake Mine. **MacLellan Site**** At the MacLellan site, high magnitude changes in water quantity are predicted; changes in streamflow exceed 30% at KEE3-B1 (QM04) and the Minton Lake outlet (QM07) on a mean monthly basis. Changes at KEE3-B1 and the Minton Lake outlet begin during construction with the development of mine infrastructure within the PDA and the subsequent reduction in effective catchment area; these changes will continue through to decommissioning and closure. The timing of changes is predicted to occur continuously during most months throughout the year and are not expected to be affected by seasonal aspects. Changes generally cause a reduction of streamflow for each Phase, however once the open pit is filled overflow from the pit will cause streamflow at KEE3-B1 to increase. When the open fit has filled, changes to surface water quantity will become stable and irreversible. Changes in streamflow are anticipated to be contained to the LAA as the changes in streamflow is reduced to negligible at Cockeram Lake (QM08). Predicted changes in water quantity are associated with watercourses and waterbodies that have either previously been or potentially continue to be influenced by historical anthropogenic disturbance, including the historical MacLellan Mine. Project-induced changes to surface water quantity have the potential to cause adverse effects to fish through changes in fish habitat (see Chapter 10). **Note:** ^Most residual effects occur in most months, despite seasonal flows. There is no clear seasonal timing for residual effects.	see above								

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Change in Surface Water Quality • Change in surface water quality associated with any mine effluent releases or surface runoff during construction, operation, and closure of the open pits, TMFs, MRSAs, and associated mine infrastructure.	**Construction, Operation and Decommissioning/ Closure** **Additional measures beyond those already described for surface water quantity** **Gordon Site** • Design of water management facilities to collect and treat (as required) contact water such that effluent meets applicable federal and provincial regulatory requirements, including the authorized limits of deleterious substances specified in Schedule 4 of the MDMER (amended), prior to discharge to the environment. • Implementing fugitive dust measures such as frequent watering of haul and access roads as. • Transporting domestic waste to the sewage treatment plant at the MacLellan site. • Aerating Wendy and East pits to encourage precipitation of elements that form oxides (e.g., iron oxide) and to break down thermal stratification prior to dewatering. • Aerating groundwater from groundwater interceptor wells to encourage precipitation of elements that form oxides (e.g., iron oxide) and to increase dissolved oxygen concentrations prior to discharge to Gordon and Farley lakes. • Dust suppression measures for exposed ground areas of the PDA, to reduce atmospheric deposition to surface water. • Sediment and erosion control measures during construction to limit the release of TSS and turbidity. • Expediting re-filling of open pits during closure to reduce exposure of pit walls. • Treating and handling of building material that is used in water to avoid the release or leaching of substances that would reduce water quality.	**Note: * means Gordon site; ** means MacLellan site** **Gordon Site*** At the Gordon site, the magnitude of potential residual effects due to predicted fluoride and phosphorus concentrations are characterized as moderate. This is because predicted concentrations for fluoride and phosphorus exceed modelled baseline + 20% and the long-term guidelines for the protection of aquatic life but are not anticipated to have an adverse effect on aquatic biota in the receiving environment. Toxicity thresholds are further evaluated in the Fish and Fish Habitat assessment (Chapter 10). Generally, Project residual effects are predicted to be greatest in West Farley Lake and never extend downstream to Ellystan Lake. For fluoride, Project residual effects are identified in all phases and assessment nodes except Susan Lake and Ellystan Lake where fluoride was not identified as parameters of potential concern (POPC). The greatest magnitude guideline exceedance is predicted to be 1.6 times the CWQG-FAL and MWQSOG-FAL (0.012 mg/L) in West Farley Lake (construction) and East Farley Lake (operation). Project residual effects due to fluoride generally occur on a seasonal basis (during the winter months when flows and dilution capacity are reduced) in all phases. One exception is West Farley Lake, where elevated fluoride concentrations are predicted to occur for 11 months of the year in construction and operation. For phosphorus, Project residual effects were limited to only a single month in the construction phase (April, Year -2). This single residual effect is predicted to occur in West Farley Lake where baseline and the MWQSOG-FAL are exceeded by approximately 1.2 and 1.1 times, respectively. Because residual effects within the Gordon site LAA are dominated by fluoride (which is associated with seasonal residual effects), the timing is characterized as 'applicable'.	5(2)(a)	C*	A	M	LAA	MT	A	R	R	D	Not significant
				C**	A	L	LAA	MT	N/A	R	R	D	
				O*	A	M	LAA	MT	A	R	R	D	
				O**	A	L	LAA	MT	N/A	R	R	D	
				D*	A	M	LAA	LT	A	R	I	D	
				D**	A	M	LAA	LT	N/A	R	I	D	

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Change in Surface Water Quality continued.	**MacLellan Site** • Design of water management facilities to collect and treat (as required) surplus contact water such that effluent meets applicable federal and provincial regulatory requirements, including the authorized limits of deleterious substances specified in Schedule 4 of the MDMER (amended), prior to discharge to the environment. • Designing the TMF with two cells to allow progressive development during operations to reduce freshwater requirements. • Operating the TMF as a non-discharging facility during operation through decommissioning and active closure. • Recycling water between the TMF and the processing facility to the maximum extent possible during operations to reduce freshwater make-up requirements. • Implementing passive treatment options (e.g., controlled pit stratification, fertilizer amendment, flow segregation) in the open pit should monitoring show that pit water quality is not suitable for release to the environment during the approximately 20 years anticipated to fill the open pit with contact water at the conclusion of mine operations. • Using a closed circuit for cyanide use and cyanide destruction in the tailings processing plant (via Air/SO_2 oxidation and precipitation of metals) to reduce cyanide concentrations in tailings slurry prior to release of the slurry for storage in the TMF. • Constructing groundwater cut-off ditches to reduce groundwater seepage from the TMF reaching Minton Lake.	**MacLellan Site**** For the MacLellan site, the magnitude of residual effects are characterized as low in construction, operation, and active closure because predicted changes in water quality either do not exceed modelled baseline + 20%, or do not exceed water quality guidelines (i.e., no POPCs were identified for the construction, operation and active closure). However, the magnitude of potential residual effects due to total aluminum, total arsenic, total and dissolved cadmium, total copper, and fluoride are characterized as moderate during post-closure. This is because predicted concentrations of these parameters exceed modelled baseline + 20% and the long-term guidelines for the protection of aquatic life but are not expected to result in adverse effects on aquatic biota (evaluated in the Fish and Fish Habitat assessment; Chapter 10). Generally, Project residual effects for the above parameters occur at the KEE3-B1 tributary within the PDA, but some residual effects are also predicted to occur downstream in the Keewatin River at node QM06 (total aluminum) and in Minton Lake (total cadmium). The seasonal timing of Project residual effects within the MacLellan LAA depends on the POPC; residual effects due to aluminum and arsenic generally occur in all months of the year at KEE3-B1, whereas residual effects due to copper and fluoride generally occur in the winter months (November to April) due to reduced flows and dilution capacity. For total and dissolved cadmium, residual effects are predicted to be limited to only two single months in post-closure (both in April of Year 34 and Year 35). Because residual effects are predicted to occur in all months of the year (when all POPCs are combined), the seasonal timing of residual effects is characterized as ‘not applicable’.	see above								

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Change in Surface Water Quality continued	• Treating domestic waste in an average 60,000 L/day sewage treatment plant so that it meets "Wastewater Systems Effluent Regulations" under the Fisheries Act prior to discharge to the Keewatin River via a pipeline and diffuse. • Implementing Project-specific environmental management and monitoring plans: Surface Water Monitoring and Management Plan, Groundwater Monitoring Plan, Erosion and Sediment Control Plan, Waste Management Plan, Mine Rock Management Plan, Emergency Response and Spill Prevention and Contingency Plan, and Conceptual Closure Plan (see Chapter 23).	**Gordon and MacLellan sites** No residual effects are predicted at the most downstream assessment nodes within each LAA. The duration of potential residual effects to surface water quality is characterized as medium-term during construction and operation phases and long-term during closure at both sites due to the potential for concentrations of POPCs at each site to exceed modelled baseline + 20% and guidelines through construction, operations, and closure (aluminum only) and for multiple years beyond active closure (aluminum, arsenic, cadmium, copper and fluoride). The frequency of potential residual effects to surface water quality is characterized as a multiple regular event at both sites because many POPCs are predicted to be elevated during the same time of year during the same flow conditions. For this reason, the timing of residual effects to surface water quality are also characterized as not applicable. Reversibility of potential residual effects at both sites is characterized as irreversible because many POPCs are predicted to occur in post-closure and are not predicted to return to baseline concentrations within the time frame predicted by the water quality models. The ecological context for the potential residual effects at both sites is characterized as disturbed due to former mining operations at both sites. Predicted changes in water quality are associated with waterbodies that have either previously been or potentially continue to be influenced by historical anthropogenic activity.	see above								

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Valued Component: Fish and Fish Habitat													
Change in fish habitat • Change in physical habitat due to mine infrastructure • Altered lake levels and stream flow (timing, duration, volume) for surface water due to construction of water management facilities and pits	**Construction, Operation and Decommissioning/Closure** **Gordon and MacLellan sites** • Sizing new culverts to convey the 1;100- year flood and using open-bottom structures where practical to maintain fish habitat values and fish passage. • New road crossings will be sized and installed following Manitoba Infrastructure guidelines (DFO and MNR 1996). • Designing open pit outlets so they are impassable to fish, to discourage fish from colonizing open pits in post-closure. • Offsetting unavoidable habitat losses as described in the Fish Habitat Offsetting Plan (Chapter 23). • Limiting the construction footprint to the extent possible to reduce potential reductions in groundwater recharge, to limit the number of watercourses overprinted by the PDA, and to limit the number of extent of changes to catchment area runoff due to encroachment of the PDA into various watersheds. • Constructing upstream perimeter ditches to divert non-contact water around Project components, reporting to the original receiving environments. • Using standard construction methods such as seepage cutoff collars, where trenches extend below the water table, to mitigate preferential flow paths. • Collecting groundwater seepage from underground/open pit dewatering. • Pumping excess water to collection ponds as needed. • Maintaining existing drainage patterns to the extent possible with the use of culverts. • Refilling open pits with contact water at closure to return groundwater levels to near baseline conditions.	**Note: * means Gordon site; ** means MacLellan site** **Gordon site*** At the Gordon site, the magnitude of potential residual effects to fish and fish habitat was characterized as high due exclusively to the predicted increases of up to 375% in Farley Creek discharge during construction and operation. However, this potential residual effect would not extend spatially beyond the LAA and the high magnitude effect would not extend temporally beyond operations (i.e., medium-term). This residual effect would occur continuously throughout construction, operation, and closure phase (although the magnitude of the effect would be low during the closure phase) and would have potential timing implications for fish species using Farley Creek for spawning, such as northern pike and white suckers. Importantly, this residual effect would be reversible because flows in Farley Creek would return to near baseline flows in post-closure. The magnitude of potential residual effects to fish and fish habitat due to potential increases in water levels in Gordon and Farley lakes were characterized as low because of the predicted changes are within the range of natural variability in these lakes which are continually affected by beaver activity. Loss of fish habitat in the existing diversion channel was also characterized as a high magnitude effect, but one that would be short-term and not result in an adverse effect on fish because it would be immediately offset by construction of the new diversion channel.	**5(1)(a)(i)** **5(2)(a)**	**C***	**A**	**H**	**LAA**	**MT**	**A**	**C**	**R**	**D**	**Not significant**
				C**	**A**	**L**	**LAA**	**ST**	**A**	**R**	**R**	**D**	
				O*	**A**	**H**	**LAA**	**MT**	**A**	**C**	**R**	**D**	
				O**	**A**	**L**	**LAA**	**ST**	**A**	**R**	**R**	**D**	
				D*	**A**	**H**	**LAA**	**MT**	**A**	**C**	**R**	**D**	
				D**	**A**	**L**	**LAA**	**ST**	**A**	**R**	**R**	**D**	

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Change in fish habitat continued	**Gordon Site** • Constructing a new diversion channel to convey surface run-off from Gordon Lake to Farley Lake. • Trucking potable water to the Gordon Mine site from the MacLellan Mine site to limit the freshwater withdrawal requirements at the Gordon Mine site to those needed for fire suppression, safety showers, and truck washes. • Constructing and operating groundwater interceptor wells on either side of the open pit to capture and return groundwater and surface water to Gordon and Farley Lakes that would otherwise flow into the open pit. • Directing contact water from the collection ditches around the MRSA, overburden stockpile, and mine infrastructure to the open pit during closure to reduce the filling period. • Continuing to operate the groundwater interceptor wells during closure while the open pit fills with water and progressively reducing their pumping rates until the water level in the open pit reaches the elevation of the surrounding groundwater table.	**MacLellan Site**** At the MacLellan site, the magnitude of potential residual effects to fish and fish habitat due to the predicted increases in discharge in the Keewatin River was characterized as low because the increases are well below the thresholds identified by DFO as likely to cause negative effects to aquatic ecosystems that support CRA fisheries (i.e., predicted flow changes are well below a 10% change in instantaneous discharge and will not lower flows below 30% of the mean annual discharge in the Keewatin River at any time). These small changes in flow are not expected to alter the ability of fish to use the Keewatin River for spawning, rearing, foraging, migration, or overwintering habitat. The changes in discharge are expected to occur each winter (i.e., multiple regular frequency) for a long-term duration. The predicted decreases in water levels Minton Lake are characterized as low, because they are within the range of natural variability in lake levels, which are driven by natural beaver activity. The loss of East Pond due to predicted drawdown of the groundwater table was characterized as a high magnitude effect, but one that would not have a measurable effect on CRA fish population in the Keewatin River. This effect would also be counterbalanced by implementation of offsets in the RAA as part of Alamos' Fisheries Offsetting Plan. **Gordon and MacLellan Sites** The ecological context for the potential residual effects at both sites were characterized as disturbed because the historical Farley and MacLellan mines would have affected the fish habitat at the Gordon and MacLellan sites. The historical Farley Mine created the Diversion Channel, Wendy Pit, and East Pit. In addition to these physical habitats, the pits and reclaimed mine rock storage areas may have affected the groundwater table. The historical underground MacLellan Mine has altered the water permeability of the ground within its footprint, altered runoff patterns, and has likely affected the local groundwater table.			see above							

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Change in fish habitat continued	**MacLellan Site** • Restricting water withdrawal rates from the Keewatin River to <10% of instantaneous discharge at all times. • Collecting and conveying non-contact water to the collection pond for discharge to the Keewatin River during operation. • Designing the TMF with two cells to allow progressive development and rehabilitation of the TMF during operation to reduce water management requirements. • Recycling water between the processing facility and the TMF to reduce freshwater requirements from the Keewatin River during operation. • Directing water from the TMF and MRSA to the open pit during closure to reduce the filling period. • Limit disturbance areas around waterbodies to maintain existing riparian vegetation and promote recovery of riparian vegetation by marking buffer zones around sensitive habitats and work areas; using existing access routes; reducing soil compaction by using weight-distributing materials under machinery. • Maintain fish passage by avoiding obstructing watercourses or otherwise interfering with fish movement.	see above										
Change in Fish Health, Growth or Survival • Lethal effects due to dewatering, infilling, blasting, change in angling pressure, or entrainment in water intakes • Change in water quality parameters that influence habitat suitability: dissolved oxygen, temperature, total suspended solids	**Construction, Operation and Decommissioning/ Closure** **General measures** • Grading perimeter and access roads to divert runoff away from the open pits and fish-bearing waterbodies. • Maintaining access roads by periodically regrading and ditching to improve water flow and reduce erosion.	**Gordon and MacLellan sites** The magnitude of potential residual effects due to the predicted fluoride and phosphorus guideline exceedances at the Gordon site are characterized as negligible. This is because the predicted fluoride concentrations are only between 1.1 and 1.6 times the CEQG but 2.5 times lower than the proposed toxicity benchmark considered more appropriate for assessing fluoride toxicity than the CEQG.	see below										

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Table 20A-1 Summary of Potential Environmental Effects, Residual Effects and Significance

Potential Effect	Mitigation Measures	Residual Effect	Area of Federal Jurisdiction CEAA, 2012	Project Activity	Residual Effects								Significance of Residual Effect
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Change in Fish Health, Growth or Survival continued • Chronic or acute toxicity effects due to changes in water and sediment quality from mine effluent releases	• Using dust suppression measures for exposed ground areas within the PDA during dry periods as necessary to reduce dust deposition to surface waters. • Constructing non-contact water ditches upslope of overburden stockpiles, MRSAs, ore stockpiles, mine infrastructure and the TMF to reduce contact water volumes. • Constructing contact water collection ditches around the MRSAs, overburden stockpiles, and ore stockpiles to convey the 1:25-year storm event to collection ponds. • Constructing contact water collection ponds to contain (without discharge) run-off from a 1:100-year storm event with active storage that considers maximum ice thickness in winter. • Designing collection pond inlets and outlets to reduce water velocities, scour and pond stratification potential (chemical or thermal). • Maintaining culverts in access road crossings to remove accumulated material and debris to reduce erosion, flooding, and sediment mobilization. • Implementing sediment and erosion control measures during construction to limit the release of total suspended solid (TSS) and turbidity in lakes and streams. • Implementing Project-specific environmental management and monitoring programs for surface water, groundwater, explosives, erosion and sediment control, wildlife, and emergency response and spill prevention and contingency plans (Chapter 23). • Implementing progressive rehabilitation (placement of vegetated soils cover) of the overburden and MRSAs to reduce infiltration rates. • Filling the open pits at closure with contact water to reduce the duration of pit wall exposure and to return groundwater levels to baseline conditions.	The phosphorus guideline exceedance was characterized as a negligible magnitude effect because the maximum predicted phosphorus concentration in Farley Lake was only 1.1 times the provincial guideline and was predicted to occur when nitrogen, not phosphorus, is the factor limiting primary production in the lake. The magnitude of potential residual effects due to total aluminum, arsenic, total and dissolved cadmium, total copper, and fluoride at the MacLellan site are also characterized as negligible. This is because the predicted concentrations of these parameters were only marginally higher than the federal or provincial guidelines, and were either below the guideline for dissolved fractions (i.e., the biologically available fraction), lower than a proposed toxicity benchmark for the most sensitive aquatic species, or were lower than a more recent guideline based research conducted since the provincial or federal guideline was developed. The duration of potential residual effects (albeit negligible) to fish health, growth, or survival was characterized as long-term at both sites due to the potential for guideline exceedances and exceedances of baseline plus 20% to occur during the post-closure phase. The frequency of residual effects to fish health, growth, or survival was characterized as multiple regular event at both sites because many POPCs are predicted to be elevated during the same time of year during the same flow conditions. The timing of residual effects to fish health, growth, or survival is characterized as applicable because changes in water quality occur in most months of the year and through various stages of the Project and, therefore, may affect all life stages of fish including eggs, fry, juveniles, and adults at various times in the life histories (e.g., spawning, rearing, overwintering). Reversibility of residual effects at both sites was characterized as irreversible because many POPCs are predicted to occur in post-closure and are not predicted to return to baseline concentrations within the time frame predicted by the water quality models.	5(1)(a)(i) 5(2)(a)	C	A	N	LAA	LT	A	R	I	R	Not significant
				O	A	N	LAA	LT	A	R	I	R	
				D	A	N	LAA	LT	A	R	I	R	

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Change in Fish Health, Growth or Survival continued	**MacLellan Site** • Constructing contact water collection ditches around the TMF to convey the 1:25-year storm event to the collection pond. • Pumping water from the existing underground works to the TMF for storage and eventual use in the processing facility. • Designing the TMF with two cells to allow progressive development during operation to reduce water management requirements. • Operating the TMF as a non-discharging facility during operation through reclaiming TMF water for use in the ore processing mill. • Recycling water between the TMF and the mill to the extent possible during operation to reduce freshwater make-up requirements. • Using a closed-circuit for cyanide use and cyanide destruction process (i.e., Air/SO_2 oxidation and precipitation of metals) to reduce cyanide concentrations in tailings slurry prior to release of the slurry for storage in the TMF. • Constructing groundwater cut-off ditches to minimize the volume of groundwater seepage from the TMF entering Minton Lake post-closure. • Treating domestic waste in an average 0.0007 m^3/s (60,000 L/day) sewage treatment plant so that it meets “Wastewater Systems Effluent Regulations” under the *Fisheries Act* and the MWQSOG (2002) prior to discharge to the Keewatin River via a pipeline and diffuser. • Implementing passive treatment options (e.g., controlled pit stratification, fertilizer amendment, flow segregation) in the open pit should monitoring show that pit water quality is not suitable for release to the environment during the approximately 20 years anticipated to fill the open pit with water at the conclusion of operation.	see above									

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Change in Fish Health, Growth or Survival continued	**Fish and Fish Habitat Specific** • Requiring heavy machinery working near water to be kept in good working condition, to be re-fueled no closer than 50 m from any waterbody or watercourse, and to be filled with biodegradable hydraulic fluids. • Identifying and flagging riparian zones within which heavy machinery is prohibited from entering. • Limiting in-water works to outside of the northern Manitoba Restricted Activity Timing Windows for the Protection of Fish and Fish Habitat (DFO 2020b) as practical. • Isolating in-water work areas and conducting fish rescues prior to dewatering, including East Pond at the MacLellan Site and Wendy and East pits at the Gordon Site, the Diversion Channel at the Gordon Site, and other locations where instream construction will be required. • Implementing runoff, erosion, and sediment control measures to reduce the amount of water available to become sediment laden, the amount of sediment that is mobilized through erosion, and the amount of sediment that is conveyed to waterbodies. Additional details are available in Erosion and Sediment Control Plan. The final plan will include the measures listed in the Measures to Protect Fish and Fish Habitat (DFO 2019). • Monitoring the effectiveness of construction management plan mitigation measures during construction activities near water, including total suspended solids and/or turbidity and comparing measured valued to MWQSOG (2002) and CCME (2002b) guidelines. • Using a heat exchanger, when required, to heat or cool water from Wendy Pit and East Pit prior to discharge to Farley Lake during construction and water from the groundwater interceptor wells prior to discharge to Gordon and Farley lakes to maintain the temperature regime in both lakes so as not to negatively affect primary and secondary production rates and alter important behavioral cues for fish (i.e., spawning and overwintering cues).	see above									

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Change in Fish Health, Growth or Survival continued	• Installing screens on the water intakes that are sized using DFO's "Interim Code of Practice: End of Pipe Fish Protection Screens for Small Water Intakes in Freshwater" (DFO 2020a). The screens will be sized based on the weakest swimming fish species in the Keewatin River (burbot, an anguilliform swimming species) and Farley Lake (white sucker and yellow perch, two subcarangiform swimming fish species). • Restricting water withdrawal rates to <10% of the instantaneous discharge of the Keewatin River at all times. • Limiting the size, timing, and setback distances of blasting charges to avoid percussive injuries to fish or damage to incubating eggs. Blasting protocols tailored to the Gordon and MacLellan sites and their fish species assemblages will be developed during Project permitting, using guidance outlined in the "Guidelines for the Use of Explosives In or Near Canadian Fisheries Waters" (Wright and Hopky 1998). • Establishing and enforcing a worker code-of-conduct for employees brought into work at the LLGP that would limit potential over-fishing of lakes, stream, and rivers in the Project area (e.g., restricting fishing in lakes of streams of a specific size, those used by local First Nations for subsistence or traditional purposes, or determined to contain already depressed populations by Manitoba Conservation and Climate). **Gordon site** • Constructing a new diversion channel prior to the decommissioning of the existing diversion channel between Gordon and Farley lakes to maintain water levels. • Aerating Wendy and East pits to encourage precipitation of elements that form oxides (e.g., iron oxide) and to break down of thermal and chemical stratification, and to increase dissolved oxygen concentrations prior to dewatering.	The ecological context for the potential residual effects at both sites were characterized as resilient because changes to water quality that could affect fish health, growth, or survival have occurred in the past at both sites due to historical mining activities and because fish populations are generally adaptable and resilient to changes in water quality that are below toxicity thresholds, as is the case for the LLGP.	see above									

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Change in Fish Health, Growth or Survival continued	• Installing and operating groundwater interceptor wells between the open pit and Gordon Lake and Farley Lake to maintain water levels in Gordon and Farley lakes. • Aerating groundwater from the interceptor wells in collection ponds to encourage iron precipitation and increase dissolved oxygen concentrations prior to discharge to Gordon Lake and Farley Lake. • Transporting domestic waste to the sewage treatment plant at the MacLellan site.	see above											
Valued Component: Vegetation and Wetlands													
Change in Landscape Diversity • Fragmentation of native plant community patches arising from native vegetation clearing	**Construction, Operation and Decommissioning/ Closure** • Restriction of construction activity to the approved PDA • Native areas disturbed by the Project will be reseeded using a native upland seed mix; however, the tailings management facility will be partially capped and seeded with a reclamation seed mix. Approximately 75% of the tailings management facility will be capped, which will be subject to confirmation of capping material availability during detailed design.	**Gordon site** Construction at the Gordon site, in conjunction with the MacLellan site are anticipated to affect the largest patch north of PR 391 (Patch 1). Patch 1 will be reduced in size by 645.7 ha (<1%), and the perimeter will be reduced by 18.6 km (6%). Construction of the Gordon site will result in an expansion of the existing developed area, and no new habitat patches are anticipated to be created in or around this site. During construction and operation of the Gordon site, Patches 18, 19 and 20 will be lost. At closure, the reclamation of the Gordon site will result in increased area of Patch 1 (see closure at the MacLellan site for more information). During construction there will be a temporary adverse reduction in habitat patch area. However, at closure, since there is no loss of large intact patches from the LAA and reclamation of the Project will result in an increase in patch area and a reduction in patch perimeter, this will result in a low magnitude, positive change to landscape diversity in the RAA for the long-term. **MacLellan site** Patches 5, 6, 8,10 will be totally lost during construction and operation at the MacLellan site, and Patch 7 will have 62% of the patch removed. During construction and operation, a portion of Patch 1 will be retained which has been called Patch 23. At closure, Patch 1 will increase in size from existing conditions by 508.6 ha (<1%) due to reclamation of the Gordon and MacLellan sites.	5(2)(a)	C	A/P	L	RAA	LT	N/A	S	R	D	Not significant
				O	A/P	L	RAA	LT	N/A	S	R	D	
				D	A/P	L	RAA	LT	N/A	S	R	D	

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Change in Landscape Diversity continued	**Construction, Operation and Decommissioning/ Closure**	The remaining area of Patch 7, Patch 11 and Patch 23 will have been engulfed by Patch 1 at closure. The perimeter of Patch 1 will decrease by 13.4 km (4%). Increasing the number of patches and patch perimeter and reducing the size of patches increases edge effects to vegetation and wetlands during construction and operation. Edge effects occur as a result of vegetation clearing. Clearing of vegetation results in changes to microclimate (i.e., light intensity, evaporation), which influence species composition and density. The effects of vegetation clearing are further discussed in Section 11.4.3, Chapter 11, and the effects of the number of patches, patch size and perimeter on wildlife habitat are discussed in Chapter 12. Closure of the Gordon and MacLellan sites will result in an increase in the size of habitat Patch 1 because areas that are currently classified as developed within the Gordon and MacLellan sites at existing conditions will mostly be reclaimed to native upland or reclaimed upland plant communities. Reclaiming these areas and the resultant increase in contiguous plant communities within Patch 1 and a reduction in patch perimeter will result in reduction of edge effects to vegetation and facilitation of species dispersal across reclaimed areas. This will result in a low magnitude, positive change to landscape diversity in the RAA for the long-term.	see above								
Change in Community Diversity • Direct loss or alteration of native vegetation communities, including ecological communities of management concern arising from native vegetation clearing	**Construction, Operation and Decommissioning/Closure** • Equipment will arrive at Project site clean and free of soil and vegetative debris. Equipment will be inspected and if deemed to be in appropriate condition, will be approved for use and identified with a suitable marker or tag. Equipment that does not arrive at the Project site in appropriate condition will not be allowed on the construction footprint until it has been cleaned, re-inspected, and deemed suitable for use. • Sensitive areas, such as wetlands, will be buffered by 30 m and clearly marked prior to clearing.	**Gordon Site** With mitigation and reclamation, the Project will result in an increase in 156.7 ha of reclaimed native upland, which replaces 119.4 ha of lost native upland plant communities in the LAA. Over the life of the Project there will be an increase in 15.5 ha of water and a decrease of 66.5 ha of wetland plant communities in the LAA. This change in plant community diversity will occur once during construction and operation at the Gordon site; however, indirect effects to plant communities from dust deposition will occur continuously. The irreversible loss of wetland plant communities is predicted because disturbed areas will be reclaimed to upland.	**5(2)(a)**	**C**	**A**	**L**	**PDA**	**LT**	**N/A**	**C**	**I**	**D**	**Not significant**
				O	**A**	**L**	**PDA**	**LT**	**N/A**	**C**	**I**	**D**	
				D	**A**	**L**	**PDA**	**LT**	**N/A**	**C**	**I**	**D**	

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Change in Community Diversity continued • Indirect alteration of native vegetation communities, including ecological communities of management concern from the introduction or establishment of regulated weeds, vegetation control (i.e., herbicide application) or deposition of dust and contaminants	• Silt fencing will be installed and maintained to reduce deleterious substances from entering adjacent to wetlands or waterbodies. • Vegetation clearing will occur during dry and frozen conditions, when possible. • A protective layer such as matting or biodegradable geotextile and clay ramps or other approved materials will be used between wetland root/seed bed and construction equipment if ground conditions are encountered that create potential for rutting, admixing or compaction. • A native seed mix will be used to assist in reducing invasive plant species spread and establishment as well as for erosion control on exposed soils. • Topsoil and subsoil piles will be monitored for invasive plant species growth during construction and corrective measures (e.g., spraying, mowing, hand-pulling) will be implemented to avoid growth and establishment. • Certified No.1 seed will be used to reseed areas, unless Certified No. 1 seed is not available for selected reclamation species (i.e., native species).	It is expected that revegetation of disturbed areas will be self-sufficient ten years after completion of reclamation as per Best Management Practice 14 (based on past evidence of reclamation in the Yukon. If it is determined that revegetation is not self-sufficient, additional revegetation effort may be required. Since no loss of any one native upland or wetland plant community is anticipated, effects to community diversity are expected to be adverse, occur during construction and last ten years post closure, be low in magnitude, restricted to a single event in the PDA and long-term in duration and irreversible. **MacLellan Site** With mitigation and reclamation, the Project will result in an increase in 607.2 ha of reclaimed native upland and 236.9 ha of reclaimed upland, which replaces a portion of the 490.4 ha of lost native upland plant communities in the LAA. The Project will also result in the loss of 370.9 ha of wetland plant communities, and an addition of 576.3 ha of reclaimed upland and 61.8 ha of water in the LAA. This change in plant community diversity will occur once during construction and operation at the MacLellan site; however, indirect effects to plant communities from dust deposition will occur continuously. The irreversible loss of native upland and wetland plant communities is predicted because it is assumed that the tailings management area will be reclaimed upland at closure, which will not be considered a native plant community, and the LAA surrounding the existing access road into the MacLellan site may be developed during construction and operation. It is expected that revegetation of disturbed areas will be self-sufficient ten years after completion of reclamation as per Best Management Practice 14 (. If it is determined that revegetation is not self-sufficient, additional revegetation effort may be required. Adverse effects to community diversity are expected to occur during construction and last through operation, be low in magnitude, restricted to a single event in the PDA, long-term in duration and irreversible.			see above							

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Change in Community Diversity continued	• Unless a certificate of weed analysis can be provided, construction material sources used for supplies of sand, gravel, rock, straw and mulch will be visually inspected to determine whether they are free of invasive species propagules to the extent possible. If sources are suspected as having invasive species propagules, they should be sampled, and lab analyzed to determine whether they meet the requirements of the responsible regulatory agency prior to obtaining or transporting material to the Project site. If sampling cannot be completed, post construction monitoring for invasive species will be completed. • If pesticide is required, a pesticide use permit will be obtained under The Environment Act (Manitoba). • Native areas disturbed by the Project will be reseeded using a native upland seed mix; however, the tailings management facility will be partially capped and seeded with a reclamation seed mix. Approximately 75% of the tailings management facility will be capped, which will be subject to confirmation of capping material availability during detailed design. • Dust suppression, as described in Chapter 6, will be applied	see above										
Change in Species Diversity • Direct loss of plant SOCC or traditional use plant species due to vegetation clearing • Indirect loss of plant SOCC or traditional use plant species due to the introduction or establishment of regulated weeds, vegetation control (i.e., herbicide application) or deposition of dust and contaminants	**Construction, Operation and Decommissioning/ Closure** • Avoiding known occurrences of SOCC. • If avoidance of plant SOCC is not possible, seed collection or transplant of the plant should be considered. • Not broad-spraying herbicide within 30 m of plant species or ecological communities of conservation concern, wetlands, or waterbodies. Spot spraying, wicking, mowing, or hand picking are acceptable measures for control of regulated weeds in these areas. • Dust suppression, as described in Chapter 6, will be applied.	**Gordon Site** Development of the Gordon site will adversely affect known plant SOCCs and species of traditional use during construction and operation, but with mitigation and reclamation, these effects will be moderate to high in magnitude. The uncertainty in magnitude is attributed to the lack of information on SOCC and traditional use species abundance in the RAA. Effects will be continuous, restricted to the LAA and be long-term. These affects may be reversible for shrubby willow if there are propagules available for reestablishment of these species 10 years post reclamation because this species produces a high abundance of seed and the variety of habitats the species can grow in. However, seed production information on boreal locoweed is	see below									

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		unavailable; therefore, it is assumed that the loss of this occurrence is irreversible.											
Change in Species Diversity continued	**Construction, Operation and Decommissioning/ Closure**	**MacLellan Site** Development of the MacLellan site will indirectly adversely affect plant SOCCs and traditional use species during construction and operation; however, with mitigation and reclamation, these effects will be moderate to high in magnitude. The uncertainty in magnitude is attributed to the lack of information on species abundance in the RAA. The effect will be continuous in the LAA and be long-term. These effects may be reversible if there are propagules available for reestablishment of these species 50 years post reclamation. These effects may be reversible for shrubby willow if there are propagules available for reestablishment of these species 50 years post reclamation because this species produces a high abundance of seed and the variety of habitats the species can grow in. However, seed production information on northern woodsia is unavailable; therefore, it is assumed that the loss of this occurrence is irreversible.	**5(2)(a)**	**C**	**A**	**M-H**	**LAA**	**LT**	**N/A**	**C**	**I/R**	**U**	**Not significant**
				O	**A**	**M-H**	**LAA**	**LT**	**N/A**	**C**	**I/R**	**U**	
				D	**A**	**M-H**	**LAA**	**LT**	**N/A**	**C**	**I/R**	**U**	
Change in Wetland Functions • Direct loss or alteration of wetland area or change in wetland type from vegetation clearing or alteration of surface or groundwater flow patterns • Indirect loss or alteration of wetland area, structure, or function (i.e., nutrient cycling and carbon sequestration)	**Construction, Operation and Decommissioning/ Closure** • Use of sediment fencing and/or other appropriate measures to prevent erosion and siltation into adjacent wetlands. • Identification of wetland boundaries for wetlands adjacent to the PDA, and establishment of a 30 m buffer. • Directing grading away from wetlands, where possible. • Reducing the removal of vegetation in wetlands to the extent possible. • Conducting ground level cutting/mowing/ mulching of wetland vegetation instead of grubbing, where possible. • Reduce grading within wetland boundaries unless required for site specific purposes.	**Gordon Site** Direct and indirect effects to wetlands functions will be reduced by the Project but loss of any particular type of wetland function is not expected in the RAA. However, there will be moderate magnitude, long-term loss of 660.0 ha of wetland as a result of clearing for development of the Gordon site, as well as from dewatering of the open pit, and natural refilling of the pit 10 years post reclamation. In addition, 10 years after reclamation, measurable changes to groundwater recharge/discharge, water storage sediment retention and carbon sequestration are not anticipated. Therefore, effects to wetland function are predicted to be continuous, moderate in magnitude, long-term in duration, restricted to the LAA, and reversible or irreversible depending on the effect.	**5(2)(a)**	**C**	**A**	**M**	**LAA**	**LT**	**N/A**	**C**	**I/R**	**U**	**Not significant**
				O	**A**	**M**	**LAA**	**LT**	**N/A**	**C**	**I/R**	**U**	
				D	**A**	**M**	**LAA**	**LT**	**N/A**	**C**	**I/R**	**U**	

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Table 20A-1 Summary of Potential Environmental Effects, Residual Effects and Significance

Potential Effect	Mitigation Measures	Residual Effect	Area of Federal Jurisdiction CEAA, 2012	Project Activity	Residual Effects								Significance of Residual Effect
					Direction	Magnitude	Geographic Extent	Duration	Timing	Frequency	Reversibility	Ecological and Socio-economic Context	
Change in Wetland Functions continued	• Use of protective layer such as matting or biodegradable geotextile and clay ramps or other approved materials between wetland root/seed bed and construction equipment if ground conditions are encountered that create potential for rutting, admixing or compaction. • Maintaining cross drainage to allow water to move freely from one side of the road to the other in areas of permanent or temporary access roads. • Use of frost packing, snow, ice, geotextile swamp mats or access mat for access through wet areas.	**MacLellan Site** Construction and operation at the MacLellan site are not expected to result in the permanent loss of wetland plant community cover type in the RAA, though there will be permanent loss of 370.9 ha of wetland area in the LAA. There is potential that 603.2 ha of wetland function indirectly lost by construction and operation of the MacLellan site. However, 50 years after reclamation, measurable changes to groundwater recharge/discharge, water storage, sediment retention and carbon sequestration are not anticipated. Therefore, effects to wetland functions are predicted to be continuous, moderate in magnitude, long-term in duration, restricted to the LAA, and reversible/irreversible.	see above									
Valued Component: Wildlife and Wildlife Habitat													
Change in Habitat • Direct and/or indirect loss or alteration of habitat due to vegetation clearing, sensory disturbance (e.g., avoidance), and/or edge effects.	**Construction, Operation and Decommissioning/Closure** • Design for limitation of construction footprint (i.e., PDA) to the extent possible. • Design for use of down-lighting, a technique of directing night lighting downward, to reduce light effects on wildlife adjacent to the PDA. • Design for maintenance of a 30 m naturally vegetated buffer around wetlands, waterbodies, and watercourses. • Design for restriction of unauthorized access to habitat adjacent to the PDA. • Design for provision of low areas in the ploughed snowbanks of access and on-site roads, where practical, to facilitate wildlife movements across and out of road corridors.	**Gordon and MacLellan Sites** Note: * magnitude is low for Gordon as effects will result in a <10% and <5% change in wildlife habitat and SAR and SOCC habitat in the LAA, respectively. ** magnitude is moderate to high for MacLellan site as effects will result in a >10% change in wildlife habitat and >20% change in SAR and SOCC habitat. The Project will result in the loss or alteration of 1,207 ha (<1%) of wildlife habitat within the RAA, 144 ha of which are part of the historical Gordon and MacLellan mine sites. Land clearing and PDA development will result in the direct loss or alteration of 609 ha (<1%) of wolverine habitat in the RAA, 644 ha (<1%) of common nighthawk habitat in the RAA, 961 ha (<1%) of olive-sided flycatcher habitat in the RAA, 836 ha (<1%) of rusty blackbird habitat in the RAA, and minimal habitat loss for barn swallow, little brown myotis, and northern myotis. Woodland caribou habitat disturbance within the RAA will increase by 207 ha (<1%) that is attributed to indirect loss or alteration (i.e., uncleared lands within 500 m of the mine sites).	5(1)(a)(iii), 5(2)(a)	C	A	L*/ M/H**	RAA	ST	A	S	R	D/U	Not significant
				O	A	L	RAA	MT	A	C	R	D/U	
				D	P/A	L	RAA	LT	A	C	R	D/U	

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					Direction	Magnitude	Geographic Extent	Duration	Timing	Frequency	Reversibility	Ecological and Socio-economic Context	
Change in Habitat continued	• Design for scheduling vegetation clearing and site preparation activities outside the breeding period for migratory birds (Zone C7; May 7 to August 7; ECCC 2019b). If activities that could result in risk of harm cannot be avoided, Alamos will develop and implement a Project-specific Wildlife Monitoring and Management Plan that outlines how risk of harm will be managed in accordance with ECCC guidance. • Flag environmentally sensitive areas (e.g., seeps and springs, mineral licks, dens, roosts, stick nests, hibernacula) prior to clearing and construction, and evaluation of the features for additional mitigation measures (e.g., setbacks). • Retain actual or potential habitat trees where safe and technically feasible to do so. If removal is required, removal activities will be scheduled, to the extent practical, outside the core maternity roosting season for bats (May 1 to August 31; Fenton and Barclay 1980; Barclay 1982, 1984) and breeding season for birds (Zone C7; May 7 to August 7; ECCC 2019b). If habitat tree removal or general tree clearing is required during the maternity roosting period, a qualified biologist will review the trees to make a determination on occupancy before removal. This measure will also reduce the risk to other species that use trees for denning or shelter (e.g., American marten). • Maintain vegetation cover along the boundaries of high activity areas (e.g., access roads) to reduce sensory (noise and visual) disturbance. • Report the discovery of nests or other animal dwellings (e.g., lodges, dens) to Alamos, and appropriate action or follow-up will be guided by the Wildlife Monitoring and Management Plan. Report to the Wildlife and Fisheries Branch of DARD for direction on follow-up actions in necessary. • Demolish existing buildings and infrastructure (at MacLellan) outside of the nesting window for birds (Zone C7; May 7 to August 7; ECCC 2019b) and the maternity roosting period for bats (May 1 to August 31; Fenton and Barclay 1980; Barclay 1982, 1984) as per the Wildlife Monitoring and Management Plan.	While the indirect loss or alteration of habitat within the Manitoba North Range (MB9) and KMU may be inconsistent with the objectives of the federal and provincial woodland caribou recovery strategies (Government of Canada 2015, MBWCMC 2015), it is unlikely that the Project will materially affect the survival and recovery of the species because the loss is small, indirect, in an area adjacent to existing disturbance, and there has been no evidence to suggest the contemporary range of woodland caribou includes the Project. The anticipated change in habitat loss or alteration in the LAA is predicted to result in a moderate magnitude Project residual effect. However, when compared to habitat availability in the RAA, it is expected that the Project will have a relatively lower magnitude effect on wildlife habitat, including for migratory birds and SAR and SOCC. Indirect loss or alteration of habitat resulting from sensory disturbance and edge effects are generally expected to be minor and generally limited to the LAA. While some species may inhabit the PDA during operation of the Project (e.g., night hawk, barn swallow), it is expected that the PDA will become naturalized following the decommissioning/closure phase of the Project that will be suitable for a wide range of species.	see above								

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Table 20A-1 Summary of Potential Environmental Effects, Residual Effects and Significance

Potential Effect	Mitigation Measures	Residual Effect	Area of Federal Jurisdiction CEAA, 2012	Project Activity	Residual Effects								Significance of Residual Effect
					Direction	Magnitude	Geographic Extent	Duration	Timing	Frequency	Reversibility	Ecological and Socio-economic Context	
Change in Mortality Risk • Direct change in mortality risk due to vegetation clearing activities, vehicular collisions, human-wildlife conflicts, and indirect change in mortality risk due to predation and harvest pressure.	**Construction, Operation and Decommissioning/Closure** • Design for scheduling vegetation clearing and site preparation activities outside the breeding period for migratory birds (Zone C7; May 7 to August 7; ECCC 2019b). If activities that could result in risk of harm cannot be avoided, Alamos will develop and implement a Project-specific Wildlife Monitoring and Management Plan that outlines how risk of harm will be managed in accordance with ECCC guidance. This plan would be developed in liaison with ECCC. • Flag environmentally sensitive areas (e.g., amphibian breeding ponds, dens, roosts, stick nests, hibernacula) prior to clearing and construction, and evaluation of the features for additional mitigation measures (e.g., setbacks). • Report the discovery of nests or other animal dwellings (e.g., lodges, dens) to Alamos, and appropriate action or follow-up will be guided by the Wildlife Monitoring and Management Plan. Report to the Wildlife and Fisheries Branch of DARD for direction on follow-up actions, as necessary. • Retain actual or potential habitat trees where safe and technically feasible to do so. If removal is required, removal activities will be scheduled, to the extent practical, outside the core maternity roosting season for bats (May 1 to August 31; Fenton and Barclay 1980; Barclay 1982, 1984) and breeding season for birds (Zone C7; May 7 to August 7; ECCC 2019b). If habitat tree removal or general tree clearing is required during the maternity roosting period, a qualified biologist will review the trees to make a determination on occupancy before removal. This measure will also reduce the risk to other species that use trees for denning or shelter (e.g., American marten). • Implement road safety measures such as speed limits and signage to reduce the chance for wildlife collisions both on-site and between sites.	**Gordon Site** During construction, there is potential for increased mortality risk to small mammals and amphibians due to their limited mobility (e.g., crushed by construction equipment). Overwintering amphibians and mammals (e.g., hibernating black bear) are also at greater risk as they may encounter heavy machinery during ground disturbance activities. Vehicle-related wildlife mortality has the potential to affect a wider range of species, including migratory birds, SAR and SOCC, and large mammals. Mortality associated with Project-related transportation is the primary pathway for wildlife mortality to occur during operation, by transportation of ore to on-site stockpiles and to the mill at the MacLellan site (estimated at seven ore trucks per hour;), and other Project-related traffic. The reported mortality risk to different wildlife groups vary but smaller herbivorous mammals (e.g., snowshoe hare), birds, and amphibians are the most at-risk species. An increase in mortality risk is possible where the trapping of problem beavers at water control structures is required, and where there is the potential for bird collisions with towers and guy wires. Proper management of wastes, including at temporary camps, will reduce the potential for wildlife to be attracted to the construction site (e.g., black bear), thus reducing the potential for mortality risk related to human-wildlife conflict. Decommissioning and reclamation activities are expected to have similar residual effects as those described above for the construction phase, albeit on a reduced scale. The decommissioning/closure phase and post-closure activities are expected to have more enduring effects, primarily as it relates to the indirect mortality of wildlife resulting from increased access. Both predators such as wolves and humans use linear features (e.g., trails, cutline) to increase hunting efficiency and gain access to prey species.	**5(1)(a)(iii), 5(2)(a)**	**C**	**A**	**L**	**LAA**	**ST**	**A**	**IR**	**R**	**D/U**	**Not significant**
				O	**A**	**L**	**LAA**	**MT**	**A**	**IR**	**R**	**D/U**	
				D	**A**	**L**	**LAA**	**LT**	**A**	**IR**	**R**	**D/U**	

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Potential Effect	Mitigation Measures	Residual Effect	Area of Federal Jurisdiction CEAA, 2012	Project Activity	Residual Effects								Significance of Residual Effect
					Direction	Magnitude	Geographic Extent	Duration	Timing	Frequency	Reversibility	Ecological and Socio-economic Context	
Change in Mortality Risk	• Report wildlife encounters and problem wildlife concerns or sightings to Alamos and appropriate action or follow-up will be guided by the Wildlife Monitoring and Management Plan. • Follow best management practices for general site housekeeping to reduce wildlife attraction (e.g. food and chemical storage, prompt removal of roadkill). • Include wildlife awareness training during site orientation to reduce the risk of human-wildlife conflict. • Control site access by resource users during post-closure. • Demolish existing buildings and infrastructure at MacLellan outside of the nesting window for birds (Zone C7; May 7 to August 7; ECCC 2019b) and the maternity roosting period for bats (May 1 to August 31; Fenton and Barclay 1980; Barclay 1982, 1984) as per the Wildlife Monitoring and Management Plan. • Using a closed circuit for cyanide use and cyanide destruction in the tailings processing plant (via Air/SO_2 oxidation and precipitation of metals) to reduce cyanide concentrations in tailings slurry prior to release of the slurry for storage in the TMF. • Maintain cyanide concentrations below guidelines in the TMF. Project activities will be aligned with the standards of practice set out in the International Cyanide Management Code. • Manage vegetation around collection ponds and the TMF to deter wildlife and consider additional mitigation measures (e.g., fencing, netting, bird/bat deterrents) if monitoring identifies concerns regarding wildlife use of these areas. • Reduce potential migratory bird mortality by avoiding distribution line routing near high-risk collision areas (e.g., wetlands), where feasible, and enhancing line visibility, where appropriate (e.g., bird diverters).	The PDA will be a single anthropogenic disturbance but will not include a network of trails or cut lines extending into the LAA that can be used by predators and hunters to access further reaches of the LAA. Additionally, the Project will not create new access opportunities to watercourse that can then be used by hunters to access previously inaccessible portions of the LAA. As the only large-bodied prey species that regularly occupies the LAA, moose are targeted by both hunters and predators (e.g., gray wolf), and are most likely to be affected by an increase in indirect mortality risk resulting from increased hunting and predation pressure. However, given the absence of linear features resulting from the Project, they are unlikely to alter their distribution to avoid the LAA beyond existing levels of anthropogenic avoidance. SAR and SOCC are not uniquely susceptible to a change in mortality risk during the decommissioning/closure phase in comparison to other species. Following mitigation measures and adherence to timing restrictions and/or MBCDC (2014) activity restriction setback buffers will reduce the potential Project effects on SAR and SOCC. Species such as common nighthawk and olive-sided flycatcher may benefit from open habitats and edges following reclamation. **MacLellan Site** While the MacLellan site has a higher amount of existing infrastructure that needs to be removed (potentially affecting bats and barn swallow) and constructed (e.g., processing plant), the Project pathways for change in mortality risk and proposed mitigation are similar for both sites during all Project phases. The main difference is the TMF at the MacLellan site that has the potential to increase wildlife mortality risk via drowning and the distribution line has the potential to increase wildlife mortality risk, primarily for migratory birds, via electrocution or line strikes. These small differences will not change the characterization of effects for a change in mortality risk; the assessment of the residual effects for the Project is the same for both sites and as described above.	see above								

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					Direction	Magnitude	Geographic Extent	Duration	Timing	Frequency	Reversibility	Ecological and Socio-economic Context	
Change in Wildlife Health • Activities associated with construction, operation, and/or decommissioning of the Project may result in increased risk of exposure of wildlife to contaminants.	**Construction, Operation and Decommissioning/Closure** • Project infrastructure and facilities designed to avoid sensitive areas (e.g., watercourses, important habitat types) to the extent possible, within watershed boundaries, and PDA reduced to the extent practical. • Design for control of fugitive dust emissions from roads, material handling, and storage areas/stockpiles and from equipment emissions. • Design for administrative controls, including a no idling policy to reduce emissions from vehicles and mobile equipment. • Design for adherence to applicable Transport Canada emission requirements for new mobile equipment on-site. • Design for use of perimeter berms and runoff and contact-water collection ditches. • Design for fuel storage in approved above ground storage tanks equipped with secondary containment systems in accordance with federal and provincial regulation and standards. • Design of sewage treatment plant and water management facilities to treat effluent to levels that will meet applicable federal and provincial guidelines of toxicity. • Dispose and handle waste oils, fuels, and hazardous waste as recommended by the suppliers and/or manufacturers in compliance with federal, provincial, and municipal regulations. • Design for enclosure of mill feed storage area and use of wet scrubbers (or equivalent). • Design of water management facilities to collect and treat (as required) surplus contact water and design for cyanide detoxification.	**Gordon Site** Risk Quotient (RQ) values higher than 1.0 were encountered for both the Baseline Case and the Future Case for copper, nickel, molybdenum, selenium, vanadium and/or zinc for several mammal and bird ecological receptors. In most of these cases, the Project-related contribution to the RQ is negligible to low (generally less than 1%). One notable increase was observed for river otter (*Lontra canadensis*) exposure to selenium, which had a RQ value of 0.74 for the Baseline Case and increased to a RQ value of 1.1 for the Future Case, slightly above the target RQ of 1.0. However, when accounting for model assumptions and conservatism an RQ value of 1.1 will likely have no material effect on the species. For example, the model assumes that the species spends 100% of the time in the area of high selenium concentration which is unlikely to be true. Therefore, Project-related increases in health risks to mammal and bird ecological receptors at the Gordon site resulting from exposure to the COPC assessed is expected to be negligible to low. **MacLellan Site** RQ values higher than 1.0 were encountered for both the Baseline Case and the Future Case for chromium, copper, nickel, selenium, vanadium and/or zinc for several mammal and bird ecological receptors (Volume 5, Appendix H). In most cases, the Project-related contribution to the RQ is negligible to low (generally less than 1%). As with the Gordon site, one notable increase was observed for river otter exposure to selenium which had a RQ value of 0.90 for the Baseline Case and increased to a RQ value of 1.1 for the Future Case, slightly above the target RQ of 1.0. As described above, Project-related increases in health risks to mammal and bird ecological receptors at the MacLellan site resulting from exposure to the COPC assessed, and in consideration of modelling conservatism, is expected to be negligible to low. .	**5(1)(a)(iii), 5(2)(a)**	**C**	**A**	**N-L**	**LAA**	**LT**	**A**	**C**	**R**	**D/U**	**Not significant**
				O	**A**	**N-L**	**LAA**	**LT**	**A**	**C**	**R**	**D/U**	
				D	**A**	**N-L**	**LAA**	**LT**	**A**	**C**	**R**	**D/U**	

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Change in Wildlife Health continued	• Manage vegetation around collection ponds and the TMF (at MacLellan) and consider additional mitigation measures (e.g., fencing, netting, bird/bat deterrents) if monitoring identifies concerns regarding wildlife, including migratory bird use of these areas	Bioaccumulation of COPC is not expected to occur as the Project is not expected to result in the emission of COPC in quantities that would bioaccumulate in the environment. For example, the predicted increase in selenium concentrations in soil at both the Gordon and MacLellan site is 0.3% which is a minor change and unlikely to affect vegetation or wildlife (Volume 5, Appendix H). SAR and SOCC and migratory birds are not uniquely susceptible to a change in wildlife health during the construction, operation, and decommissioning/closure phases in comparison to other species. Therefore, SAR and SOCC can be expected to be subject to a similar level of effects as non-SAR and SOCC wildlife species.	see above									
Valued Component: Labour and Economy													
Change in Local And Regional Labour Force • Project demand for labour	**Construction, Operation and Decommissioning/ Closure** • Inform residents and Indigenous communities of job and procurement opportunities during all Project phases and implement a policy of local hire where priority is given to the workers from the LAA, followed by other parts of the RAA, other parts of Manitoba, and other parts of Canada. • Post job qualifications in advance and identify available training programs and providers so that local and Indigenous residents can acquire the necessary skills and qualify for potential Project-related employment. • Identify potential shortages of workers with specific skill requirements, and work with training and education facilities, Indigenous communities, and local communities to increase opportunities for local community members to obtain training required for Project participation. • Require workers (not inclusive of summer students) 19 years and younger to have completed grade 12 or have an appropriate equivalency to prevent young people from leaving school prematurely. • Workforce education to encourage healthy lifestyle choices, sensitivity training and strict enforcement of Alamos' health and safety policies.	**Gordon and MacLellan Sites** With the implementation of mitigation and management measures, Project residual effects on the local and regional labour force are expected to be positive in direction but low in magnitude during construction and operation. Low magnitude adverse effects are anticipated as the Project transitions from operation into and through the completion of decommissioning/closure (i.e., loss of direct employment). Positive and adverse effects are expected to extend to the RAA, although it is recognized that employment does extend to other parts of Manitoba and beyond. Effects are short-term in duration during construction and decommissioning/ closure, and medium-term in duration during operation. Effects occur continuously through each Project phase and are reversible following the completion of construction and operation but irreversible (with the Project) following the completion of decommissioning/ closure. Based on existing conditions, effects occur within a non-resilient socio-economic context within the LAA and a resilient context within the RAA. There are no seasonal timing considerations with respect to residual effects.	**5(1)(c)(i), 5(2)(b)(i)**	**C**	**P**	**L**	**LAA/ RAA**	**ST**	**N/A**	**C**	**R**	**NR/R**	**Not significant**
				O	**P**	**L**	**LAA/ RAA**	**MT**	**N/A**	**C**	**R**	**NR/R**	
				D	**A**	**L**	**LAA/ RAA**	**ST**	**N/A**	**C**	**I**	**NR/R**	

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					Direction	Magnitude	Geographic Extent	Duration	Timing	Frequency	Reversibility	Ecological and Socio-economic Context	
Change in Local And Regional Business • Project regional expenditures • Project direct employment	**Construction Operation and Decommissioning/ Closure** • Inform residents and Indigenous communities of job and procurement opportunities during all Project phases and implement a policy of local hire where priority is given to the workers from the LAA, followed by other parts of the RAA, other parts of Manitoba, and other parts of Canada. • Develop work packages that consider the capacity and capabilities of local and regional businesses and plan for working with local and Indigenous-owned businesses to enhance their potential for successfully bidding on Project contracts regarding the supply of goods and services. • Post Project purchasing requirements in advance so that local and regional businesses can position themselves to effectively compete to supply goods and services needed for Project construction and operation. • Design for completion of timber removal in accordance with *The Forest Act* of Manitoba. • Work with local communities to develop training programs (e.g., contract opportunities) oriented to Project operational needs	**Gordon and MacLellan Sites** With the implementation of mitigation and management measures, Project residual effects on local and regional businesses are expected to be mixed (positive and adverse). Positive effects relate to Project spending on goods and service contracts and indirect and induced employment effects. Adverse effects result from anticipated upward pressure on wages and increased difficulty of local employers to recruit or retain workers who may be qualified for employment with the Project. In both cases (positive and adverse), effects are expected to extend to the RAA, although it is recognized that employment does extend to other parts of Manitoba and beyond. Effects are short-term in duration during construction decommissioning/closure, and medium-term in duration during operation. Effects occur continuously through each Project phase and are reversible following the completion of construction and operation but irreversible (with the Project) following the completion of decommissioning/closure. Based on existing conditions, effects occur within a non-resilient socio-economic context within the LAA and a resilient context within the RAA. There are no seasonality considerations with respect to residual effects (timing – not applicable).	5(1)(c)(i), 5(2)(b)(i)	C	P	L	LAA/ RAA	ST	N/A	C	R	NR/R	Not significant
				O	P	L	LAA/ RAA	MT	N/A	C	R	NR/R	
				D	A	L	LAA/ RAA	ST	N/A	C	I	NR/R	
Change in Local And Regional Economy • Project regional expenditures • Project direct employment • Project property taxes	**Construction, Operation and Decommissioning/ Closure** • Mitigation and management measures identified in sections on local and regional labour force and business also apply to the assessment of ‘change in local and regional economy’	**Gordon and MacLellan Sites** With the implementation of mitigation and management measures, Project residual effects are predicted to be positive in direction during construction, operation, and decommissioning/closure. Given the value of baseline GDP and in consideration of nature of the Project (i.e., resumption of mining operation within the LAA), Project GDP contributions (direct, indirect, and induced) are expected to be positive in direction but moderate in magnitude. Contributions to municipal government revenues are conservatory characterized as being low in magnitude.	5(1)(c)(i), 5(2)(b)(i)	C	P	L-M	LAA/ RAA	ST	N/A	C	R	R	Not significant
				O	P	L-M	LAA/ RAA	MT	N/A	C	R	R	
				D	A*	M	LAA/ RAA	ST	N/A	C	I	R	

Legend Key: Project Activity: C – Construction; O – Operation; D – Decommissioning/Closure; **Direction:** P – Positive; A – Adverse; **Magnitude:** N – Negligible; L – Low; M – Moderate; H – High; **Geographic Extent:** PDA – Project Development Area; LAA – Local Assessment Area; RAA – Regional Assessment Area; **Duration:** ST – Short-term; MT – Medium-term; LT – Long-term; **Timing:** A – Applicable; N/A – Not Applicable; **Frequency:** S – Single; IR – Irregular; R – Regular; C – Continuous; **Reversibility:** R – Reversible; I – Irreversible; **Ecological/Socio-economic Context:** D – Disturbed; U – Undisturbed; R – Resilient: NR – Not Resilient

Table 20A-1 Summary of Potential Environmental Effects, Residual Effects and Significance

Potential Effect	Mitigation Measures	Residual Effect	Area of Federal Jurisdiction CEAA, 2012	Project Activity	Residual Effects								Significance of Residual Effect
					Direction	Magnitude	Geographic Extent	Duration	Timing	Frequency	Reversibility	Ecological and Socio-economic Context	
Change in Local And Regional Economy continued	**Construction, Operation and Decommissioning/ Closure**	Effects are expected to primarily extend to the RAA, although it is recognized that Project expenditures, and therefore contributions to GDP also occur in other parts of Manitoba, Canada, and foreign markets. Effects are short-term in duration during construction and decommissioning/closure and medium-term in duration during operation. Effects occur continuously through each Project phase and are reversible following the completion of construction and operation but irreversible (with the Project) following the completion of decommissioning/closure. Because Project effects on GDP and municipal government revenues are purely beneficial, the socio-economic context in which effects occur is characterized as being resilient. There are no seasonality considerations with respect to residual effects (timing – not applicable). Note: * Adverse effects associated with losses in employment and contributions to GDP occur continuously over the short-term during decommissioning/closure.	see above									
Valued Component: Community Infrastructure, Services and Well-being													
Change in Housing and Temporary Accommodations • Demand on housing and temporary accommodations may be affected by Project activities and Project-related population growth.	**Construction and Operation** • The primary mitigation for change in housing and temporary accommodations will be the implementation of a worker housing strategy. An accommodation camp will be in place for pre-production (construction and commissioning) and operation. No additional mitigation is required for housing.	**Gordon and MacLellan Sites** The use of a work camp during construction and operation, which will house the non-local workforce, will satisfy requirements for worker accommodation. Therefore, with the implementation of a Project accommodations strategy residual effects on housing and temporary accommodation during construction and operation are expected to be adverse but negligible and will occur in the LAA. Effects will be continuous, medium-term, reversible, and occur in a socio-economic context that is not resilient.	**5(2)(b)(i)**	**C**	**A**	**N**	**LAA**	**MT**	**N/A**	**C**	**R**	**NR**	**Not significant**
				O	**A**	**N**	**LAA**	**MT**	**N/A**	**C**	**R**	**NR**	
				D	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	

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					Direction	Magnitude	Geographic Extent	Duration	Timing	Frequency	Reversibility	Ecological and Socio-economic Context	
Change in Local Services and Infrastructure • Demand on local services and infrastructure may be affected by Project activities and Project-related population growth.	**Construction and Operation** • Work camp at the MacLellan site to accommodate workers during construction and operation. • During construction, first aid facilities will be supplied by the Engineering, Procurement, and Construction Management (EPCM) contractor. First-aid personnel will provide transport to Lynn Lake hospital when required. During operation, first aid facilities will be supplied by a dedicated first aid/mine rescue office in each of the site administration offices. Site security personnel will be trained as EMS first responders, and when required, provide transfer to Lynn Lake hospital. • Power, water, and wastewater treatment will be provided by Alamos and will not rely on resources within the Town of Lynn Lake. • Development of a Waste Management Plan. Because there will be a Project demand for landfill capacity for construction and non-hazardous domestic solid waste during operation, Alamos will liaise with planners in Lynn Lake regarding these needs and potential requirements for landfill expansion. • Mandatory safety orientations for new employees. • Control of access to the PDA using a security gate and guard house, and by employing on-site security staff. • Site security services to help limit demands on the local police system. • Careful control of flammable material (such as fuels and explosives) on-site. • Training of Project personnel in fuel handling, equipment maintenance, and fire prevention and response measures. • Scheduling of alternating work shifts so that all workers do not arrive in and leave the area at the same time will limit Project-related demands on both traffic and air services and infrastructure.	**Gordon and MacLellan Sites** The presence of non-local workers during construction and operation, together with Project activities, will not place additional demands on power, water, and wastewater services and infrastructure. With the application of mitigation and management measures, the residual adverse effects on the capacity of local services and infrastructure during all Project phases are predicted to be low in magnitude, and continuous throughout construction, operation, and decommissioning. They are predicted to occur in a socio-economic context that is resilient, and effects are likely to be reversed following decommissioning.	5(2)(b)(i)	C	A	L	LAA	MT	N/A	C	R	R	Not significant
				O	A	L	LAA	MT	N/A	C	R	R	
				D	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	

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					Direction	Magnitude	Geographic Extent	Duration	Timing	Frequency	Reversibility	Ecological and Socio-economic Context	
Change in Local Services and Infrastructure continued	• Liaise with local emergency providers so that roles and responsibilities are understood, and that the necessary resources required to respond are in place. • Maintenance of fire prevention and suppression systems onsite, including water supplies, sprinklers, fire extinguishers and other firefighting equipment. • Workforce education to encourage healthy lifestyle choices, sensitivity training and strict enforcement of Alamos' health and safety policies. For example, sensitivity training would raise the level of awareness about the potential effects that workers can have on the community and their families through drug and alcohol use or other social concerns. • Access to Employee Assistance Program for Project personnel, and requirement for pre-employment physicals. • Development of cooperative protocols with responsible agencies to deal with access of Project personnel to emergency and other medical services. • Development and implementation of Project-specific environmental management plans and monitoring programs, including a Waste Management Plan that sets out procedures for reducing Project-related waste and limiting demands on local landfills. • Development and implementation of Project-specific Emergency Response and Spill Prevention and Contingency Plans will reduce the likelihood and severity of accidents and potential fires.	see above											
Change in Transportation Services and Infrastructure • Demand on transportation services and infrastructure may be affected by Project activities and Project-related population growth.	**Construction and Operation** • Scheduling of alternating work shifts so that workers do not arrive in and leave the area at the same time will limit Project-related demands on both traffic and air services and infrastructure. • Upgrading and resurfacing the existing access roads to the MacLellan and Gordon sites. • Implement standard construction procedures, including traffic control, to reduce traffic delays during construction. The procedures will be developed during ongoing planning and engineering design to address traffic staging to reduce delays.	**Gordon and MacLellan Sites** The residual adverse effect of the Project of a change in transportation services and infrastructure is therefore predicted to be low in magnitude and continuous throughout construction and operation of the Project. Effects will occur in the LAA in a resilient socio-economic context and are likely to be reversed following active closure.	**5(2)(b)(i)**	**C**	**A**	**L**	**LAA**	**MT**	**N/A**	**C**	**R**	**R**	**Not significant**
				O	**A**	**L**	**LAA**	**MT**	**N/A**	**C**	**R**	**R**	
				D	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	

Legend Key: Project Activity: C – Construction; O – Operation; D – Decommissioning; **Direction:** P – Positive; A – Adverse; **Magnitude:** N – Negligible; L – Low; M – Moderate; H – High; **Geographic Extent:** PDA – Project Development Area; LAA – Local Assessment Area; RAA – Regional Assessment Area; **Duration:** ST – Short-term; MT – Medium-term; LT – Long-term; **Timing:** A – Applicable; N/A – Not Applicable; **Frequency:** S – Single; IR – Irregular; R – Regular; C – Continuous; **Reversibility:** R – Reversible; I – Irreversible; **Ecological/Socio-economic Context:** D – Disturbed; U – Undisturbed; R – Resilient: NR – Not Resilient

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Potential Effect	Mitigation Measures	Residual Effect	Area of Federal Jurisdiction CEAA, 2012	Project Activity	Residual Effects								Significance of Residual Effect
					Direction	Magnitude	Geographic Extent	Duration	Timing	Frequency	Reversibility	Ecological and Socio-economic Context	
Change in Transportation Services and Infrastructure continued	• Providing bussing services between the temporary camp and Gordon site. • Encouraging carpooling among locally resident construction and operation workers. • Scheduling arrivals/departures of employee traffic to occur earlier than the existing observed a.m. peak hour for local traffic and later than the existing observed p.m. peak hour if needed.	see above											
Change in Community Well-Being • Project-related employment has the potential to increase individual and household income, increase disposable income, and reduce financial barriers to beneficial health practices or negative coping mechanisms. • Project-related population growth has potential to change the demographics of nearby communities and result in changes to community cohesion • The Project has the potential to change (increase or decrease) the amount of time individuals and households have to participate in recreational, subsistence, and family-related activities through gained employment	**Construction and Operation** • Work camp at the MacLellan site to accommodate workers during construction and operation. • Workforce education to encourage healthy lifestyle choices, sensitivity training and strict enforcement of Alamos' health and safety policies. For example, sensitivity training would raise the level of awareness about the potential effects that workers can have on the community and their families through drug and alcohol use or other social concerns. • Access to Employee Assistance Program for Project personnel, and requirement for pre-employment physicals.	**Gordon and MacLellan Sites** A mixture of positive and adverse residual effects on community wellbeing are anticipated. Positive effects result from low magnitude, Project-related employment and income and related beneficial changes to individual and household disposable income resulting in increased available time (depending on pre-employment conditions) and reduced financial barriers to engage in subsistence, and family-related activities and healthy eating. Positive effects are characterized as being low in magnitude during construction and operation, occur within the LAA on a continual basis over the medium-term, and are reversable following the completion of decommissioning/closure. Effects occur within a non-resilient socio-economic context, largely based on existing labour force conditions and the sizable proportion of the population that are included in the definition of a vulnerable population. Adverse residual effects on community well-being result from moderate Project-related changes in the size and demographic composition of the LAA and subsequent changes in perceived levels of "sense of community belonging". Residual effects also result from low magnitude, Project-related changes in employment and income, which can increase time spent away from home communities and families (contributing to increases in stress) and contribute to increased reliance on negative coping skills.	5(2)(b)(i)	C	P/A	L/M	LAA	MT/ LT	N/A	C	R	NR	Not significant
				O	P/A	L/M	LAA	MT/ LT	N/A	C	R	NR	
				D	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	

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Potential Effect	Mitigation Measures	Residual Effect	Area of Federal Jurisdiction CEAA, 2012	Project Activity	Residual Effects								Significance of Residual Effect
					Direction	Magnitude	Geographic Extent	Duration	Timing	Frequency	Reversibility	Ecological and Socio-economic Context	
Change in Community Well-Being continued	**Construction and Operation**	Adverse effects are conservatively characterized as being moderate in magnitude during construction and operation, occur within the LAA on a continual basis over the long-term, and are reversable following the completion of decommissioning/closure. Effects occur within a non-resilient socio-economic context. Residual effects during decommissioning/closure are considered to be negligible in magnitude. No further characterization is provided.	see above										
Valued Component: Land and Resource Use													
Change in Land Use • Project activities incompatible with applicable land use plans and zoning • Disturbance and nuisance effects on property (noise, dust) • Project presence and site activities may affect use/future development	**Construction, Operation and Decommissioning/ Closure** • The Project footprint will be limited to the extent possible including site clearing and disturbance, access routes and distribution line ROW. • Existing access roads, trails and ROW will be used to the extent possible; access routes will be developed in compliance with provisions of *The Crown Lands Act* and *The Mines and Minerals Act.* • Alamos will implement traffic control measures which may include gating approaches to Project access roads, placing large boulders and/or gated fencing to restrict public access to the PDA. • Signage will be installed around the PDA to alert land users of the presence of the Project and its facilities. • Alamos will communicate the schedule of Project activities throughout the construction, operation, and decommissioning phases to affected local resource users and MCC Regional Officials. • Alamos will engage with Town of Lynn Lake Municipality and provincial Crown land use permit holders to address potential conflict, disturbance, or access restrictions to municipal and Crown land use areas. • Alamos will undertake rehabilitation activities in consideration of desired end land uses that are achievable in the preparation of a Conceptual Closure Plan under the provisions of *The Mines and Minerals Act* for both the Gordon and MacLellan sites.	**Gordon and MacLellan Sites** With the implementation of mitigation measures, residual effects from the Project on land use are anticipated to be of low magnitude. Noise levels at the Gordon and MacLellan sites are predicted to have low to moderate magnitude residual effects. Access to areas in the PDA and LAA will be affected by construction activities and restrictions will extend to the operation period. The socio-economic context for residual effects includes a PDA and LAA that have historically been affected by mining development (i.e., the Gordon site has been reclaimed and the MacLellan site has been under care and maintenance) and continues to experience disturbance from major transportation infrastructure (i.e., PR 391). The Project is not expected to affect protected areas under Manitoba's Protected Areas Initiative, First Nation land, TLE sites or other provincial Crown land permit/lease sites. Project effects on unoccupied Crown land and provincial land within the boundaries of Lynn Lake are expected to be short-term and irregular in frequency for the construction phase, medium-term (long-term for visual), and continuous in frequency occurring during operation, and reversible upon Project decommissioning (with the exception of the permanent open pits).	**5(2)(a)**	**C**	**A**	**L-M**	**PDA/ LAA**	**ST-LT**	**N/A**	**IR/C**	**R/IR**	**D**	**Not significant**
				O	**A**	**L-M**	**PDA/ LAA**	**ST-LT**	**N/A**	**IR/C**	**R/IR**	**D**	
				D	**A**	**L-M**	**PDA/ LAA**	**ST-LT**	**N/A**	**IR/C**	**R/IR**	**D**	

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Change in Recreation • Project clearing may result in the loss of area available for recreational use • Project presence and site activities may affect access to or quality of recreational use (inclusive of land and water-based activities)	**Construction, Operation and Decommissioning/ Closure** • Signage will be installed around the perimeter of the PDA to alert local land and resource users of the presence of the Project and its facilities. • Project lighting will be limited to that which is necessary for safe and efficient Project activities. Directional lighting will be used to limit the transmission of light outside of the PDA. Portable lighting equipment will be positioned to limit visibility at nearby receptors, to the extent feasible. • Noise mitigation measures will be selected and installed. • Workers will be prohibited from bringing firearms and fishing gear to the sites while working to limit competition for wildlife and fish species of value to resource users. • Alamos will post warning signs on the access roads and distribution line ROW to discourage unauthorized access and snowmobiling due to safety concerns. • Alamos will implement traffic control measures which may include gating approaches to Project access roads, placing large boulders and/or gated fencing to restrict public access to the PDA. • Alamos will engage local land and resource users (e.g., recreational harvesters) and the Town of Lynn Lake to address, to the extent possible, issues related to the removal and inaccessibility of lands and resources within the PDA at Project sites, including the restriction in use of the Gordon site access road, and with local boaters to address navigation issues as well as access and safety issues related to navigation along watercourses affected by the Project, including engagement regarding the need to provide marked portages to circumvent obstructions. • Desired end land and resource uses will be considered in the preparation of the conceptual Closure Plan as part of Project rehabilitation.	**Gordon and MacLellan Sites** With the implementation of mitigation measures, residual effects from the Project on recreation are anticipated to be low in magnitude for each Project phase. Noise levels at the Gordon and MacLellan sites are predicted to have low to moderate magnitude residual effects. Because there are numerous recreational opportunities available across the landscape, it is predicted that recreational activities will be able to continue at or near current levels. Access to recreational areas will be restricted directly in the PDA (269 ha at Gordon and 938 ha at MacLellan); however, the PDA is not considered to provide “prime” recreation areas given past mine use, and alternative recreational areas are available throughout the LAA (20,678 ha). Indirect effects extend to recreational users of lakes located outside of the LAA through the restriction of access along the Gordon site access road. Seasonal aspects are considered in the context of recreational activities, including canoeing, since many recreational activities are seasonal. The socio-economic context for residual effects includes the LAA encompassing an area that has been previously disturbed by mining (i.e., Gordon has been reclaimed and MacLellan has been under care and maintenance). Residual effects are expected to be short- to medium- to long-term, irregular to continuous (occurring throughout the life of the Project), and reversible following Project decommissioning (with the exception of permanent open pits) because closure activities will include consideration of desired end uses such as recreation.	5(2)(a)	C	A	L-M	PDA/ LAA	ST-LT	A	IR/C	R/IR	D	Not significant
				O	A	L-M	PDA/ LAA	ST-LT	A	IR/C	R/IR	D	
				D	A	L-M	PDA/ LAA	ST-LT	A	IR/C	R/IR	D	

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					Direction	Magnitude	Geographic Extent	Duration	Timing	Frequency	Reversibility	Ecological and Socio-economic Context	
Change in Resource Use • Project can reduce productive forest land, annual allowable cut (AAC) and merchantable timber, and cause disturbance to high- value forest sites • Disruption effects to development/extraction (minerals and aggregate) • Can disrupt resource harvesting success (hunting, trapping, fishing)	**Construction, Operation and Decommissioning/ Closure** • The Project footprint will be limited to the extent possible (i.e., PDA) including site clearing and disturbance, access routes and distribution line ROW. • Existing access roads and trails will be used to the extent possible; renewed access routes will be developed in compliance with provisions of *The Mines and Minerals Act* (in the case of the Gordon site). • Signage will be installed around the PDA to alert local resource users of the presence of Project facilities and activities. • Alamos will implement traffic control measures which may include gating approaches to Project access roads, placing large boulders and/or gated fencing to restrict public access to the PDA. • Work schedules will be implemented for Project construction workers (subject to fly-in/fly-out employment) to deter workers from hunting locally outside of working hours during a shift. • Workers will be prohibited from bringing firearms and fishing gear to the sites while working to limit competition for wildlife and fish species of value to resource users. • Alamos will communicate the schedule of Project activities throughout the construction, operation, and decommissioning phases to potentially affected local resource users and MCC Regional Officials. • Alamos will engage with local resource users (hunters, outfitters, trappers, anglers) and MCC Regional Officials to address to the extent possible the potential conflict, disturbance, or access restrictions to hunting, trapping, and fishing areas in the PDA, and availability of wildlife and fish resources. • Timber removal will be completed in accordance with *The Forest Act* (Manitoba).	**Gordon and MacLellan Sites** With the implementation of mitigation measures, residual effects from the Project on resource use (i.e., hunting, outfitting, trapping, forestry, and fishing are anticipated to be low in magnitude and low in magnitude for fishing. Noise levels at the Gordon and MacLellan sites are predicted to have low to moderate magnitude residual effects. Physical Project disturbance on outfitting represents approximately 0.8% of the total area for outfitting in the RAA (i.e., bear allocation area) and an overlap of trapping activities ranging from 0.2% to 5.8% of the total area of registered trapping in the RAA and LAA. Loss of productive provincial Crown forest land in FMUs 72 (0.1%) and 71 (0.3%) and the theoretical reduction in the net merchantable AAC (0.6%) are low in relation to the total commercial forest area and total available AAC in the RAA. The related change in the affected land base represents a small area. Because there are numerous opportunities to hunt, trap, and fish outside of the PDA, it is predicted that hunting, outfitting, trapping, and fishing activities will be able to continue at or near current levels. There are no waterbodies that are commercially fished within the PDA. Potential changes to fish habitat, and thus the availability of fish resources, are not expected to cause measurable reductions in the productivity of focal fish populations in the Gordon and MacLellan LAA (see Chapter 10). The restriction in use of the Gordon site access road will potentially result in an adverse indirect effect to resource users in the LAA who have used this road to access other lakes inside (e.g., Simpson and Swede lakes) and outside (e.g., White Owl and Barrington lakes) the LAA. There are several waterbodies within the LAA (or adjacent to it) that are sport fished or have sport fish species: Minton Lake, Keewatin River, Lynn River, Cockeram Lake, Cartwright Lake, Hughes Lake, Hughes River, Simpson Lake, and Swede Lake. Existing access to Keewatin River, Lynn River, Cockeram Lake and Hughes Lake off PR 391 will not be affected by the Project. Accessing both Simpson and Swede lakes and other points east of the Gordon site will be made more difficult during operation.	5(2)(a)	C	A	L	PDA/ LAA	ST-LT	N/A	S/IR/ C	R/IR	D	Not significant
				O	A	L	PDA/ LAA	ST-LT	N/A	S/IR/ C	R/IR	D	
				D	A	L	PDA/ LAA	ST-LT	N/A	S/IR/ C	R/IR	D	

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					Direction	Magnitude	Geographic Extent	Duration	Timing	Frequency	Reversibility	Ecological and Socio-economic Context	
Change in Resource Use continued	• Merchantable timber may be salvaged and used, if feasible, to enhance carbon storage, or it will be made available to local communities for fuelwood. • Construction and operation and maintenance activities will be restricted to the PDA, as much as possible, to reduce disturbances to adjacent productive forest land. • Loss of provincial Crown forest land from Project clearing will require compensation, due to the Crown, to be paid by Alamos for Project effects on provincial Crown forest as specified in the forest damage appraisal and valuation (FDAV) policy.	Even with the restriction and difficulty in access, there will be other opportunities to sport fish across the land base and fishing activities should be able to continue at or near current levels. Seasonal aspects are unlikely to alter residual environmental effects on resource use as the effects will be the same regardless of the season, occurring year-round. The socio-economic context for residual effects includes the Project encompassing an area that has been previously disturbed by mining (i.e., the Gordon site has been reclaimed and the MacLellan site has been under care and maintenance). Residual effects related to hunting, outfitting, trapping, and sport fishing will be short-term (for construction noise) to medium-term (for sensory disturbance) and long-term for visual, irregular to continuous in frequency, and reversible following Project decommissioning (with the exception of permanent open pits). The adverse effect on AAC will be a single, medium-term, event because the affected productive forest land will remain deforested for the duration of the Project. The Project effects are considered reversible upon decommissioning given compensation provided through the FDAV for reforestation activities.	see above									
Valued Component: Heritage Resources													
Change to Heritage Resources • Project components requiring ground disturbance have the potential to change the horizontal and vertical context of known or potential heritage resource sites	**Construction and Operation** • Implementation of the Heritage and Cultural Resource Protection Plan (HCRPP) when heritage or cultural resources, or objects thought to be heritage or cultural objects, are exposed. • Protective barriers placed around heritage resource sites that are inadvertently found during construction so that the area can be protected while work proceeds. • Evaluation by a professional archaeologist of PDA changes or added development components. • Education of construction contractors for the appropriate protocols if heritage or cultural resources, or objects thought to be heritage or cultural resources, are discovered.	**Gordon Site** No heritage resources are known in the Gordon site PDA/LAA. Predictive modelling has indicated that there is a low potential for the PDA/LAA to contain unknown heritage resources. Engagement with Marcel Colomb First Nation and the Manitoba Metis Federation traditional land and resource use (TLRU) study suggest that there are no culturally important spaces in the PDA/LAA. A HCRPP is in place to mitigate inadvertently exposed heritage resources. As such, no Project residual effects are anticipated for changes to heritage resources at the Gordon site.	**5(1)(c)(iv), 5(2)(b)(iii)**	**C**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**Not significant**
				O	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	
				D	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	

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Table 20A-1 Summary of Potential Environmental Effects, Residual Effects and Significance

Potential Effect	Mitigation Measures	Residual Effect	Area of Federal Jurisdiction CEAA, 2012	Project Activity	Residual Effects								Significance of Residual Effect
					Direction	Magnitude	Geographic Extent	Duration	Timing	Frequency	Reversibility	Ecological and Socio-economic Context	
Change to Heritage Resources continued	• Controlled surface collection or salvage excavation of known heritage resource sites, or a portion thereof, that cannot be avoided (MacLellan). • Construction monitoring by a professional archaeologist in areas that are heritage sensitive such as sites identified as being culturally sensitive by Indigenous engagement (MacLellan). • As-found recording of site HfMf-7, a shed related to historical mining activity.	**MacLellan Site** None of the proposed Project components interact with known heritage resources at the MacLellan site. With application of the mitigation described above, including the HCRPP that will mitigate inadvertently exposed heritage resources, no changes to heritage resources are anticipated at the MacLellan site and therefore, no residual Project effect to heritage resources.	see above										
Valued Component: Current Use of Lands and Resources for Traditional Purposes													
Change in Availability of Resources Currently Used for Traditional Purposes • Vegetation clearing associated with Project construction could result in a loss of habitat for species of traditional importance, including plants and animals relied on for traditional hunting, trapping, or plant harvesting • Loss or alteration of fish habitat resulting from disturbance to watercourses • Sensory disturbance from Project operation has the potential to affect the availability of habitat for species traditional importance • An increase in hunting or fishing pressure by non-Indigenous people has the potential to affect the availability of traditionally used species • Potential effects on wildlife, fish, and vegetative health that could affect the availability of traditional resources	**Construction, Operation and Decommissioning/ Closure** • Wetland buffering, silt fencing, and timing of vegetation clearing will reduce habitat loss or loss of traditionally important species. • Dust suppression to reduce sensory disturbance, effects to habitat or traditionally harvested species. • Erosion and sediment control measures during construction, timing works outside of sensitive periods will reduce alteration or loss of fish habitat. • Workers will be prohibited from bringing firearms and fishing gear to the sites while working to limit competition for wildlife and fish as described in the land and resource use VC. • Mitigations as described in the fish and fish habitat VC will reduce effects on traditionally important fish species and habitat. Offsetting lost habitat area where serious harm to fish will occur. • Relevant mitigations as described in the groundwater VC to reduce effects on traditionally important species and resources. • Relevant mitigations as described in the wildlife and wildlife habitat VC to reduce effects on traditionally important species and resources. • Apply relevant actions in the Wildlife Monitoring and Management Plan to reduce effects on traditionally important species and resources. • Apply the Surface Water Monitoring and Management Plan (MacLellan).	**Gordon and MacLellan Sites** Project residual effects after mitigation on Current Use of Lands and Resources for Traditional Purposes (Current Use) will be adverse through construction, operation, and decommissioning. Because the PDA is within the disturbed context of existing mine sites and the LAA includes an existing road, magnitude is anticipated to be low with indirect effects, especially sensory disturbance, extending into the LAA. The effects will be long term, extending beyond the Project life until the PDA returns to its pre-Project state, except for the open pits and mine rock, which will be permanent features. While the timing of construction, operation, and decommissioning may affect Current Use dependent on seasonal resources and access, effects on land-based cultural sites and areas are not sensitive to seasonal variation. Effects on Current Use will be reversible with decommissioning, except for the open pits and mine rock, which will be permanent features.	**5(1)(c)(iii)**	**C**	**A**	**L**	**LAA**	**LT**	**A**	**C**	**R**	**D**	**Not significant**
				O	**A**	**L**	**LAA**	**LT**	**A**	**C**	**R**	**D**	
				D	**A**	**L**	**LAA**	**LT**	**A**	**C**	**R**	**D**	

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Change in Access to Resources or Areas Currently Used for Traditional Purposes • Loss, alteration, or restriction of access (including trails and travelways) to current lands and resources used for traditional purposes	**Construction, Operation and Decommissioning/ Closure** • Site access by traditional harvesters will be controlled post-closure. • Existing access roads and trails will be used to the extent possible; access routes will be refurbished in compliance with provisions of *The Crown Lands Act* and *The Mines and Minerals Act*.	**Gordon and MacLellan Sites** Residual effects are as above.	**5(1)(c)(iii)**	**C**	**A**	**L**	**LAA**	**LT**	**A**	**C**	**R**	**D**	**Not significant**
				O	**A**	**L**	**LAA**	**LT**	**A**	**C**	**R**	**D**	
				D	**A**	**L**	**LAA**	**LT**	**A**	**C**	**R**	**D**	
Change to Traditional Cultural and Spiritual Sites and Areas • Project construction and operation could result in a loss or alteration of identified current use harvesting sites, habitation areas, cultural and sacred sites • Indirect effects on the experience of Indigenous peoples which adversely alter the perceived values of current use sites or areas	**Construction, Operation and Decommissioning/ Closure** • Although no known cultural and spiritual sites or areas are in the PDA, Alamos' ongoing engagement program will facilitate development of mitigation measures if these are reported or discovered during construction and operation phases. • Design for limitation of Project footprint (i.e., PDA) to the extent possible. • Design for use of down-lighting, a technique of directing night lighting downward, to reduce light effects adjacent to the PDA. • Buffers around wetlands, waterbodies, and watercourses as described in the vegetation and wetlands VC will be maintained to reduce effects to cultural and spiritual sites or areas. • Design for restriction of unauthorized access adjacent to the PDA. • Maintain vegetation cover along the boundaries of high activity areas (e.g., access roads) to reduce sensory (noise and visual) disturbance. • The Heritage and Cultural Resource Protection Plan (HCRPP) will be implemented when previously unidentified heritage or cultural resources, or objects thought to be heritage or cultural objects, are exposed. • Controlled surface collection or salvage excavation will be implemented for any discovered heritage resource sites, or a portion thereof, that cannot be avoided (MacLellan).	**Gordon and MacLellan Sites** Residual effects are as above.	**5(1)(c)(ii)** **5(1)(c)(iii)**	**C**	**A**	**L**	**LAA**	**MT**	**N/A**	**C**	**R**	**D**	**Not significant**
				O	**A**	**L**	**LAA**	**MT**	**N/A**	**C**	**R**	**D**	
				D	**A**	**L**	**LAA**	**MT**	**N/A**	**C**	**R**	**D**	

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Table 20A-1 Summary of Potential Environmental Effects, Residual Effects and Significance

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					Direction	Magnitude	Geographic Extent	Duration	Timing	Frequency	Reversibility	Ecological and Socio-economic Context	
Change to the Environment that Affects Cultural Value or Importance Associated with Current Use* • Indirect effects on the experience of Indigenous peoples which adversely alter the perceived value of access to traditional resources for current use or current use sites and areas • Change to values or attributes of the area that make it important • Presence of worker or increased access to the area by non-Indigenous peoples • Sensory disturbance from Project construction and operations has the potential to affect • Changes that could detract from use of the area or lead to avoidance of the area as a result of real and perceived disturbance of the environment	**Construction, Operation and Decommissioning/ Closure** • Ongoing engagement with potentially affected communities may help mitigate effects to cultural values, through sharing results from monitoring and facilitating tours to verify efforts to manage effects.	*Note: Change to the environment that affects cultural value or importance associated with current use is considered in Chapter 17 of the EIS. As indicated there, effects on cultural value are often intangible, and do not lend themselves well to being characterized. As such, the discussion in Chapter 17 regarding cultural values is focused on presenting information shared by Indigenous communities engaged on the Project and does not assign residual effects characterizations. The inclusion of 'N/A' in the characterization categories is not meant to imply that there is no effect, but rather that this particular potential effect was not considered in the way that other potential effects are considered by other VCs. **Gordon and MacLellan Sites** Changes to the environment resulting from the Project that have the potential to affect cultural values associated with Current Use include those that may interfere with cultural transmission through the experience of traditional practices. Any such practices that occur in the LAA may be indirectly affected by sensory disturbances including noise, light, and dust. Change in access to Current Use areas may also contribute to effects on transmission of cultural values through increase in travel time and distance or increased inconvenience of access.	**5(1)(c)(ii)** **5(1)(c)(iii)**	**C**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**Not applicable**
				O	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	
				D	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	
Valued Component: Human Health													
Change in Human Health • Inhalation of contaminants of potential concern (COPC) emissions in air • Ingestion and dermal contact with COPC in soil due to Project emissions. • Ingestion of COPC in surface water due to Project emissions.	**Construction, Operation and Decommissioning/ Closure** Mitigation measures include: • The use of dust suppressants (e.g., water and chemical), dust collectors (e.g., baghouse and wet scrubbers at crushers) and dust enclosures at mill feed conveyors and storage areas. • An Air Quality Management Plan.	**Gordon and MacLellan Sites** The Project will have residual effects on human health in the Gordon region and MacLellan region during the construction, operation, and decommissioning phases. Human health risks are predicted to increase in both the Gordon and MacLellan regions of the Project and therefore, the residual effects are considered to be adverse. However, the magnitudes of these increases are considered negligible in the Gordon region and the MacLellan region. Project residual effects on human health will be limited to the LAA/RAA.	**5(1)(c)(i),** **5(2)(b)(i)**	**C**	**A**	**N**	**LAA, RAA**	**LT**	**N/A**	**C**	**I**	**D**	**Not significant**
				O	**A**	**N**	**LAA, RAA**	**LT**	**N/A**	**C**	**I**	**D**	
				D	**A**	**N**	**LAA, RAA**	**LT**	**N/A**	**C**	**I**	**D**	

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Change in Human Health • Ingestion of COPC in backyard produce, traditional plants, wild meat, and fish due to Project emissions and uptake of COPC from soil, water and/or tissue. • Ingestion and dermal contact with COPC in sediment due to Project emissions.	• Water management including surface water runoff control practices, diversion of freshwater away from the Project by designing culverts and ditches, management of contact water (by construction of collection pits, ponds, ditches and culverts), installation of groundwater interceptor wells and dewatering ditches, and progressive rehabilitation (e.g., placement of vegetated soil cover) to reduce infiltration into overburden and stockpiles.	The predicted changes in human health risk are related to changes in metal concentrations in environmental media (soil and water). Increases in metal loadings to these media would be permanent and therefore, the duration of the effects on human health risk is considered to be long-term (permanent) and irreversible. Changes in human health risk associated with inhalation exposures to NO_2 are associated with Project activities and would only occur during Project operations and thus would to be reversible and short-term. The Gordon and MacLellan regions are pre-existing mine sites and thus, the ecological and socio-economic context for residual effects on human health is considered to be disturbed.	see above										
Valued Component: Indigenous Peoples													
Indigenous Health Conditions Considered: - **Change to current use of lands and resources for traditional purposes** - **Change to human health**	**Construction, Operation and Decommissioning/ Closure** **Current Use of Land and Resources for Traditional Purposes and Human Health** • Avoidance through Project design (for plant harvesting sites). • Avoidance through timing of Project activities and potential scheduling of construction during periods of lower sensitivity and during periods of least effect. • Incorporation of plant species of interest to Indigenous communities into rehabilitation plans where appropriate and technically feasible. • Use signage for changes in access. • Ongoing engagement with Indigenous communities regarding their concerns, mitigation of potential Project effects on TLRU, and potential monitoring opportunities. • Design for implementation of work schedules for Project construction workers (12 hours per day, seven days per week) will deter workers from hunting and fishing locally outside of working hours during a shift.	**Gordon and MacLellan Sites** Although some alteration of behavior will be required to continue harvesting country foods, there will not be a long-term loss of availability of traditional use resources or access to lands relied on for harvesting country foods. Exposures for most chemicals of potential concern are not expected to exceed regulatory thresholds. Where exceedances are predicted, they existed prior to the Project at baseline conditions, and are expected to be infrequent. The predicted exceedances in inhalation exposures are based on single events and do not represent continuous exposures that would represent potential concerns for Indigenous health. Audible noise levels from the Project are not expected to exceed provincial guidelines or result in an increase that could affect Indigenous health and wellbeing. The PDA and Indigenous Health Conditions LAA have been previously disturbed by mining activity and the anticipated change to noise disturbance is likely to be incremental.	**5(1)(c)(i)**	**C O D**	**A**	**M**	**LAA**	**LT**	**A**	**IR**	**I/R**	**D**	**Not significant**

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Indigenous Health Conditions continued	• Development and implementation of Project-specific environmental management and monitoring plans, and discussion with Indigenous communities regarding these plans. • Implementation of additional mitigation measures outlined for Vegetation and Wetlands, Fish and Fish Habitat, Wildlife and Wildlife Habitat, and Land and Resource Use VCs. Indigenous Communities Recommendations and Requests for Mitigation • Marcel Colomb First Nation recommends cultural sensitivity training for contractors and monitoring of vegetation clearing by an Elder. • Manitoba Metis Federation indicated that a clear closure plan needs to be put in place to ensure potential social, economic, and environmental impacts from the mine closure upon decommissioning are avoided.	see above											
Indigenous Socio-Economic Conditions **Considered:** - **Change to land and resource use** - **Change to community services, infrastructure, and well-being** - **Change to labour and economy**	**Construction, Operation and Decommissioning/ Closure** **Land and Resource Use, Community Services, Infrastructure and Well-being, Labour and Economy** • Alamos will engage local land and resource users (e.g., Indigenous guides), affected tenure holders (trappers), and the Town of Lynn Lake to address, to the extent possible, issues related to the removal and inaccessibility of lands and resources within the PDA at Project sites, including the restriction in use of the Gordon site access road. • Alamos will engage with local resource users (hunters, outfitters, trappers, anglers) and MCC Regional Officials to address to the extent possible the potential conflict, disturbance, or access restrictions to hunting, trapping, and fishing areas in the PDA, and availability of wildlife and fish resources.	**Gordon and MacLellan Sites** While Project construction may affect, restrict, or change the land base available for recreational activities, the Project will not result in wide degradation, restriction or disruption of present land and resource use activities. Land and resource use activities and production are predicted to continue at or near baseline levels. Residual effects to local services and infrastructure, including education, health care and emergency services, that could affect Indigenous socio-economic conditions are anticipated to be limited. Economic effects from the Project for Indigenous people are anticipated to be positive due to the potential for increased local spending by Project workers and increased employment opportunities for Indigenous peoples.	**5(1)(c)(i)**	**C O D**	**A, P**	**M**	**LAA**	**LT**	**A**	**C**	**R**	**D**	**Not significant**

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Indigenous Socio-Economic Conditions continued	• Alamos has been collaborating with Indigenous communities and will continue to work towards potential training and education partnerships with Manitoba Keewatinowi Okimakanak Inc, (MKO) the Northern Manitoba Sector Council (NMSC), and Atoskiwin Training and Employment Centre (ATEC) to provide opportunities for Indigenous people to obtain skills and training required for Project participation. • With Alamos's support, Marcel Colomb First Nation has previously facilitated activities intended to increase Indigenous cultural awareness for Project employees. Alamos will continue to engage with Marcel Colomb First Nation in supporting development and presentation of these activities and events. • Work schedules will be implemented for Project construction workers (subject to fly-in/fly-out employment) to deter workers from hunting locally outside of working hours during a shift. • Alamos will communicate the schedule of Project activities throughout the construction, operation, and decommissioning phases to affected Indigenous communities. • Development and implementation of Project-specific environmental management and monitoring plans, and discussion with Indigenous communities regarding these plans. • Design for site security services to help limit demands on the local police system. • Design for implementation of work schedules for Project construction workers (12 hours per day, seven days per week) that deter FIDO/DIDO workers from spending time off shift in local communities and accessing community recreation services and facilities outside of working hours as these services and infrastructure are relied upon by Indigenous and non-Indigenous residents.	see above										

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Indigenous Socio-Economic Conditions continued	• Implement standard construction procedures and a Traffic Management Plan to reduce traffic delays during construction. The Traffic Management Plan will be developed during ongoing planning and engineering design to address traffic staging to reduce delays. • Scheduling of alternating work shifts so that all workers do not arrive in and leave the area at the same time, will limit Project-related demands on both traffic and air services and infrastructure. • An accommodation camp will be put in place for construction, commissioning, and operation. • Provide bussing services between the temporary camp and the Gordon site. • Encouraging carpooling among locally resident construction and operation workers. • Schedule arrivals/departures of employee traffic to occur earlier than the existing observed a.m. peak hour for local traffic and later than the existing observed p.m. peak hour if needed. • Plan for workforce education to encourage healthy lifestyle choices, cultural sensitivity training and strict enforcement of Alamos' health and safety policies will also help mitigate adverse social effects. For example, such training would raise the level of awareness about the potential effects that workers can have on the community and their families through drug and alcohol use or other social concerns. • If during operation workers and their families relocate to Lynn Lake, Alamos will collaborate with the Town of Lynn Lake and surrounding Indigenous communities to discuss appropriate monitoring or management plans to address draws on services. • Alamos is in discussions with Manitoba Infrastructure regarding the need for upgrades to PR 391 and/or weight exception requirements to support the Project.	see above									

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Indigenous Socio-Economic Conditions continued	• Design to enhance potential positive effects by: – Posting of job qualifications in advance and identifying available training programs and providers so that local and Indigenous residents can acquire the necessary skills and qualify for potential Project-related employment. – Posting of Project purchasing requirements in advance so that Indigenous businesses can position themselves to effectively compete to supply goods and services needed for Project construction and operation. – Working with Indigenous communities to develop training programs oriented to Project operational needs. – Developing a plan for working with Indigenous-owned businesses to enhance their potential for successfully bidding on Project contracts regarding the supply of goods and services. Indigenous Communities Recommendations and Requests for Mitigation: • Marcel Colomb First Nation requested cultural sensitivity training for contractors and monitoring of vegetation clearing by an Elder. • Mathias Colomb Cree Nation indicated that the Granville Lake community was interested in training programs and training alliances. • Peter Ballantyne Cree Nation requested that Peter Ballantyne Cree Nation community members would be guaranteed employment as part of the Project. Peter Ballantyne Cree Nation also expressed interest in economic benefits/opportunities, commitments to employment, and training. Peter Ballantyne also expressed interest in partnerships that will be offered.	see above										

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Potential Effect	Mitigation Measures	Residual Effect	Area of Federal Jurisdiction CEAA, 2012	Project Activity	Residual Effects								Significance of Residual Effect
					Direction	Magnitude	Geographic Extent	Duration	Timing	Frequency	Reversibility	Ecological and Socio-economic Context	
Indigenous Socio-Economic Conditions continued	• Nisichawayasihk Cree Nation, O-Pipon-Na-Piwin Cree Nation, Manitoba Metis Federation, Hatchet Lake First Nation, and Sayisi Dene First Nation each expressed interest in workforce and business opportunities. Barren Lands First Nation indicated that the biggest positive outcome of the Project was job creation. • Manitoba Metis Federation requested the employment of Métis Nation monitors. • Manitoba Metis Federation expressed interest in potential economic development opportunities and in provision of construction services through Métis N4 Construction Inc. Manitoba Metis Federation also would like to discuss mandatory minimums for Indigenous procurement and suggested that contract work that goes out for tender needs to prioritize Métis-owned businesses. • Manitoba Metis Federation indicated that the hiring, retention, and support of local Métis citizens will be good for Métis community and families. • Manitoba Metis Federation indicated that a clear closure plan needs to be put in place so that potential adverse social, economic, and environmental from the mine closure are avoided.	see above											
Indigenous Physical and Cultural Heritage **Considered:** - **Change to heritage resources** - **Change to current use of lands and resources for traditional purposes**	**Heritage Resources and Current Use of Lands and Resources for Traditional Purposes** • Consideration of mitigation measures proposed by Indigenous communities. • Ongoing engagement with Indigenous communities regarding their concerns, mitigation of potential Project effects on traditional land and resource use, and potential monitoring. • Development and implementation of Project-specific environmental management and monitoring plans, and discussion with Indigenous communities regarding these plans. • Implementation of the HCRPP when heritage or cultural resources, or objects thought to be heritage or cultural objects, are exposed.	**Gordon and MacLellan Sites** Indigenous communities engaged on the Project have not identified Indigenous physical and cultural heritage sites that directly intersect Project components or physical disturbances. Unmitigated disturbance to, or destruction of, heritage sites in the Project PDA or unmitigated disturbance or destruction of a cultural area identified by Indigenous communities are not anticipated.	**5(1)(c)(ii)**	**C O D**	**A**	**L**	**LAA**	**LT**	**N/A**	**C**	**I**	**D**	**Not significant**

Legend Key: Project Activity: C – Construction; O – Operation; D – Decommissioning; **Direction:** P – Positive; A – Adverse; **Magnitude:** N – Negligible; L – Low; M – Moderate; H – High; **Geographic Extent:** PDA – Project Development Area; LAA – Local Assessment Area; RAA – Regional Assessment Area; **Duration:** ST – Short-term; MT – Medium-term; LT – Long-term; **Timing:** A – Applicable; N/A – Not Applicable; **Frequency:** S – Single; IR – Irregular; R – Regular; C – Continuous; **Reversibility:** R – Reversible; I – Irreversible; **Ecological/Socio-economic Context:** D – Disturbed; U – Undisturbed; R – Resilient: NR – Not Resilient

Table 20A-1 Summary of Potential Environmental Effects, Residual Effects and Significance

Potential Effect	Mitigation Measures	Residual Effect	Area of Federal Jurisdiction CEAA, 2012	Project Activity	Residual Effects								Significance of Residual Effect
					Direction	Magnitude	Geographic Extent	Duration	Timing	Frequency	Reversibility	Ecological and Socio-economic Context	
Indigenous Physical and Cultural Heritage continued	• Protective barriers placed around heritage resource sites that are inadvertently found during construction so that the area can be protected while work proceeds. • Evaluation by a professional archaeologist of PDA changes or added development components. • Controlled surface collection or salvage excavation of known heritage resource sites, or a portion thereof, that cannot be avoided. • Education of construction contractors for the appropriate protocols if heritage or cultural resources, or objects thought to be heritage or cultural resources, are discovered. • Training of staff in the recognition of archaeological features and objects such as precontact Indigenous material culture, and 19th and 20th century Euro-Canadian material culture. • Review the potential and documented historical use and occupation of the PDA and Indigenous physical and cultural heritage LAA with staff. • Construction monitoring by a professional archaeologist in areas that are heritage sensitive such as sites identified as being culturally sensitive by Indigenous engagement. • Potential for the hiring of Indigenous field support staff as part of an environmental monitoring team. • Implementation of the procedures identified in the HCRPP in the event of a suspected archaeological discovery. Indigenous Communities Recommendations and Requests for Mitigation • Marcel Colomb First Nation recommended protection for unmarked burials.	see above										

Legend Key: Project Activity: C – Construction; O – Operation; D – Decommissioning/Closure; **Direction:** P – Positive; A – Adverse; **Magnitude:** N – Negligible; L – Low; M – Moderate; H – High; **Geographic Extent:** PDA – Project Development Area; LAA – Local Assessment Area; RAA – Regional Assessment Area; **Duration:** ST – Short-term; MT – Medium-term; LT – Long-term; **Timing:** A – Applicable; N/A – Not Applicable; **Frequency:** S – Single; IR – Irregular; R – Regular; C – Continuous; **Reversibility:** R – Reversible; I – Irreversible; **Ecological/Socio-economic Context:** D – Disturbed; U – Undisturbed; R – Resilient: NR – Not Resilient

Appendix 20B SUMMARY OF KEY MITIGATION, COMMITMENTS AND FOLLOW-UP MONITORING

Table 20B-1 Summary of Key Mitigation, Commitments and Follow-up and Monitoring

Valued Component	Key Mitigation/Commitments	Follow-up and Monitoring
Atmosphere	Mitigation measures will be implemented for the management and reduction of diesel exhaust emissions from off-road equipment and vehicles during construction and operation at the Gordon and MacLellan sites. • Engines and exhaust systems will be properly maintained to keep construction and mining equipment in good working condition. • The concentration of sulphur in diesel fuel shall not exceed 15 milligrams/kilogram (mg/kg), as per the Sulphur in Diesel Fuel Regulations (ECCC 2002). • Haul trucks and vehicle idling times will be reduced to the extent possible to reduce emissions. • Cold starts will be limited to the extent possible to reduce emissions. Mitigation measures will also be implemented for the management and reduction of fugitive dust emissions from construction and mining activities at the Gordon and MacLellan sites. • On-site haul roads and access roads will be maintained in good condition, with regular inspections to monitor loose dust on the roads. • During dry periods, water will be applied to haul roads and access roads to mitigate dust emissions. The application of water will be limited to non-freezing temperatures to avoid icing that can present a safety hazard. Watering is most effective immediately after application, and repeated watering several times a day might be required, depending on surface and meteorological conditions. Watering of the haul roads will be implemented in the required quantity and frequency to achieve 75% control efficiency of dust emissions from haul roads and access roads. • Chemical dust suppressants will be applied to haul roads as an alternative option to watering. Chemical dust suppression will be applied on an as-needed basis during high wind conditions or if measured ambient particulate matter (PM) concentrations are in exceedance of the Manitoba Ambient Air Quality Criteria (AAQC) and if an increase of watering is determined ineffective or unfeasible at the time. Examples of suppressants include chlorides, petroleum products, liquid polymer emulsions, and agglomerating chemicals. These suppressants, if required, will be applied, as per the manufacturer's recommendations, to preclude unintended environmental effects. • Haul truck speed on the on-site haul roads will be limited to 35 km/h (loaded) and 40 km/h (empty). Vehicle speed on the access roads will be limited to 40 km/h. • Track-out of PM material to Provincial Road (PR) 391 will be reduced by dust sweeping and truck wheel washing stations prior to entering PR 391. • Surfaces of topsoil and overburden stockpiles will be stabilized during extended periods between usage, by means of vegetating or covering the exposed surfaces. An ambient air monitoring program will be implemented that will include: • Meteorological monitoring (wind speed and wind direction) • Ambient PM monitoring (total suspended particles [TSP], PM_{10} and $PM_{2.5}$).	An Air Quality Management Plan (AQMP) will be created for Project construction and operation. The AQMP will specify the mitigation measures for the management and reduction of air emissions during Project construction and operation and the proposed ambient air quality monitoring program. Ambient air and meteorology monitoring will be implemented in conjunction with emissions mitigation to provide an understanding of the meteorological conditions and offsite concentrations and evaluate the need for more rigorous mitigation. Monitoring will include meteorological monitoring (wind speed and wind direction) and monitoring of ambient TSP, PM_{10} and $PM_{2.5}$ concentrations. The results of the ambient PM monitoring will be used to assess the effectiveness of the dust mitigation and to evaluate the need for more rigorous dust mitigation. If the monitoring program indicates that ground-level TSP, PM_{10} or $PM_{2.5}$ concentrations are greater than the Manitoba AAQC, additional mitigation measures to reduce PM emissions will be implemented. Given that fugitive dust from the haul roads is the largest source of PM emissions, more frequent road watering or an application of a dust suppressant will be implemented as an intervention mechanism.
Noise and Vibration	Mitigation measures will be implemented as needed to reduce potential noise effects during construction and operation at the Gordon and MacLellan sites. • Where possible, large stationary machinery (i.e., crushers) will be located inside buildings. • Fully enclosed conveyor will be used between buildings in processing plant. • Large transportation trucks will be used to reduce the number of trips. • Mobile equipment will have exhaust mufflers. • Work camp building walls and roof will include noise insulated panels. • Work camp building will include air conditioning system such that double pane windows and insulated doors can be closed during the summer season.	A noise monitoring program is proposed at the most affected receptor locations (temporary work camp, permanent work camp, receptor ID 73, and receptor ID 76) to monitor the effectiveness of Project mitigation measures. In addition to the outdoor noise monitoring, an indoor noise monitoring program is proposed at the temporary and permanent work camps. The indoor noise monitoring program will measure the indoor daytime and nighttime noise level to confirm the effectiveness of mitigation. A Vibration Monitoring Program is proposed at receptor IDs 73, 76, 85, and 86 to measure the vibration air overpressure level during a blast event. In the event that the measured values exceed the recommended limits, corrective actions including additional mitigation will be considered.

Table 20B-1 Summary of Key Mitigation, Commitments and Follow-up and Monitoring

Valued Component	Key Mitigation/Commitments	Follow-up and Monitoring
Noise and Vibration	• Reduce idling of heavy fleet vehicles when not operating. Mitigation measures will also be implemented as needed to reduce potential blast-related vibration effects during blasting operation at the Gordon and MacLellan sites. • Highest explosive per time delay will not exceed 207.9 kilograms (kg) • Only one hole/delay will be fired in the blast • Minimum time delay between holes in blasts will not be less than 8 milliseconds (ms). Specific blast design mitigation measures for receptor ID 76 and ID 73 near the Gordon site are: • The reduced blast charge of 43 kg can be increased if the distance between the blast and closest receptor ID 76 and ID 73 is more than 1,430 m and 2,170 m (distance based on receptor location to pit boundary), respectively. • The reduced blast charge of 43 kg can be increased if monitoring results indicate air overpressure level below 120 decibels (dBL) at ID 76 and ID 73. • Engagement with Marcel Colomb First Nation to discuss the potential of a seasonal mitigation approach, which relaxes the reduced blast charge of 43 kg during off-season period when trapping activities at receptors (ID 76 and ID 73) is not expected. Specific mitigation measures for the Permanent Worker Camp with the MacLellan site are as follows: • The reduced blast charge of 85 kg can be implemented initially to achieve the overpressure level of 125 dBL at the Permanent Worker Camp. • Reduced blast charge of 85 kg can be increased if monitoring results indicate air overpressure level below 125 dBL at Permanent Worker Camp and there is no annoyance complaints. • Reduced blast charge of 85 kg can be increased if the distance between the blast Permanent Worker Camp is more than 800 m. • Blasting will be scheduled during shift change (e.g. less worker sleeping and more local activities) to reduce potential annoyance at the Permanent Worker Camp.	
Groundwater	Mitigation measures will be implemented to avoid or reduce effects to groundwater as follows: • Limit construction footprint (i.e., PDA) to the extent possible to reduce the potential for reductions in groundwater recharge and limit the number of watersheds overprinted by the PDA. • Use standard management practices throughout the Project, including drainage control and excavation and open pit dewatering. • Use standard construction methods, such as seepage cutoff collars, where trenches extend below the water table to mitigate preferential flow paths. • Return water generated from the Gordon site groundwater interceptor wells (with treatment as required) to Gordon and Farley lakes during operations and a portion of closure to offset a reduction in groundwater discharge. • Design material rock storage areas (MRSAs) to increase the amount of runoff and reduce the amount of infiltration through the MRSAs, thereby reducing the recharge and loading to groundwater. • Install contact water collection ditches around the overburden storage area, ore stockpile and MRSAs to collect toe seepage and groundwater recharge from these Project components. • Install seepage collection ditches around the tailings management facility (TMF) to collect seepage from the TMF dam and groundwater recharge originating from the TMF. • Monitor groundwater levels in monitoring wells to document changes in water levels and flow in response to dewatering of the open pits and changes in recharge due to Project components. Monitor using a combination of manual and automated monitoring methods with the frequency and approach modified throughout the life of the Project. During initial periods of monitoring, automated monitoring will be implemented to confirm initial water level responses to dewatering. As effects on levels are confirmed, monitoring may be transitioned to manual methods or discontinued at locations where no effects are observed.	Although there are no groundwater well users within the LAA/RAA at either the Gordon or MacLellan sites where effects on groundwater are anticipated, Alamos will develop a follow-up and monitoring program to monitor groundwater levels and groundwater quality at key Project locations. Monitoring data from these locations will be used to verify and confirm the anticipated effects identified in the groundwater flow model and to meet regulatory requirements related to specific permits or conditions of approval. During operation, a detailed groundwater monitoring program will be implemented for each site, building on the baseline monitoring program, to confirm potential changes in groundwater associated with mine operations. The EIS follow-up and monitoring program for groundwater will be developed based on regulatory requirements for both quantity and quality. During closure, the groundwater monitoring program for each site will be continued to document the recovery in groundwater levels as the open pit fills. Monitoring for each site will be comprised of the following key elements: • Monitoring wells at select locations around the open pit to monitor groundwater levels during construction, operation, and closure as the open pit is dewatered during construction and operation and subsequently recovers during closure. • Monitoring wells/drive point piezometers in the vicinity of, but not limited to, Susan Lake, Gordon Lake, and Farley Lake at the Gordon site and the Keewatin River, Keewatin River Tributary, Minton Lake, and the Payne Lake Tributary at the MacLellan site. The monitoring wells/drive point piezometers will be used to collect groundwater levels during construction, operation, and closure to monitor the effects on groundwater levels due to open pit dewatering and recovery during closure. • Monitoring wells upgradient, cross gradient, and downgradient of the TMF (the MacLellan site only) and MRSAs will be established to collect groundwater levels and water quality during construction, operation, and closure to document changes to groundwater levels and flow and groundwater quality.

Table 20B-1 Summary of Key Mitigation, Commitments and Follow-up and Monitoring

Valued Component	Key Mitigation/Commitments	Follow-up and Monitoring
Groundwater	• Monitor groundwater quality to document the effects of changes in groundwater quality associated with the Project components. Select monitoring locations near the immediate source area to confirm the quality of water infiltrating to the groundwater system and down gradient of the seepage collection ditches. The monitoring locations immediately down gradient of the Project component and seepage collection ditches will be used as trigger monitoring location to identify the need for adaptive management. • Monitoring locations will be maintained until the location is no longer required. If a monitoring location/station is no longer required but is identified as part of a regulatory approval, it will only be removed from the monitoring program once the required amendments are approved. • Monitor groundwater levels (monthly or continuous depending on location) and water quality (annually) in monitoring wells upgradient, cross gradient, and downgradient of the MRSAs and TMF to monitor for changes in groundwater quality and flow regime due to Project development. Monitor groundwater levels (monthly or continuous depending on location) and water quality (annually) in background monitoring wells.	• Groundwater quality samples from monitoring wells will be monitored in spring, summer, and fall during construction, operation and closure with the frequency progressively reduced based on monitoring results and Project phase. Winter groundwater sampling is not feasible as, based on the baseline data, the monitoring wells are generally frozen and not possible to sample. Groundwater quality samples will be analyzed for general chemistry and select dissolved metals. • Follow-up monitoring results will be compared with applicable regulatory standards set out in the Guidelines for Canadian Drinking Water Quality (GCDWQ), Manitoba Water Quality Standards, Objectives, and Guidelines (MWQSOG), Canadian Water Quality Guidelines – Freshwater Aquatic Life (CWQG-FAL), and the Ontario Ministry of the Environment Aquatic Protection (GW3) criteria and Project-specific regulatory approvals. Groundwater monitoring locations will be reviewed at regular intervals. Monitoring locations/stations may be added or removed from the monitoring program in accordance with their utility in monitoring the effects of the Project on the environment. Monitoring locations will be maintained until the location is no longer required. If a monitoring location/station is no longer required but is identified as part of a regulatory approval, it will only be removed from the monitoring program once the required amendments are approved. Chapter 23 provides additional information on Environmental Management and Monitoring Programs.
Surface Water	Surface Water Quantity (both sites) • Establish surface water quantity monitoring program prior to onset of construction activities. • During Year 1 of the Project, extraction of freshwater from the Keewatin River for process make-up water, potable water, and other water uses will not exceed 10% of instantaneous stream discharge. Surface Water Quality Gordon Site • Design of water management facilities to collect and treat (as required) contact water such that effluent meets applicable federal and provincial regulatory requirements, including the authorized limits of deleterious substances specified in Schedule 4 of the MDMER (amended), prior to discharge to the environment. • Transporting domestic waste to the sewage treatment plant at the MacLellan site • Aerating Wendy and East pits to encourage precipitation of elements that form oxides (e.g., iron oxide) and to break down of thermal stratification prior to dewatering. • Aerating groundwater from groundwater interceptor wells to encourage precipitation of elements that form oxides (e.g., iron oxide) and to increase dissolved oxygen concentrations prior to discharge to Gordon and Farley lakes • Dust suppression measures for exposed ground areas of the PDA, to reduce atmospheric deposition to surface water. • Sediment and erosion control measures during construction to limit the release of TSS and turbidity. • Expediting the re-filling of open pits during closure to reduce exposure of pit walls. • Treating and handling of building material that is used in water to avoid the release or leaching of substances that would reduce water quality. MacLellan Site • Design of water management facilities to collect and treat (as required) surplus contact water such that effluent meets applicable federal and provincial regulatory requirements, including the authorized limits of deleterious substances specified in Schedule 4 of the MDMER (amended), prior to discharge to the environment. • Designing the TMF with two cells to allow progressive development during operations to reduce freshwater requirements. • Operating the TMF as a non-discharging facility during operation through decommissioning and active closure. • Recycling water between the TMF and the processing facility to the maximum extent possible during operations to reduce freshwater make-up requirements. • Implementing passive treatment options (e.g., controlled pit stratification, fertilizer amendment, flow segregation) in the open pit should monitoring show that pit water quality is not suitable for release to the environment during the approximately 20 years anticipated to fill the open pit with contact water at the conclusion of mine operations.	Surface water monitoring throughout the life of the Project based on the Surface Water Monitoring and Management Plan. Surface Water Quantity: • Provide a framework for monitoring surface water quantity in near-field, far-field, and reference sites at both sites, and lake level and stream flow monitoring at baseline locations (modified to focus on areas of potential effects) in accordance with regulatory requirements. • Outline standard management practices for drainage control, dewatering, control of site runoff and seepage, contact-water collection, storage, and reuse, tailings management, water management facilities for collection and treatment, maintenance of drainage patterns and works, progressive rehabilitation to address infiltration and evapotranspiration capacity, and open pit filling at closure and post-closure. Surface Water Quality: • Provide a framework for monitoring surface water quality in near-field, far-field, and reference sites at both sites, and lake level and stream flow monitoring at baseline locations (modified to focus on areas of potential effects) in accordance with regulatory requirements. • Outline standard management practices for drainage control, dewatering, control of site runoff and seepage, contact-water collection, storage, and reuse, tailings management, water management facilities for collection and treatment, maintenance of drainage patterns and works, progressive rehabilitation to address infiltration and evapotranspiration capacity, and open pit filling at closure. Management plans that may pertain to source(s) of identified surface water POPCs include: • The Mine Rock Management Plan (MRMP to guide the handling, storage, and management of mine rock for the Project. The MRMP will outline procedures and test methods to classify the acid rock drainage and metal leaching (ARD/ML) potential and geochemical properties of the materials. • The Groundwater Monitoring Plan to provide a framework for monitoring potential changes in groundwater quantity and quality in relation to the Project. • The Erosion and Sediment Control Plan to provide environmental protection measures for the aquatic environment and protect watercourses and wetlands from the experiencing effects from mobilization of sediment. • In accordance with MDMER, an Environmental Effects Monitoring Plan (EEMP) will be developed to address the potential treatment of discharge water, and to plan Project-specific details for monitoring and reporting as required under the MDMER.

Table 20B-1 Summary of Key Mitigation, Commitments and Follow-up and Monitoring

Valued Component	Key Mitigation/Commitments	Follow-up and Monitoring
Surface Water	• Using a closed circuit for cyanide use and cyanide destruction in the tailings processing plant (via Air/SO_2 oxidation and precipitation of metals) to reduce cyanide concentrations in tailings slurry prior to release of the slurry for storage in the TMF. • Constructing groundwater cut-off ditches to reduce groundwater seepage from the TMF reaching Minton Lake • Treating domestic waste in an average 60,000 L/day sewage treatment plant so that it meets "Wastewater Systems Effluent Regulations" under the *Fisheries Act* prior to discharge to the Keewatin River via a pipeline and diffuser.	• The Conceptual Closure Plan will also include monitoring plans for surface water quality and aquatic elements as follows: o Water chemistry monitoring – surface water monitoring (pit lake water, TMF sediment pond, receiving waterbodies and watercourses upstream and downstream of discharge flows); groundwater monitoring (around open pits, in vicinity of Gordon and Farley lakes and Keewatin River, and monitoring wells upgradient and downgradient of TMF, mine rock storage areas, and other material stockpiles); and water quality (general parameters, anions, metals). • Aquatic monitoring – Environmental Monitoring and Management Plans (EMMPs) will be prepared for the aquatic and terrestrial environments as the Project progresses. The EMMPs will include monitoring programs to assess the effectiveness of the mitigation measures related to revegetation and the establishment of wildlife/fish habitat.
Fish and Fish Habitat	Common Mitigation Measures • Sizing new culverts to convey the 1:100-year flood and using open-bottom structures where practical to maintain fish habitat values and fish passage. • New road crossings will be sized and installed following Manitoba Infrastructure guidelines (DFO and MNR 1996). • Designing open pit outlets so they are impassable to fish, to discourage fish from colonizing open pits in post-closure. • Offsetting unavoidable habitat losses as described in the Fish Habitat Offsetting Plan (Chapter 23). • Limiting the construction footprint to the extent possible to reduce potential reductions in groundwater recharge, to limit the number of watercourses overprinted by the PDA, and to limit the number of extent of changes to catchment area runoff due to encroachment of the PDA into various watersheds. • Constructing upstream perimeter ditches to divert non-contact water around Project components, reporting to the original receiving environments. • Using groundwater seepage cutoff collars, where trenches extend below the water table, to mitigate preferential flow paths. • Collecting groundwater seepage from underground/open pit dewatering. • Pumping excess water to collection ponds as needed. • Maintaining existing drainage patterns to the extent possible with the use of culverts. • Refilling open pits with contact water at closure to return groundwater levels to near baseline conditions. • Grading perimeter and access roads to divert runoff away from the open pits and fish-bearing waterbodies. • Maintaining access roads by periodically regrading and ditching to improve water flow and reduce erosion. • Using dust suppression measures for exposed ground areas within the PDA during dry periods as necessary to reduce dust deposition to surface waters. • Constructing non-contact water ditches upslope of overburden stockpiles, MRSAs, ore stockpiles, mine infrastructure and the TMF to reduce contact water volumes. • Constructing contact water collection ditches around the MRSAs, overburden stockpiles, and ore stockpiles to convey the 1:25-year storm event to collection ponds. • Constructing contact water collection ponds to contain (without discharge) run-off from a 1:100-year storm event with active storage that considers maximum ice thickness in winter. • Designing collection pond inlets and outlets to reduce water velocities, scour (erosion of sediment) and pond stratification potential (chemical or thermal). • Maintaining culverts in access road crossings to remove accumulated material and debris to reduce erosion, flooding, and sediment mobilization.	• Compliance and effectiveness monitoring in offsetting habitats. If the monitoring program indicates that the constructed or restored habitats are not functioning, remedial actions or additional offsets would be considered. • Lake level monitoring described in the Surface Water Monitoring and Management Plan. Monitored lakes will include, but not be limited to, Gordon Lake, Farley Lake, and Minton Lake. • Stream flow monitoring as described in Surface Water Monitoring and Management Plan. Monitored watercourses will include, but not be limited to, Farley Creek and the Keewatin River downstream of the MacLellan site. • Develop a fish and fish habitat monitoring plan with engagement with local First Nations, DFO, and MCC. • Environmental monitoring during construction and operation to follow-up on the Erosion and Sediment Control Plan. • Surface water quality monitoring at both sites, described in the Surface Water Monitoring and Management Plan. • Developing monitoring plans related to sources of POPCs that can affect water quality such as the Mine Rock Management Plan, Groundwater Monitoring Plan, Erosion and Sediment Control Plan. • Developing an Environmental Effects Monitoring Plan, which is required under the MDMER when there is discharge or seepage of mine water to the aquatic environment and includes monitoring for effluent and water quality, benthic invertebrate communities, and fish health and population studies at reference sites and at site(s) downstream of the discharge point(s).

Table 20B-1 Summary of Key Mitigation, Commitments and Follow-up and Monitoring

Valued Component	Key Mitigation/Commitments	Follow-up and Monitoring
Fish and Fish Habitat	• Implementing erosion and sediment control measures during construction to reduce increases in total suspended solid (TSS) concentrations in lakes and streams. • Reclaiming overburden and MRSAs to reduce infiltration rates. • Filling the open pits at closure with contact water to reduce the duration of pit wall exposure and to return groundwater levels to baseline conditions. Gordon Mitigation Measures • Constructing a new diversion channel to convey surface run-off from Gordon Lake to Farley Lake • Trucking potable water to the Gordon Mine site from the MacLellan Mine site to limit the freshwater withdrawal requirements at the Gordon Mine site to those needed for fire suppression, safety showers, and truck washes. • Constructing and operating groundwater interceptor wells on either side of the open pit to capture and return groundwater and surface water to Gordon and Farley Lakes that would otherwise flow into the open pit. • Directing contact water from the collection ditches around the MRSA, overburden stockpile, and mine infrastructure to the open pit during closure to reduce the filling period. • Continuing to operate the groundwater interceptor wells during closure while the open pit fills with water and progressively reducing their pumping rates until the water level in the open pit reaches the elevation of the surrounding groundwater table. • Constructing a new diversion channel prior to the decommissioning of the existing diversion channel between Gordon and Farley lakes to maintain water levels. • Aerating Wendy and East pits to encourage precipitation of elements that form oxides (e.g., iron oxide), to break down of thermal and chemical stratification, and to increase dissolved oxygen concentrations prior to dewatering. • Installing and operating groundwater interceptor wells between the open pit and Gordon Lake and Farley Lake to maintain water levels in Gordon and Farley lakes. • Aerating groundwater from the interceptor wells in collection ponds to encourage iron precipitation and increase dissolved oxygen concentrations prior to discharge to Gordon Lake and Farley Lake. • Transporting domestic waste to the sewage treatment plant at the MacLellan site. MacLellan Mitigation Measures • Restricting water withdrawal rates from the Keewatin River to <10% of instantaneous discharge at all times. • Collecting and conveying non-contact water to the collection pond for discharge to the Keewatin River during operation. • Implementing progressive rehabilitation (e.g., placement of soil cover and vegetation) to reduce water infiltration into the TMF. • Designing the TMF with two cells to allow progressive development and rehabilitation of the TMF during operation to reduce water management requirements. • Recycling water between the processing facility and the TMF to reduce freshwater requirements from the Keewatin River during operation. • Directing water from the TMF and MRSA to the open pit during closure to reduce the filling period. • Constructing contact water collection ditches around the TMF to convey the 1:25-year storm event to the collection pond. • Pumping water from the existing underground works to the TMF for storage and eventual use in the processing facility. • Designing the TMF with two cells to allow progressive development during operation to reduce water management requirements. • Operating the TMF as a non-discharging facility during operation through reclaiming TMF water for use in the ore processing mill.	

Table 20B-1 Summary of Key Mitigation, Commitments and Follow-up and Monitoring

Valued Component	Key Mitigation/Commitments	Follow-up and Monitoring
Fish and Fish Habitat	• Recycling water between the TMF and the mill to the maximum extent possible during operation to reduce freshwater make-up requirements. • Using a closed-circuit for cyanide use and cyanide destruction (via Air/SO_2 oxidation and precipitation of metals) to reduce cyanide concentrations in tailings slurry prior to release of the slurry for storage in the TMF. • Constructing groundwater cut-off ditches to reduce the volume of groundwater seepage from the TMF entering Minton Lake post-closure. • Treating domestic waste in an average 60,000 L/day sewage treatment plant so that it meets “Wastewater Systems Effluent Regulations” under the *Fisheries Act* prior to discharge to the Keewatin River via a pipeline and diffuser. • Implementing progressive rehabilitation (e.g., placement of soil cover and vegetation) to reduce infiltration into the TMF at closure. • Implementing passive treatment options (e.g., controlled pit stratification, fertilizer amendment, flow segregation) in the open pit should monitoring show that pit water quality is not suitable for release to the environment during the approximately 20 years anticipated to fill the open pit with water at the conclusion of operation. Fish and Fish Habitat Measures • Limit disturbance areas around waterbodies to maintain existing riparian vegetation and promote recovery of riparian vegetation by marking buffer zones around sensitive habitats and work areas; using existing access routes; reducing soil compaction by using weight-distributing materials under machinery. • Maintain fish passage by avoiding obstructing watercourses or otherwise interfering with fish movement. • Requiring all heavy machinery working near water to be kept in good working condition, to be re-fueled no closer than 50 m from any waterbody or watercourse, and to be filled with biodegradable hydraulic fluids. • Identifying and flagging riparian zones within which heavy machinery is prohibited from entering. • Limiting in-water works to outside of the northern Manitoba Restricted Activity Timing Windows for the Protection of Fish and Fish Habitat (DFO 2020b) as practical. • Isolating in-water work areas and conducting fish rescues prior to dewatering, including East Pond at the MacLellan site, Wendy and East pits at the Gordon site, the Diversion Channel at the Gordon site, and any other locations where instream construction will be required. • Implementing runoff, erosion, and sediment control measures to reduce the amount of water available to become sediment laden, the amount of sediment that is mobilized through erosion, and the amount of sediment that is conveyed to waterbodies. Additional details are available in Erosion and Sediment Control Plan. The final plan will include the measures listed in the Measures to Protect Fish and Fish Habitat (DFO 2019). • Monitoring the effectiveness of construction management plan mitigation measures during construction activities near water, including total suspended solids and/or turbidity and comparing measured valued to MWQSOG (2002) and CCME (2002b) guidelines. • Using a heat exchanger to heat or cool water from Wendy Pit and East Pit prior to discharge to Farley Lake during construction and water from the groundwater interceptor wells prior to discharge to Gordon and Farley lakes to maintain the temperature regime in both lakes so as not to negatively affect primary and secondary production rates and alter important behavioral cues for fish (i.e., spawning and overwintering cues). • Installing screens on the water intakes that are sized using DFO’s “Interim Code of Practice: End of Pipe Fish Protection Screens for Small Water Intakes in Freshwater” (DFO 2020a). The screens will be sized based on the weakest swimming fish species in the Keewatin River (burbot, an anguilliform swimming species) and Farley Lake (white sucker and yellow perch, two subcarangiform swimming fish species).	

Table 20B-1 Summary of Key Mitigation, Commitments and Follow-up and Monitoring

Valued Component	Key Mitigation/Commitments	Follow-up and Monitoring
Fish and Fish Habitat	• Restricting water withdrawal rates to <10% of the instantaneous discharge of the Keewatin River at all times. • Limiting the size, timing, and setback distances of blasting charges to avoid percussive injuries to fish or damage to incubating eggs. Blasting protocols tailored to the Gordon and MacLellan sites and their fish species assemblages will be developed during Project permitting, using guidance outlined in the "Guidelines for the Use of Explosives In or Near Canadian Fisheries Waters" (Wright and Hopky 1998). Establishing and enforcing a worker code-of-conduct for employees brought into work at the LLGP that would limit potential over-fishing of lakes, stream, and rivers in the Project area (e.g., restricting fishing in lakes of streams of a specific size, those used by local First Nations for subsistence or traditional purposes, or determined to contain already depressed populations by Manitoba Conservation and Climate).	
Vegetation and Wetlands	Mitigation measures will be implemented as follows: • Effects to fragmentation will be mitigated at both the Gordon and MacLellan sites during construction and operation through restriction of construction activity to the approved PDA. • Equipment will arrive at Project site clean and free of soil and vegetative debris. Equipment will be inspected and if deemed to be in appropriate condition, will be approved for use and identified with a suitable marker or tag. Equipment that does not arrive at the Project site in appropriate condition will not be allowed on the construction footprint until it has been cleaned, re-inspected and deemed suitable for use. • Sensitive areas, such as wetlands, will be buffered by 30 m and clearly marked prior to clearing. • Silt fencing will be installed and maintained to reduce deleterious substances from entering adjacent to wetlands or waterbodies. • Vegetation clearing will occur during dry and frozen conditions. If clearing must occur in non-ideal conditions, construction matting will be used. • A native seed mix will be used to assist in reducing invasive plant species spread and establishment as well as for erosion control on exposed soils. • Topsoil and subsoil piles will be monitored for invasive plant species growth during construction and corrective measures (e.g., spraying, mowing, hand-pulling) will be implemented to avoid growth and establishment. • Certified No.1 seed will be used to reseed areas, unless Certified No. 1 seed is not available for selected reclamation species (i.e., native species). • Unless a certificate of weed analysis can be provided, construction material sources used for supplies of sand, gravel, rock, straw and mulch will be visually inspected to determine whether they are free of invasive species propagules to the extent possible. If sources are suspected as having invasive species propagules, they should be sampled, and lab analyzed to determine whether they meet the requirements of the responsible regulatory agency prior to obtaining or transporting material to the Project site. If sampling cannot be completed, post construction monitoring for invasive species will be completed. • If pesticide is required, a pesticide use permit will be obtained under *The Environment Act* (Manitoba). • Native areas disturbed by the Project will be reseeded using a native upland seed mix; however, the tailings management facility will be partially capped and seeded with a reclamation seed mix. Approximately 75% of the tailings management facility will be capped, which will be subject to confirmation of capping material availability during detailed design. • Avoiding known occurrences of species of conservation concern (SOCC). If avoidance of plant SOCC is not possible, seed collection or transplant of the plant should be considered. • Herbicide will not occur within 30 m of plant species or ecological communities of conservation concern, wetlands, or waterbodies. Spot-spraying, wicking, mowing, or hand picking are acceptable measures for control of regulated weeds in these areas. • Dust suppression, as described in Chapter 6 will be applied. • Grading will be directed away from wetlands, where possible. • The removal of vegetation in wetlands will be reduced to the extent possible. • Ground level cutting/mowing/mulching of wetland vegetation instead of grubbing will be conducted, where possible. • Grading within wetland boundaries will be reduced unless required for site specific purposes.	Monitoring of soil stockpiles for regulated weeds during construction and operation will be conducted annually during the growing season. Intervention mechanisms, (e.g., spraying and hand-pulling) will be implemented where necessary to control instruction and spread of regulated weeds. Post reclamation monitoring will be completed five years after revegetation to determine revegetation success. Re-vegetation success issues identified during monitoring will be addressed by applying supplementary mitigation measures, such as reseeding and regulated weed mitigation. Reclaimed areas will be considered successfully reclaimed when re-vegetation is assessed to be composed of mostly native species that are self-sufficient. Soil stockpiles will be monitored during construction and operation. Post reclamation re-vegetation success monitoring will be conducted to facilitate self-sufficient re-vegetation post reclamation.

Table 20B-1 Summary of Key Mitigation, Commitments and Follow-up and Monitoring

Valued Component	Key Mitigation/Commitments	Follow-up and Monitoring
Vegetation and Wetlands	• A protective layer such as matting or biodegradable geotextile and clay ramps or other approved materials will be used between wetland root/seed bed and construction equipment if ground conditions are encountered that create potential for rutting, admixing or compaction. • Cross drainage will be maintained to allow water to move freely from one side of the road to the other in areas of permanent or temporary access roads. • Frost packing, snow, ice, geotextile swamp mats or access mat will be used for access through wet areas.	
Wildlife and Wildlife Habitat	Measures will be implemented to mitigate habitat loss or alteration as follows: • Design for limitation of construction footprint (i.e., PDA) to the extent practical. • Design for use of down-lighting, a technique of directing night lighting downward, to reduce light effects on wildlife adjacent to the PDA. • Design for maintenance of a 30 m naturally vegetated buffer around wetlands, waterbodies, and watercourses. • Design for restriction of unauthorized access to habitat adjacent to the PDA. • Design for provision of low areas in the ploughed snowbanks of access and on-site roads, where practical, to facilitate wildlife movements across and out of road corridors. • Design for scheduling vegetation clearing and site preparation activities outside the breeding period for migratory birds (Zone C7; May 7 to August 7; ECCC 2019b). If activities that could result in risk of harm cannot be avoided, Alamos will develop and implement a Project-specific Wildlife Monitoring and Management Plan that outlines how risk of harm will be managed in accordance with ECCC guidance. • Flag environmentally sensitive areas (e.g., seeps and springs, mineral licks, dens, roosts, stick nests, hibernacula) prior to clearing and construction, and evaluation of the features for additional mitigation measures (e.g., setbacks). • Retain actual or potential habitat trees where safe and technically feasible to do so. If removal is required, removal activities will be scheduled, to the extent practical, outside the core maternity roosting season for bats (May 1 to August 31; Fenton and Barclay 1980; Barclay 1982, 1984) and breeding season for birds (Zone C7; May 7 to August 7; ECCC 2019b). If habitat tree removal or general tree clearing is required during the maternity roosting period, a qualified biologist will review the trees to make a determination on occupancy before removal. This measure will also reduce the risk to other species that use trees for denning or shelter (e.g., American marten). • Maintain vegetation cover along the boundaries of high activity areas (e.g., access roads) to reduce sensory (noise and visual) disturbance. • Report the discovery of nests or other animal dwellings (e.g., lodges, dens) to Alamos, and appropriate action or follow-up will be guided by the Wildlife Monitoring and Management Plan. Report to the Wildlife and Fisheries Branch of the Department of Agriculture and Resource Development (DARD) for direction on follow-up actions, as necessary. • Demolish existing buildings and infrastructure outside of the nesting window for birds and the maternity roosting period for bats as per the Wildlife Monitoring and Management Plan. Measures will be implemented, where feasible, to manage and reduce wildlife mortality risk as follows: • Design for scheduling vegetation clearing and site preparation activities outside the breeding period for migratory birds (Zone C7; May 7 to August 7; ECCC 2019b). If activities that could result in risk of harm cannot be avoided, Alamos will develop and implement a Project-specific Wildlife Monitoring and Management Plan that outlines how risk of harm will be managed in accordance with ECCC guidance. • Flag environmentally sensitive areas (e.g., amphibian breeding ponds, dens, roosts, stick nests, hibernacula) prior to clearing and construction, and evaluation of the features for additional mitigation measures (e.g., setbacks). • Report the discovery of nests or other animal dwellings (e.g., lodges, dens) to Alamos, and appropriate action or follow-up will be guided by the Wildlife Monitoring and Management Plan. Report to the Wildlife and Fisheries Branch of DARD for direction on follow-up actions, as necessary.	A Wildlife Monitoring and Management Plan will be developed to implement mitigation measures, manage wildlife and wildlife habitat, comply with authorizations and approvals, and monitor and evaluate the effectiveness of wildlife mitigation measures with respect to predictions in the Environmental Assessment. Follow-up and Monitoring will consist of three phases: pre-construction surveys, construction monitoring, and post-construction monitoring. These activities will be designed to address each environmental effect listed in Section 12.3, Chapter 12 and to address the uncertainty in the prediction confidence regarding the presence of woodland caribou and bat hibernacula in the RAA. Woodland caribou monitoring will be incorporated into the Wildlife Mitigation and Monitoring Plan and developed in liaison with federal and provincial regulators. Follow-up and monitoring activities will be conducted using methods similar to those used during baseline studies to allow for comparison of results. Follow-up and monitoring may reveal the need to implement adaptive management strategies if mitigation measures are found to be less effective than predicted. Results of the ERA suggests that the ecological health risks related to the Project are negligible to low and further measures to mitigate potential risk specific to this ERA are not required. Future Case health risks in this ERA were calculated based on changes in COPC concentrations predicted for various media (e.g., air, soil, water). Management plans which include monitoring of various media will be developed to ascertain how the Project affects COPC concentrations in those media. The data from these monitoring programs will be used to determine if the Future Case concentrations used in ERA reflect actual concentrations and, by extension, if risk estimates are reflective of future conditions. As a result, there are no follow-up and monitoring activities for a change in wildlife health specific to the wildlife and wildlife habitat VC.

Table 20B-1 Summary of Key Mitigation, Commitments and Follow-up and Monitoring

Valued Component	Key Mitigation/Commitments	Follow-up and Monitoring
Wildlife and Wildlife Habitat	• Retain actual or potential habitat trees where safe and technically feasible to do so. If removal is required, removal activities will be scheduled, to the extent practical, outside the core maternity roosting season for bats (May 1 to August 31; Fenton and Barclay 1980; Barclay 1982, 1984) and breeding season for birds (Zone C7; May 7 to August 7; ECCC 2019b). If habitat tree removal or general tree clearing is required during the maternity roosting period, a qualified biologist will review the trees to make a determination on occupancy before removal. This measure will also reduce the risk to other species that use trees for denning or shelter (e.g., American marten). • Implement road safety measures such as speed limits and signage to reduce the chance for wildlife collisions both on-site and between sites. • Report wildlife encounters and problem wildlife concerns or sightings to Alamos and appropriate action or follow-up will be guided by the Wildlife Monitoring and Management Plan. • Follow best management practices for general site housekeeping to reduce wildlife attraction (e.g. food and chemical storage, prompt removal of roadkill). • Include wildlife awareness training during site orientation to reduce the risk of human-wildlife conflict. • Control site access by resource users during post-closure. • Demolish existing buildings and infrastructure outside of the nesting window for birds (Zone C7; May 7 to August 7; ECCC 2019b) and the maternity roosting period for bats (May 1 to August 31; Fenton and Barclay 1980; Barclay 1982, 1984) as per the Wildlife Monitoring and Management Plan. • Using a closed circuit for cyanide use and cyanide destruction in the tailings processing plant (via Air/SO_2 oxidation and precipitation of metals) to reduce cyanide concentrations in tailings slurry prior to release of the slurry for storage in the TMF. • Maintain cyanide concentrations below guidelines in the TMF. Project activities will be aligned with the standards of practice set out in the International Cyanide Management Code. • Manage vegetation around collection ponds and the TMF to deter wildlife and consider additional mitigation measures (e.g., fencing, netting, bird/bat deterrents) if monitoring identifies concerns regarding wildlife use of these areas. • Reduce potential migratory bird mortality by avoiding distribution line routing near high-risk collision areas (e.g., wetlands), where feasible, and enhancing line visibility, where appropriate (e.g., bird diverters). Measures will be implemented, where feasible, to mitigate effects on wildlife health as follows: • Project infrastructure and facilities designed to avoid sensitive areas (e.g., watercourses, important habitat types) to the extent possible, within watershed boundaries, and PDA reduced to the extent practical. • Design for control of fugitive dust emissions from roads, material handling, and storage areas/stockpiles through measures such as: application of dust suppressants (e.g., water); use of surfactants (as a contingency); dust sweeping; gravel application; truck wheel washing stations; and enclosure of dust sources. • Design for administrative controls, including a no idling policy to reduce emissions from vehicles and mobile equipment. • Design for adherence to applicable Transport Canada emission requirements for new mobile equipment on-site. • Design for use of perimeter berms and runoff and contact-water collection ditches around the overburden storage areas, ore stockpiles, and mine rock storage areas to collect overland flow and seepage, intercept groundwater flow, and divert non-contact water away from Project components. • Design for fuel storage in approved above ground storage tanks equipped with secondary containment systems in accordance with federal and provincial regulation and standards. • Design of sewage treatment plant and water management facilities to treat effluent to levels that will meet applicable federal and provincial guidelines of toxicity. • Employment of dust suppressants (e.g., water) in situations that have increased potential to generate dust. • Maintenance of on-site roads in good condition with regular inspections to monitor dust control effectiveness. • Conducting effective and timely equipment maintenance to keep mining vehicles and equipment in good working condition. • Disposal and handling of waste oils, fuels, and hazardous waste as recommended by the suppliers and/or manufacturers in compliance with federal, provincial, and municipal regulations. • Design for enclosure of mill feed storage area and use of dust collection/control systems (e.g., baghouse or equivalent and protective covers) at crushing plant to reduce potential dust emissions during ore transfer and crushing activities.	

Table 20B-1 Summary of Key Mitigation, Commitments and Follow-up and Monitoring

Valued Component	Key Mitigation/Commitments	Follow-up and Monitoring
Wildlife and Wildlife Habitat	• Design for use of high efficiency wet scrubbers (or equivalent) to control emissions from Project facilities, where feasible. • Design of water management facilities to collect and treat (as required) surplus contact water such that effluent meets applicable federal and provincial regulatory requirements, including the authorized limits of deleterious substances specified in Schedule 4 of the Metal and Diamond Mining Effluent Regulations (MDMER) (amended) prior to discharge into the environment. • Design for cyanide detoxification within the mill using the air/sulphur dioxide (SO_2) oxidation process resulting in the degradation of cyanide and precipitation of metals prior to discharge to the TMF. • Manage vegetation around collection ponds and the TMF (at MacLellan) and consider additional mitigation measures (e.g., fencing, netting, bird/bat deterrents) if monitoring identifies concerns regarding wildlife, including migratory bird use of these areas. Mitigation measures and regional initiatives to limit cumulative environmental effects on wildlife habitat, wildlife mortality risk, and wildlife health include: • Adherence to Project-specific Wildlife Monitoring and Management Plans. • Implementation of the Conceptual Closure Plan. • Continuation of the remote camera study in the RAA to monitor large mammal distributions. • Contribute to the identification and protection of critical habitat as part of existing and future federal and provincial SAR recovery strategies (i.e., woodland caribou). • Implement reclamation plans that involve revegetating/decommissioning new access trails/roads. • Use existing roads and trails where possible. • Implement road safety measures such as speed limits and signage to reduce the chance for wildlife collisions both on-site and between sites. • Implement measures to control access on mine access roads during the decommissioning/closure phase (e.g., gates). • Aerating existing pits at the Gordon site to encourage precipitation of elements that form oxides (e.g., iron oxide) and to break down thermal stratification prior to dewatering. • Design for control of fugitive dust emissions from roads, material handling, and storage areas/stockpiles through measures such as: application of dust suppressants (e.g., water); use of surfactants (as a contingency); dust sweeping; gravel application; truck wheel washing stations; and enclosure of dust sources. • Design for cyanide detoxification within the mill using the air/SO_2 oxidation process resulting in the degradation of cyanide and precipitation of metals prior to discharge to the TMF. • Operate the TMF as a non-discharging facility during operation through decommissioning/closure phases. • Optimization of haul roads and infrastructure to reduce transportation and haul distances. Optimization of the TMF to reduce the area of exposed dry surfaces to reduce the potential for windblown dust emissions.	
Labour and Economy	To enhance beneficial effects and mitigate adverse effects Alamos will: • Inform residents and Indigenous communities of job and procurement opportunities during all Project phases and implement a policy of local hire where priority is given to the workers from the LAA, followed by other parts of the RAA, other parts of Manitoba, and other parts of Canada. • Post job qualifications in advance and identify available training programs and providers so that local and Indigenous residents can acquire the necessary skills and qualify for potential Project-related employment. • Identify potential shortages of workers with specific skill requirements, and work with training and education facilities, Indigenous and local communities to increase opportunities for local community members to obtain training required for Project participation. • Require workers (not inclusive of summer students) 19 years and younger to have completed grade 12 or have an appropriate equivalency to prevent young people from leaving school prematurely.	No follow-up and monitoring programs are proposed.

Table 20B-1 Summary of Key Mitigation, Commitments and Follow-up and Monitoring

Valued Component	Key Mitigation/Commitments	Follow-up and Monitoring
Labour and Economy	• Workforce education to encourage healthy lifestyle choices, sensitivity training and strict enforcement of Alamos' health and safety policies. • Develop work packages that consider the capacity and capabilities of local and regional businesses and plan for working with local and Indigenous-owned businesses to enhance their potential for successfully bidding on Project contracts regarding the supply of goods and services. • Post Project purchasing requirements in advance so that local and regional businesses can position themselves to effectively compete to supply goods and services needed for Project construction and operation. • Design for completion of timber removal in accordance with *The Forest Act* of Manitoba. Work with local communities to develop training programs (e.g., contract opportunities) oriented to Project operational needs.	
Community Infrastructure, Services and Well-Being	Measures to mitigate effects for community services, infrastructure and well-being are as follows: • A work camp at the MacLellan site will accommodate workers during construction and operation. • During construction, first aid facilities will be supplied by the Engineering, Procurement, and Construction Management (EPCM) contractor. First-aid personnel will provide transport to Lynn Lake hospital when required. During operations, first aid facilities will be supplied by a dedicated first aid/mine rescue office in each of the site administration offices. Site security personnel will be trained as emergency medical services (EMS) first responders, and when required, provide transfer to Lynn Lake hospital. • Power, water, and wastewater treatment will be provided by Alamos and will not rely on resources within the Town of Lynn Lake. • Development of a Waste Management Plan. Because there will be a Project demand for landfill capacity for construction and non-hazardous domestic solid waste during operation, Alamos will liaise with planners in Lynn Lake regarding these needs and potential requirements for landfill expansion. • Mandatory safety orientations for all new employees. • Control of access to the PDA using a security gate and guard house, and by employing on-site security staff. • Site security services to help limit demands on the local police system. • Careful control of flammable material (such as fuels and explosives) on-site. • Training of Project personnel in fuel handling, equipment maintenance, and fire prevention and response measures. • Implementation of work schedules for Project workers (e.g., 12 hours per day, seven days per week) that deter fly-in fly-out/drive-in drive-out (FIFO/DIDO) workers from spending time off shift in local communities and accessing community recreation services and facilities outside of working hours. • Scheduling of alternating work shifts so that all workers do not arrive in and leave the area at the same time will limit Project-related demands on both traffic and air services and infrastructure. • Liaise with local emergency providers so that roles and responsibilities are understood, and that the necessary resources required to respond are in place. • Maintenance of fire prevention and suppression systems onsite, including water supplies, sprinklers, fire extinguishers and other firefighting equipment. • Workforce education to encourage healthy lifestyle choices, sensitivity training and strict enforcement of Alamos' health and safety policies. For example, sensitivity training would raise the level of awareness about the potential effects that workers can have on the community and their families through drug and alcohol use or other social concerns. • Access to Employee Assistance Program for Project personnel, and requirement for pre-employment physicals. • Development of cooperative protocols with responsible agencies to deal with access of Project personnel to emergency and other medical services. • Development and implementation of Project-specific environmental management plans and monitoring programs (see Chapter 23), including a Waste Management Plan that sets out procedures for reducing Project-related waste and limiting demands on local landfills. • Development and implementation of Project-specific Emergency Response and Spill Prevention and Contingency Plans will reduce the likelihood and severity of accidents and potential fires. • Upgrading and resurfacing the existing access roads to the MacLellan and Gordon sites.	Government departments, public agencies, and private-sector companies that deliver community services and infrastructure will monitor the ongoing demand for community services as part of their normal planning practices. No follow-up and monitoring program is required. Similarly, community wellbeing is monitored by Manitoba Health Seniors and Active Living (MHSAL) and the Northern Regional Health Authority (NRHA) as part of their service delivery and regular assessment of community wellbeing. For this reason and because the management of population health falls under the provincial government responsibility, no follow-up and monitoring program is required.

Table 20B-1 Summary of Key Mitigation, Commitments and Follow-up and Monitoring

Valued Component	Key Mitigation/Commitments	Follow-up and Monitoring
Community Infrastructure, Services and Well-Being	• Implement standard construction procedures and a Traffic Management Plan (see Chapter 23) to reduce traffic delays during construction. The Traffic Management Plan will be developed during ongoing planning and engineering design to address traffic staging to reduce delays. • Provide bussing services between the temporary camp and Gordon site. • Encourage carpooling among locally resident construction and operation workers. Schedule arrivals/departures of employee traffic to occur earlier than the existing observed a.m. peak hour for local traffic and later than the existing observed p.m. peak hour if needed.	
Land and Resource Use	Measures to mitigate effects for land and resource use are as follows: • The Project footprint will be limited to the extent possible (i.e., PDA) including site clearing and disturbance, access routes and distribution line right-of-way (ROW). • Existing access roads, trails and ROW will be used to the extent possible; access routes will be developed in compliance with provisions of *The Crown Lands Act* and *The Mines and Minerals Act.* • Project lighting will be limited to what is necessary for safe and efficient Project activities. Directional lighting will be used to limit the transmission of light outside of the PDA. Portable lighting equipment will be positioned to limit visibility at nearby receptors, to the extent feasible. • Installation of noise mitigation measures will be selected and installed as described in Noise and Vibration VC. • Signage will be installed around the PDA to alert local land and resource users of the presence of Project and its facilities. • Alamos will post warning signs on the access roads and distribution line ROW to discourage unauthorized access and snowmobiling due to safety concerns. • Alamos will implement traffic control measures which may include gating approaches to Project access roads, placing large boulders and/or gated fencing to restrict public access to the PDA. • Work schedules will be implemented for Project construction workers (subject to fly-in/fly-out employment) to deter workers from hunting locally outside of working hours during a shift. • Workers will be prohibited from bringing firearms and fishing gear to the sites while working to limit competition for wildlife and fish species of value to resource users. • Alamos will communicate the schedule of Project activities throughout the construction, operation, and decommissioning phases to affected local resource users and Manitoba Conservation and Climate (MCC) Regional Officials. • Alamos will engage with Town of Lynn Lake Municipality and provincial Crown land use permit holders to address potential conflict, disturbance, or access restrictions to municipal and Crown land use areas. • Alamos will engage with Marcel Colomb First Nation's harvester's committee about remote cabin usage within the LAA to discuss their occupancy, potential future use of these remote cabins, and potential applicable mitigation measures. • Alamos will engage local land and resource users (e.g., recreational harvesters) and the Town of Lynn Lake to address, to the extent possible, issues related to the removal and inaccessibility of lands and resources within the PDA at Project sites, including the restriction in use of the Gordon site access road and with local boaters to address navigation issues as well as access and safety issues related to navigation along watercourses affected by the Project, including engagement regarding the need to provide marked portages to circumvent obstructions. • Alamos will submit the locations of water crossings and works to Transport Canada for review related to effects on navigation. Conditions specified in a permit and other directives will apply to the work. - Transport Canada Canadian Navigable Waters Act (CNWA) approvals will be required for the construction of permanent non-scheduled waterbody crossings and/or other in-water structures. Where applicable, provisions of the Minor Works Order for classes of work related to Aerial Cables and Outfalls and Water Intakes will be adhered to. Alamos will submit the locations of the water crossings and works to Transport Canada for review related to effects on navigation. Conditions specified in a permit and other directives will apply to the work. • Alamos will engage with local resource users (hunters/outfitters, trappers, commercial fish harvesters, anglers) and MCC Regional Officials to address to the extent possible potential conflict, disturbance, or access restrictions to hunting, trapping, fishing areas in the PDA, and availability of wildlife resources.	Dedicated follow-up and monitoring activities are not anticipated for the land and resource use VC. It is expected that Alamos will develop a Project-specific Environmental Management Program (EMP) and other relevant plans for follow-up and monitoring (see Chapter 23). As part of the EMP mitigation measures will be stipulated for construction, operation, and decommissioning/closure activities related to atmosphere, surface water, fish and fish habitat, wildlife and wildlife habitat, and human health VCs. These measures are subject to regular review as to their effectiveness as part of a process of adaptive management in Project monitoring and follow-up. Land and resource use activities within the RAA are the subject of ongoing planning, management, regulatory enforcement, and monitoring by the federal, provincial, and municipal governments. This includes the monitoring and collection of information on, for example, municipal land use, hunting, trapping, and fishing activity and development for the purposes of licensing, enforcement, and resource management. Alamos has provided, and will continue to provide, Project information to relevant agencies and organizations.

Table 20B-1 Summary of Key Mitigation, Commitments and Follow-up and Monitoring

Valued Component	Key Mitigation/Commitments	Follow-up and Monitoring
Land and Resource Use	• Timber removal will be completed in accordance with *The Forest Act* (Manitoba). • Merchantable timber may be salvaged and used, if feasible, to enhance carbon storage or made available to local communities for fuelwood. • The Project footprint will be limited to the extent possible (i.e., PDA) including construction and operation and maintenance activities to reduce disturbances to adjacent productive forest land. • Alamos will work with MCC to finalize the required compensation payable to MCC under the Forest Damage Appraisal and Valuation (FDAV), for removal of provincial Crown forest land at the Gordon and MacLellan sites. • Alamos will undertake rehabilitation activities in consideration of desired end land uses that are achievable in the preparation of a Conceptual Closure Plan (Chapter 23, Appendix 23B) under the provisions of *The Mines and Minerals Act* for both the Gordon and MacLellan sites. • Desired end land and resource uses will be considered in the preparation of the Conceptual Closure Plan as part of Project rehabilitation.	
Heritage Resources	• The confidential Heritage Resource Impact Assessment (HRIA) report was filed with the province, as required under archaeological investigation permits. Alamos will complete an as-found record of site HfMf-7, a shed related to historic mining activity. • During construction, inadvertent discoveries of heritage resources will be reported to provincial authorities, as required under provincial heritage legislation. Procedures to follow for chance finds are documented in the HCRPP.	By developing the HCRPP, Alamos will verify the accuracy of this environmental assessment and determine the effectiveness of the recommended mitigation measures to address adverse environmental effects of the Project. Alamos and its construction contractors will abide by requirements issued by the provincial regulator for site avoidance, excavation, or heritage resource monitoring. The HCRPP will describe the processes and protocols to be followed during the construction and operation of the Project to allow Alamos to safeguard cultural and heritage resources discovered or disturbed during the construction of the Project. If cultural and heritage resources are found, Alamos and its contractors will leave all artifacts *in situ*, that is, in the same position and will not remove objects from the site until advised by a permitted archaeologist. There will be no activities within a 50 m radius buffer until the archaeologist has completed an archaeological investigation. No reports related to any such find and its analysis will be published, other than such reports provided to the HRB or other agencies, as may be required by law.
Current Use of Land and Resources for Traditional Purposes	Measures to mitigate effects for current use of land and resources for traditional purposes are as follows: • Construction and operation and maintenance activities will be restricted to the PDA, as much as possible, to reduce disturbances to adjacent forest land. • Site clearing and disturbance will be limited to the Project footprint and associated access routes. • Existing access roads and trails will be used to the extent possible; access routes will be refurbished in compliance with provisions of *The Crown Lands Act* and *The Mines and Minerals Act*. • Signage will be implemented around the PDA to alert traditional harvesters of the presence of Project facilities. • Workers will be prohibited from bringing firearms to the sites while working to limit competition for wildlife species of value to traditional harvesters. • Workers will be prohibited from bringing fishing gear to the sites while working to limit competition for fish species of value to traditional harvesters. • Alamos will communicate the schedule of Project activities throughout the construction, operation, and decommissioning phases to potentially affected Indigenous Communities. • Alamos will engage with potentially affected Indigenous communities to address to the extent possible the potential conflict, disturbance, or access restrictions to traditional practice and harvesting areas and resources in the PDA. • Mitigation to changes in access to lands and resources currently used for traditional purposes through; timing of Project activities, potential scheduling of construction, signage, and engagement with Indigenous groups to identify potential alternate routes of access. • Refer to Atmospheric Environment regarding mitigation measures that will be implemented for the management and reduction of fugitive dust emissions from construction and mining activities at the Gordon and MacLellan sites • Refer to Heritage Resources regarding inadvertent discoveries of heritage resources. Procedures to follow for chance finds are documented in the HCRPP.	Follow-up and monitoring is intended to verify the accuracy of the Environmental Assessment, assess the implementation and effectiveness of mitigation and the nature of the residual effects, and to manage adaptively if required. A Project-specific Environmental Protection Program will be developed wherein mitigation measures are stipulated for construction, operation, and decommissioning/closure activities. This is summarized in Chapter 23. As part of an adaptive management plan for follow-up and monitoring, these mitigation measures will be regularly reviewed and updated by Alamos to verify and enhance their effectiveness.

Table 20B-1 Summary of Key Mitigation, Commitments and Follow-up and Monitoring

Valued Component	Key Mitigation/Commitments	Follow-up and Monitoring
Human Health	Commitments made in Chapter 6, Section 6.9 to mitigate or manage reductions in diesel exhaust from off-road equipment and vehicles and to mitigate fugitive dust during construction and operations at the Gordon and MacLellan sites will also serve to mitigate potential human health risks associated with atmospheric releases of COPC from the Project. Commitments made in Chapter 9, Section 9.9.2 to implement surface water monitoring and management plans, such as the collection and treatment of water to meet discharge criteria and operation of the TMF as a TMF will also serve to mitigate potential human health risks.	The results of follow-up and monitoring programs identified in the Atmospheric Environment VC , Surface Water VC, and the Fish and Fish Habitat VC can be used to confirm the conservative assumptions and modelling results applied in the Human Health VC. There are no additional future follow-up or monitoring events, that would be specifically required by the Human Health VC beyond what is already planned within the Atmospheric Environment VC, Surface Water VC or the Fish and Fish Habitat VC.
Indigenous Peoples	Measures to mitigate effects to Indigenous Peoples are as follows: • Avoidance of plant harvesting sites in the PDA through Project design, timing, and scheduling. • Incorporation of plant species of interest to Indigenous communities into rehabilitation plans where appropriate and technically feasible. • Implementation of the mitigation measures outlined for the Vegetation and Wetlands (Chapter 11), Land and Resource Use (Chapter 15), Fish and Fish Habitat (Chapter 10), and Wildlife and Wildlife Habitat (Chapter 12) VCs. • Mitigation to changes in access to lands and resources currently used for traditional purposes through timing of Project activities, potential scheduling of construction, signage, and engagement with Indigenous communities to identify alternate routes of access. • Ongoing engagement with Indigenous communities regarding their concerns, mitigation of potential Project effects on traditional land and resource use, and potential monitoring, as well as consideration of mitigation measures proposed by Indigenous communities. • Ongoing engagement with Indigenous communities involved on the Project, including discussion of development and implementation of Project-specific environmental management and monitoring plans. • Project design for engaging local land and resource users and for implementing Project construction work schedules and prohibiting Project employees from bringing firearms of fishing gear to work sites. • Commitments made to implement surface water monitoring and management plans will also serve to mitigate potential health risks. • Design for community services, infrastructure and well-being, including work site security to offset demands on local police, implementation of a Traffic Management Plan, bussing services for Project employees, and workforce education programs to raise awareness regarding potential worker effects on host communities. • Development of plan for working with Indigenous-owned businesses to enhance their potential for successfully bidding on Project contracts regarding the supply of goods and services. • Alamos will continue to work towards potential training and education partnerships with Manitoba Keewatinowi Okimakanak Inc, (MKO) the Northern Manitoba Sector Council (NMSC), and Atoskiwin Training and Employment Centre (ATEC) to provide opportunities for Indigenous people to obtain skills and training required for Project participation. • Alamos will continue to engage with indigenous communities in supporting the development and promotion of cultural sensitivity training. • Alamos will work with Indigenous communities to develop training programs oriented to Project operational needs. • Education of construction contractors for the appropriate protocols if heritage or cultural resources, or objects thought to be heritage or cultural resources, are discovered. • Training of staff in the recognition of archaeological features and objects such as precontact Indigenous material culture, and 19th and 20th century Euro-Canadian material culture. • Potential for the hiring of Indigenous field support staff as part of an environmental monitoring team.	Follow-up and monitoring requirements specific to Indigenous peoples have not yet been identified. Similar to Current Use of Lands for Traditional Purposes, the current follow-up and monitoring approach for Indigenous peoples will be based on sharing the results of other relevant monitoring with Indigenous communities as part of Alamos's ongoing engagement process for the Project (see Chapter 3).. Through the Indigenous engagement process for the Project, Indigenous communities identified potential topics for future monitoring, including: • Marcel Colomb First Nation and Peter Ballantyne Cree Nation recommended water quality monitoring. • Manitoba Metis Federation recommended water quality monitoring. • Manitoba Metis Federation recommended the development of a country foods monitoring program. Alamos is committed to ongoing engagement with Indigenous communities and through this process will discuss these recommendations and the need for and nature of potential monitoring programs. Alamos will also share the results of monitoring and follow-up programs and discuss the efficacy of proposed mitigation with Indigenous communities. Additionally, a Project-specific Environmental Protection Program will be developed wherein mitigation measures are stipulated for construction, operation, and decommissioning/closure activities (summarized in Chapter 23). As part of an adaptive management plan for follow-up and monitoring, these mitigation measures will be regularly reviewed and updated by Alamos to verify and enhance their effectiveness.

ALAMOS GOLD INC.

Lynn Lake Gold Project Environmental Impact Statement Chapter 21 - Effects of the Environment on the Project

Stantec

Prepared by:

Stantec Consulting Ltd.

May 25, 2020

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Acronyms and Abbreviations

%	percent
°C	degrees Celsius
CDA	Canadian Dam Association
CEAA, 2012	*Canadian Environmental Assessment Act, 2012*
cm	centimeter
ECCC	Environment and Climate Change Canada
EIS	Environmental Impact Statement
FWI	fire weather index
GHG	greenhouse gas
IPCC	Intergovernmental Panel on Climate Change
km, km/h	kilometre, kilometre per hour
mm	millimeter
m/s	metre per second
PDA	Project Development Area
RCP	representative concentration pathways
W/m^2	Watts per square metre

21.0 ASSESSMENT OF POTENTIAL EFFECTS OF THE ENVIRONMENT ON THE PROJECT

Effects of the environment on the Project has been included in this assessment due to the potential for environmental forces, events, and conditions to interact with the Project. These interactions may include naturally occurring events related to climate (including weather and its variables), climate change, geologic hazards (such as seismic activity, erosion, and landslides), and forest fires (i.e., wildfires). Effects of the environment on the Project is not a valued component; however, it is assessed here for continuity in the assessment of the potential interactions between the Project and the environment.

If effects of the environment on the Project are not managed effectively, adverse changes may occur to Project components and infrastructure, construction schedule (including site preparation, physical construction and equipment installation, and commissioning), and operational performance. Typically, these potential effects are addressed through Project design, scheduling, applying industry standards and best management practices, and operational procedures implemented in consideration of gradual changes (e.g., continuing increase in atmospheric temperature) as well as more sudden, and/or extreme environmental conditions (e.g., short-term intense rain events that cause flooding). It should be noted that reasonable and viable engineering designs tend to overestimate and account for possible forces of nature, and therefore inherently incorporate a considerable margin of safety for the expected lifetime of the Project.

21.1 SCOPE OF ASSESSMENT

This assessment of the effects of the environment on the Project is based on consideration of the Project's Final Guidelines for the Preparation of an Environmental Impact Statement, pursuant to CEAA (2012), dated November 2017 (Final EIS Guidelines; Appendix 4A), and a review of known historical and existing conditions. Based on these sources, the assessment herein considers the following environmental conditions/events:

- Climate (including weather and its variables, such as temperature, precipitation, fog/visibility, winds, and extreme weather events).
- Climate change.
- Geologic hazards (including seismic activity, erosion, landslides, and subsidence).
- Forest fires.

Each of these is described in further detail below, including the existing conditions, potential effects on the Project, mitigation, and potential residual effects.

21.1.1 The Influence of Engagement on the Assessment

Engagement for the Project has been an ongoing process that will continue with government agencies, stakeholders, and local Indigenous communities for the life of the Project. Engagement with Indigenous

communities and the public did not identify specific issues or concerns directly related to effects of the environment on the Project. A summary of issues and concerns with respect to the Project identified during engagement with Indigenous communities is provided in Chapter 3.

21.2 BOUNDARIES

21.2.1 Spatial Boundaries

The spatial boundary for effects of the environment on the Project is limited to those areas having Project-related infrastructure within them (i.e., the Project Development Area [PDA]). There is no local or regional assessment area associated with the effects of the environment on the Project.

21.2.2 Temporal Boundaries

The temporal boundaries for the Project consist of the following main phases:

- Construction – two years (scheduled to be carried out concurrently from Year -2 to Year 1 at both sites).
- Operation – 13 years (scheduled to be carried out from Year 1 to Year 6 at the Gordon site and from Year 1 to Year 13 at the MacLellan site).
- Decommissioning/closure – five to six years of active closure (scheduled to begin in Year 6 at the Gordon site and in Year 14 at the MacLellan site). Active closure will be followed by post-closure, which is the time period during which active reclamation measures are complete, but monitoring is still required. The expected duration for post-closure is approximately 10 years. Pit filling is expected to take 11 years at the Gordon site and 21 years at the MacLellan site under average conditions (Chapter 9, Section 9.4.1). Permanent closure will occur when the site is stable, and monitoring is no longer required.

21.3 SIGNIFICANCE DEFINITION

Interactions may occur between the environment and the Project that could result in changes to Project schedule or operation. A significant adverse residual effect of the environment on the Project is:

- A substantial change to the Project construction schedule (e.g., a delay resulting in the construction period being extended by a construction season).
- A substantial change to the Project operation schedule (e.g., an interruption in mining activity such that annual production targets cannot be met).
- Damage to the Project infrastructure resulting in increased safety risk.
- Damage to the Project infrastructure resulting in repairs that could not be technically or economically implemented.

21.4 ASSESSMENT OF THE EFFECTS OF THE ENVIRONMENT ON THE PROJECT

21.4.1 Climate and Climate Change

As described in Chapter 6, climate is defined as the long-term average, seasonal and extreme meteorological conditions in an area, which usually includes measurable parameters such as temperature, precipitation, fog/visibility, and winds. Environment and Climate Change Canada (ECCC) has developed 30-year statistical summaries of data (1981 – 2010) collected from weather stations located throughout Canada, referred to as climate normals data. The closest weather station to the Project with available data is located at the Lynn Lake Airport (station name: Lynn Lake A), located approximately 8 km southwest from the MacLellan site. Additional hourly wind data was collected at the Lynn Lake Airport from 2015 to 2018 to provide a more refined understanding of winds local to the PDA. A summary of the existing conditions of temperature, precipitation, fog/visibility, and winds is presented in the following sections. Additional information can be found in Chapter 6. The full description of climate and meteorology baseline conditions is presented in the Climate and Meteorology Baseline Technical Data Report and associated Validation Report (Volume 4, Appendix C).

21.4.1.1 Existing Conditions

Air Temperature and Precipitation

Historical temperature data between 1981 to 2010 indicates that the mean annual temperature at the Lynn Lake A weather station was -3.2 degrees Celsius (°C). The minimum and maximum monthly mean temperatures were -8.6°C and 16.2°C, respectively. July is typically the warmest month of the year, and January is usually the coldest. The total average annual rainfall was 318 millimeters (mm), with July being the wettest month. The total average snowfall was 208 centimeters (cm), with the highest monthly total snowfall occurring in November (ECCC 2019a).

Fog and Visibility

Fog is defined as ground-level cloud, or water droplets suspended in the air, which reduces visibility to less than 1 kilometer (km) (ECCC 2019b). The Lynn Lake A weather station experienced, on average, 77.4 hours (3.2 days) per year when visibility is less than 1 km. Fog conditions are most prevalent in the fall and early-winter (42.9 hours from September-December) when cold air settles over relatively warmer waterbodies which creates steam fog that can move over land (ECCC 2019a).

Winds

Hourly wind speed and direction data at the Lynn Lake Airport were collected from 2013 to 2014 and analyzed for this environment assessment. These data are summarized in Chapter 6 and detailed results from wind data analyses are available in Volume 4, Appendix C. The maximum hourly wind speed (13.9 metres per second (m/s) or 50 kilometres per hour (km/h)) was observed in June. Monthly average wind

speeds are highest in May and June. Winds are generally from the northwest in colder months, and easterly in the warmer months.

Extreme Weather Events

The Government of Canada lists severe storms, tornadoes, flooding, landslides, and wildfires amongst Manitoba's regional environmental hazards in the federal "Get Prepared" campaign (GC 2019). The Final EIS Guidelines (Appendix 4A) also include drought, ice jams, avalanches, erosion, subsidence, outflow conditions, and seismic events as factors to consider. Geologic hazards (including landslides, erosion, subsidence, and seismic events) and wildfires are presented in Sections 21.4.2 and 21.4.3, respectively. Since Avalanche Canada (2019) has no records of avalanches occurring in Manitoba from the early 1800s to present, avalanche events are not considered further in this assessment.

Severe storms can occur in any season in Manitoba, and can result in threats to public safety, disruptions to transportation systems, and damage to utilities and/or property. Winter storm events can consist of high winds, snow, ice, and blizzards. During the summer months, severe weather can develop quickly, including thunder, lightning, hail, and tornadoes (GMB 2019).

On average, the province of Manitoba experiences 7-10 tornadoes per year (GMB 2019, UWinnipeg 2019). They usually occur between May and August, with June and July being the most likely months (UWinnipeg 2019). In 2007, the strongest tornado in Canadian history touched down in Elie, Manitoba (CBC News 2007). The storm was rated 5 on the Fujita-Scale (CBC News 2007), meaning wind speeds were between 420 and 510 km/h (GC 2018). Video taken during the tornado shows a house being thrown several hundred meters through the air (CBC News 2007). More recently, a strong tornado killed one person in Alonsa, Manitoba in August 2018 (CBC News 2018). The tornado was rated 4 on the Enhanced Fujita Scale (CBC News 2018), meaning wind speeds were between 270 and 310 km/h (GC 2018). No tornadoes have occurred in Lynn Lake in recent times (1980 – 2009; ECCC 2017).

Flooding is a regular occurrence in the province and has resulted in substantial investment in flood mitigation and planning throughout Manitoba (GMB 2019). Extreme precipitation and mild spring weather can result in rapid snow melt, ice jams, and flooding. The most severe recent flooding events in Manitoba occurred in 1950, 1997, and 2011. These flooding events resulted in extensive property damage and evacuations (GMB 2019). The flood in 1997 was dubbed "the Flood of the Century". It caused more than $500 million in damages and evacuation of more than 28,000 people in the Red River Valley area of southern Manitoba (CBC News 2016). The flood in 2011, on the Assiniboine River, was the 6th largest flood in Manitoba's history, and the 3rd highest since 1969. Although it was not as extreme as the flood in 1997, it lasted longer and affected a much larger area (GMB n.d.1). Statistically, the 2011 flood was estimated to be at levels experienced once in 330 years (GMB n.d.2). The ore milling and processing plant (MacLellan site) is in an area that has not known to have flooded in previous floods. In recent history, the most severe flooding events in Manitoba have occurred in the southern part of the province.

Flooding within the region can be triggered by extreme precipitation, rapid snow melt, ice jams, and beaver activity, with peak flows generally occurring during freshet in the spring. Catchments within the area surrounding the Project are generally small and therefore have low flood severity. Larger catchments such as the Keewatin River are populated by large lakes which mitigate peak flows. An assessment of peak

flows on the Keewatin River found that in the reach of the river adjacent to the project, river stage (water surface elevation) is less sensitive to flood magnitudes due to the large channel capacity (Stantec 2016). A flood assessment on Farley Lake also found that there are only small changes in water surface elevation associated with substantial changes to lake inflows.

Beaver activity is extensive within the areas surrounding the Project and can produce high water levels in both streams and lakes. The influence of beaver activity, particularly at the Gordon site, was prevalent during the 2015/2016 hydrology baseline program when a large increase in water level related to the construction of a beaver dam was observed in Farley Lake. Smaller beaver dams were also observed at the Simpson Lake and Swede Lake outlets. A Wildlife Monitoring and Management Plan Activity Management Plan will be implemented which will include measures to manage beaver dam construction activities at the mine sites during Project operation (Chapter 23).

In the last 100 years, extensive droughts lasting several years, have occurred in the province. In the 1980s, severe drought caused agricultural production in Manitoba to be 60% lower than average. In the 1990s and early 2000s, a severe drought plagued the Canadian Prairies. Manitoba Hydro incurred the largest financial loss in its history in 2003/2004, $336 million, due to low water flows. There have been droughts in Manitoba in 2012, 2015, 2017, 2018, and 2019 (GMB n.d.3). In the summers of 2017, 2018, and 2019, foundations of homes cracked, and homes in Winnipeg sank due to dry conditions (CBC News 2018, 2019).

Surface water quantity, as it relates to the Project (including outflow) is discussed further in Chapter 9, Section 9.4.1 and Volume 5, Appendices D and E.

Climate Change Predictions

Climate change is defined by the Intergovernmental Panel on Climate Change (IPCC) as "*a change in the state of climate that can be identified (e.g., by using statistical tests) by changes in the mean and/or variability of its properties and that persists for an extended period, typically decades or longer"* (IPCC 2014). Climate change can be due to naturally occurring events (such as solar cycles or volcanic eruptions) and human activities that cause changes to the atmosphere and land use (IPCC 2014).

Predictions of future climate change are derived from mathematical/statistical models. While these models can provide useful information on predicting climate change over a large scale, such as continental climate change, the ability to predict changes on small, regional scales is relatively limited (Randall et al. 2007; Flato et al. 2013). Climate change predictions suggest Manitoba will experience warmer and wetter winters, and longer, warmer, and drier summers (GMB n.d.4; Sauchyn and Kulshreshtha 2008; Manitoba Hydro 2015). Extreme weather, such as heat waves, droughts, floods, and extreme storms, are expected to become more frequent (GMB n.d.4).

Many climate change projections refer to four GHG concentration trajectories, called representative concentration pathways (or RCPs). The RCPs are indicative of the potential range of radiative forcing values that could result in GHG-related heating of the planet by the year 2100 (as compared to pre-industrial values) (Moss et al. 2010). The four RCP values are RCP2.6, RCP4.5, RCP6.0, and RCP8.5, and represent GHG-related heating of the planet a rates of 2.6 Watts per square metre (W/m²), 4.5 W/m², 6 W/m², and 8.5 W/m², respectively.

The Prairie Climate Centre of the University of Winnipeg has conducted climate change projections for the Manitoba Northern Boreal Shield, where the Project is located, under RCP4.5 (intermediate carbon emissions) and RCP8.5 (high carbon emissions). The results of the study are shown in Table 21-1.

Table 21-1 Forecasted Temperature and Precipitation Data for the Manitoba North Boreal Shield (2021-2050) from the Baseline (1981-2010)

Climate Variable	1981 – 2010 (Baseline)	2021-2050*
Mean Annual Temperature	-2.3°C	-0.5°C
Mean Summer Temperature	16.4°C	17.3°C
Mean Winter Temperature	-18.9°C	-17.2°C
Days ≥ 30°C	1.3 days	3.7 days
Days ≤ -30°C	34.2 days	21.9 days
Annual Precipitation	463.5 mm	491.4 mm
Summer Precipitation	191.7 mm	187.9 mm
Winter Precipitation	75.4 mm	79.0 mm

*In this work, temperature and precipitation data from 12 models were collected, and advanced statistical techniques were used to create versions of the data for this study. The mean (average) values are shown in this table. The 10th and 90th percentiles (low and high) values were also estimated but are not shown here.

Source: PCC 2016b.

The mean annual temperature in the area is predicted to increase by 1.8°C. Days with temperatures over 30°C are expected to more than double, and there will be fewer days with temperatures below -30°C. The projected mean annual precipitation for the area is expected to increase from 463.5 mm to 491.4 mm; this represents a 6% increase in precipitation. The study (PCC 2016b) expects precipitation in the summer to decrease, and precipitation in the winter to increase (Table 21-1).

21.4.1.2 Potential Effects of Climate and Climate Change on the Project

Climate and climate change are important considerations in Project planning as interactions may occur that could result in changes to Project schedule or damage to the Project. Extreme temperatures, heavy precipitation, fog, winds, and storms could potentially result in the following effects on the Project:

- Damage to Project infrastructure and equipment (e.g., increased structural loading).
- Additional effort for snow clearing and removal.
- Reduced visibility and inability to manoeuvre equipment.
- Delays to construction activities.
- Reduced site accessibility for workers.
- Interruptions to Project operation, and product delivery to market.

It is expected that future climate change could result in increased temperatures (and drought), increased frequency and magnitude of precipitation, an increase in the frequency and magnitude of storm events, and increased incidence of flooding and erosion.

Very low temperatures could reduce the flexibility of construction materials and increase their susceptibility to breaking. Heavy snowfall, rain or ice storms could result in delays to the construction schedule, additional unexpected effort for snow clearing and removal, reduced visibility, or inability to maneuver equipment, and could render the site inaccessible to workers. However, delays due to poor weather can often be predicted ahead of time and allowance for these events will be included in the construction schedule. Wet snow, freezing rain, and ice have the potential to damage infrastructure and equipment if the loading of accumulated snow and ice exceeds design loads. Electrical transmission cables and conductors could be weighed down, causing power outages and delays to operational activities.

Extreme precipitation from rainfall and/or snowmelt has the potential to result in flooding, ice jams, erosion, and other events such as washouts on access roads, or an overabundance of water in collection ponds or the Project's water drainage/diversion system. These events could lead to the erosion of topsoil, the degradation of soil quality, structure and stability, changes to slope stability, and the failure of erosion or sedimentation control structures. This could result in the release of total suspended solids in runoff and related environmental effects, or a possible failure of Project infrastructure. These types of releases are considered accidental and are discussed further in Chapter 22. During electrical storms, a lightning strike could ignite a fire.

Fog (reduced visibility) could cause difficulties in maneuvering Project equipment, affect charters flying to site (landing ability), or could result in potential delays in the receipt of construction materials or delivery of product during operation. Extreme winds could also cause reduce visibility (due to blowing snow, dust, or debris). Wind also has the potential to increase structural loadings on buildings, cause damage to Project infrastructure or equipment, or cause erosion.

Drought could reduce water levels in surrounding watersheds and deplete groundwater quantity (USGS 2019). If water levels in the surrounding watersheds (including Gordon Lake and the Keewatin River) decrease, the Project could be required to reduce surface water withdrawals, resulting in decreased production. For more effects related to groundwater and surface water, including outflow conditions, see Chapters 8 and 9, respectively.

Potential effects of climate and climate change on the Project has the potential to result in damage to Project infrastructure and equipment (e.g., water control structures and dams), which could therefore result in effects to the environment (e.g., releases to surface water and fish habitat). Adverse environmental effects from the malfunction of Project infrastructure is assessed in Chapter 22.

21.4.1.3 Mitigation

Climate change is viewed as a risk to the mining industry Canada-wide, based on a poll conducted in 2014 (Delphi Group 2014). Mitigation measures are primarily achieved with design, engineering, and

infrastructure adaptations (Delphi Group 2014). For this Project, interactions between climate/climate change and the Project will be managed through use of the following mitigation measures:

- The Project will be designed and constructed to meet applicable engineering codes, standards, and best management practices. These include applicable building safety, industry codes, and standards for weather variables such as climate and weather, including the *National Building Code of Canada*.
- Project design will consider normal and extreme weather conditions that may arise and will include measures for climate adaptation. For example, power equipment, including distribution lines, wires, and conductors, would be designed and rated for climatic conditions that can reasonably be expected over the life of the Project.
- Delays due to poor weather or additional effort for snow clearing/removal will be anticipated and can sometimes be predicted. Allowance for these events will be included in the construction schedule. It is not anticipated that they would substantially affect the Project schedule beyond delays that reasonably be expected.
- Mining, administration, and processing plant staff offices will be close together to limit walking distance during extreme cold weather.
- The potential effects of extreme weather, including storms, precipitation, flooding/ice jams, and drought will be considered in Project design and operation, including the selection of materials and equipment.
- The tailings management facility (MacLellan site) is equipped with an emergency spillway to allow safe routing of increased flows due to precipitation. The design flooding event for the operation of the Project was selected as 1/3 between the 1 in 1000-year and the probable maximum flood, according to the Canadian Dam Association (CDA) Dam Safety Guidelines. The design flooding event for the closure (passive care) phase of the Project was selected as 2/3 between the 1 in 1000-year and the probable maximum flood.
- Environmental management plans will be implemented, including a groundwater management plan, a surface water monitoring and management plan, and an erosion and sediment control plan. Specific mitigation measures related to groundwater and surface water (including erosion, flooding, infrastructure damage, runoff, sedimentation) are found in Chapters 8 and 9.
- Regular maintenance and safety inspections will be conducted on Project infrastructure and equipment.
- An emergency response and spill prevention and contingency plan will be implemented (Chapter 23, Section 23.5.1), including measures prescribed for the provision of emergency response planning, training, responsibilities, clean-up equipment and materials, and contact and reporting procedures.
- The proponent will monitor observed effects of the environment on the Project and will take action to maintain, repair and upgrade infrastructure/equipment, as required.

21.4.1.4 Residual Effects

The potential effects of climate and extreme weather will be considered and incorporated into the planning, design, construction, operation, and decommissioning/closure of the Project to reduce the potential for long-term damage to infrastructure and equipment. Regular maintenance and inspections will be conducted to avoid the deterioration of Project infrastructure and equipment, to help the Project comply with applicable design criteria, best management practices, codes, and standards, and to maintain reliability of the Project. These design criteria, codes and standards will include the latest projections related to climate change. Project delays due to poor weather will be anticipated and can often be predicted ahead of time; allowance for them will be included in the construction schedule. Although it is likely that Lynn Lake will experience extreme weather conditions during the life of the Project and residual effects related to project delays, the potential adverse effects on the Project during these events have been taken into consideration by Project design and planning. Therefore, substantive changes to Project schedule or damage to Project infrastructure from climate and climate change are not anticipated.

21.4.2 Geological Hazards

21.4.2.1 Existing Conditions

Seismic Activity

Seismic activity is characterized by the local geography of an area and the movement and/or fracture of rocks within the Earth's surface (e.g., the movement of tectonic plates). These movements release seismic waves that radiate and cause vibration of the ground (known as earthquakes) (NRCan 2019a).

Manitoba is the province least likely to experience earthquakes in Canada; the entire province is classified as "low" for seismic hazard (NRCan 2015). Over time, a few earthquakes have occurred on the border of the province and off the coast of northern Manitoba (Figure 21A-1, Appendix 21A). Earthquakes are not listed as a regional environmental hazard for the province of Manitoba by the federal government (GC 2019a).

Landslides

The regional landscape surrounding the Project is flat to gently undulating with most slopes ranging between 0 to 15%, limiting the potential for geotechnical hazards associated with steep slopes, such as landslides (Chapter 5, Section 5.2.5). The Project is located in an area ranked with low landslide susceptibility (Bobrowsky and Dominguez 2012).

Field investigations identified one old landslide deposit (a geologic deposit created by a landslide) formed in till along the lower slope marking the edge of a till-covered ridge in the northeastern portion of the MacLellan site. However, recent terrain constraints analysis suggests a low susceptibility of materials to landslide in the PDA. The full assessment of landslide potential is presented in the Soil and Terrain Baseline Technical Data Report and associated Validation Report in Volume 4, Appendix E.

Erosion

Erosion, the process of geological materials being worn away from one location and transported to another, can be caused by wind or water. Field investigations identified both the Gordon site and the MacLellan site as being at high risk for wind erosion and low risk for water erosion. A complete analysis of wind and water erosion at the Gordon site and MacLellan site can be found in Volume 4, Appendix E).

Subsidence

Subsidence, the settling/sinking of land, can be caused by removing groundwater, compaction of soil, underground mining, or the thawing of permafrost (CGA 2013). Irregular topography related to thaw subsidence was identified at the Project site during desktop mapping exercises and field investigations (Volume 4, Appendix E). Subsidence related to thermokarst (landforms resulting from the thawing of ice-rich permafrost) was noted at several locations during geotechnical studies. Approximately half of the land surveyed during baseline studies contains permafrost (Chapter 5, Maps 5-1 and 5-2). The full assessment of the terrestrial environment baseline conditions is presented in the Soil and Terrain Baseline Technical Data Report (Volume 4, Appendix E).

21.4.2.2 Potential Effects of Geologic Hazards on the Project

Seismic activity could interrupt Project operation or result in damage to Project infrastructure. As noted in Section 21.4.2.1, there is no history of seismic events occurring near the PDA and the risk of seismicity in the province is low. Therefore, the probability of a major seismic event occurring and having an effect on Project-related activities or phases is low.

Although there is an old landslide deposit at the MacLellan site, recent studies suggest low susceptibility of materials to landslide in the PDAs (Bobrowsky and Dominguez 2012). Therefore, the probability of a landslide occurring at the PDAs that would cause substantial Project damage or interruption of the Project during construction, operation, and/or decommissioning/closure is low.

Erosion can result in the removal/movement of topsoil, sedimentation, and the degradation of soil quality, structure and stability, and related environmental effects. The failure of erosion and sedimentation control structures are discussed above in Section 21.4.1.2. The risk of wind and water erosion occurring at the Gordon site and the MacLellan site discussed in Section 21.4.2.1.

Subsidence could cause damage to Project infrastructure or equipment, by weakening buildings and potentially causing building collapse or power outage, and by twisting/damaging roads and underground infrastructure such as pipes. A full assessment of the terrestrial environment baseline conditions is presented in the Soil and Terrain Baseline Technical Data Report (Volume 4, Appendix E).

Potential effects of geological hazards on the Project has the potential to result in damage to Project infrastructure and equipment (e.g., slope failures), which could therefore result in effects to the environment (e.g., releases to surface water and fish habitat). Adverse environmental effects from the malfunction of Project infrastructure is assessed in Chapter 22.

21.4.2.3 Mitigation

Interaction between geologic hazards and the Project will be managed through use of the following mitigation measures:

- The Project will be designed and constructed to meet applicable engineering codes, standards, and best management practices. These include applicable building safety, industry codes, and standards for geologic hazards, including the *National Building Code of Canada*, which provides standards of safety to account for seismic activity, and will form the basis of design and construction of the Project.
- The tailings management facility and dams will be founded on bedrock.
- The tailings management facility dams are designed to withstand a 1 in 2,475-year seismic event during operation, and ½ between a 1 in 2,475-year and a 1 in 10,000-year event for passive closure, according to the CDA Dam Safety Guidelines.
- Regular maintenance and safety inspections will be conducted on Project infrastructure and equipment.
- An emergency response and spill prevention and contingency plan will be implemented (Chapter 23, Section 23.5.1), including measures prescribed for the provision of emergency response planning, training, responsibilities, clean-up equipment and materials, and contact and reporting procedures.
- The proponent will monitor observed effects of the environment on the Project, and will act as required to maintain, repair and upgrade infrastructure/equipment as required.
- An investigation of the nature, degree and extent of permafrost will be conducted to support the final infrastructure siting and design.

Mitigation related to erosion/sedimentation is discussed in Section 21.4.1.3.

21.4.2.4 Residual Effects

The potential effects of geologic hazards, including seismic events, landslides, erosion, and subsidence will be considered and incorporated into the planning, design, construction, operation, and decommissioning/closure of the Project to reduce the potential for long-term damage to infrastructure and equipment, and changes to construction or operation of the Project. With the application of the mitigation measures listed above, seismicity, landslides, erosion, and subsidence are not considered to have the potential to substantively interrupt Project schedule or damage Project infrastructure or components during construction, operation, and/or decommissioning/closure of the Project. Substantial residual effects of geologic hazards on the Project are not anticipated.

21.4.3 Forest Fires

21.4.3.1 Existing Conditions

The prediction of forest fire activity is linked to the Fire Weather Index (FWI), which is a numeric rating of forest fire intensity produced by Natural Resources Canada. The FWI is based on weather/climate, vegetation, and soil conditions (moisture), and fire behavior indices (NRCan 2019b). The mean fire weather index in Lynn Lake, when the risk of forest fires is highest (June to August), is rated from 5-10 (from 1981 to 2010). This is in the lower range of possible forest fire risk, the lowest being 0-5 and the highest being a rating over >30 (NRCan 2019c). In other parts of Manitoba, the fire weather index gets as high as 10-20 (medium risk) (NRCan 2019c).

There have been several incidences of forest fire near the Project in recent years. Between 1946 – 2019, forest fires have burned 34% of the Wildlife and Wildlife Habitat RAA and 33% of the Wildlife and Wildlife Habitat LAA (see the definition of the Wildlife and Wildlife Habitat RAA and LAA in Chapter 12, and mapping of recent forest fires in [Volume 4, Appendix M, Map 5). Recent burns are particularly evident north of the Gordon site (2003) and north of Provincial Road 391 between the mine sites (2007), and south of the MacLellan site (2019). For more information, see Chapter 12 and Volume 4, Appendix L, Section 3.2.

21.4.3.2 Potential Effects of Forest Fires on the Project

Forest fires could potentially result in the following effects on the Project:

- Reduced visibility due to smoke, causing difficulty in maneuvering equipment on site or delays in the receipt/delivery of materials.
- Delays in project schedule.
- Damage to infrastructure, equipment, or roads.
- Safety issues for personnel or render the site inaccessible to workers (e.g., at present, there is only one road leaving Lynn Lake).
- Loss of electrical power, and subsequent loss of production.

A forest fire that enters the PDA may affect personnel, equipment, temporary and constructed infrastructure, and schedule during Project construction and operation and maintenance. Fires during operations could damage infrastructure such as bridges, water control structures, and power lines, as well as vegetation and habitat for wildlife. Damaged or compromised infrastructure has the potential to release hazardous material. A hazardous material release is considered accidental and is discussed further in Chapter 22.

Forest fire discussed here does not include fire that results from activities at the mine (e.g., from electrical equipment or careless smoking) and could spread to surrounding areas; the potential effects of those types of fires are assessed in the context of Project-related accidents and malfunctions in Chapter 22.

Potential effects of forest fires on the Project has the potential to result in damage to Project infrastructure and equipment, which could therefore result in effects to the environment (e.g., socio-economic effects related to mine shutdown). Adverse environmental effects from the malfunction of Project infrastructure is assessed in Chapter 22.

21.4.3.3 Mitigation

Interaction between forest fires and the Project will be managed through use of the following mitigation measures:

- The *National Fire Code of Canada* and the Manitoba *Fires Prevention and Emergency Response Act* will be adhered to.
- Regular maintenance and safety inspections will be conducted on Project infrastructure and equipment.
- An emergency response and spill prevention and contingency plan will be implemented (Chapter 23, Section 23.5.1), including measures prescribed for the provision of emergency response planning, training, responsibilities, clean-up equipment and materials, and contact and reporting procedures.
- First response firefighting activities will be conducted by the mine rescue team using on-site water trucks and emergency medical services equipment.
- Onsite fire prevention and response equipment will be provided and maintained, and employees will be trained in safe fire response.
- Work procedures and Project schedules will be adjusted in case of a severe fire, including mine shut down and evacuation in the event of a forest fire.

21.4.3.4 Residual Effects

Mitigation listed above will reduce the potential effects that forest fires could have on Project schedule and/or Project infrastructure and components. If a forest fire were to occur close to the Project, emergency measures would be implemented quickly to control and/or extinguish the fire prior to contact with Project components. Therefore, substantive delays to Project schedule or damage to infrastructure from forest fires are not anticipated. As evidenced by recent forest fire activity in the PDA, it is possible that forest fires could result in an interruption in Project operations, resulting in residual effects. However, given the mitigation above, substantial delays to Project schedule or damage to infrastructure are not anticipated.

21.5 SUMMARY AND DETERMINATION OF SIGNIFICANCE

The Project is being designed and engineered in consideration of environmental conditions, including climate, climate change, geologic hazards (seismic activity, erosion, landslides and subsidence), and forest fires by applying industry standards and best management practices, and implementing appropriate operational procedures and mitigation measures.

There are no environmental attributes that, during the Project, are anticipated to have the potential to result in:

- A substantial change to the Project construction schedule (e.g., a delay resulting in the construction period being extended by a construction season).
- A substantial change to the Project operation schedule (e.g., an interruption in servicing such that annual production targets cannot be met).
- Substantial damage to the Project infrastructure resulting in increased safety risk,
- Substantial damage to the Project infrastructure resulting in adverse effects to the environment, or
- Substantial damage to the Project infrastructure resulting in repairs that could not be technically or economically implemented.

Therefore, the residual effects of the environment on the Project during construction, operation, and decommissioning of the Project are not significant.

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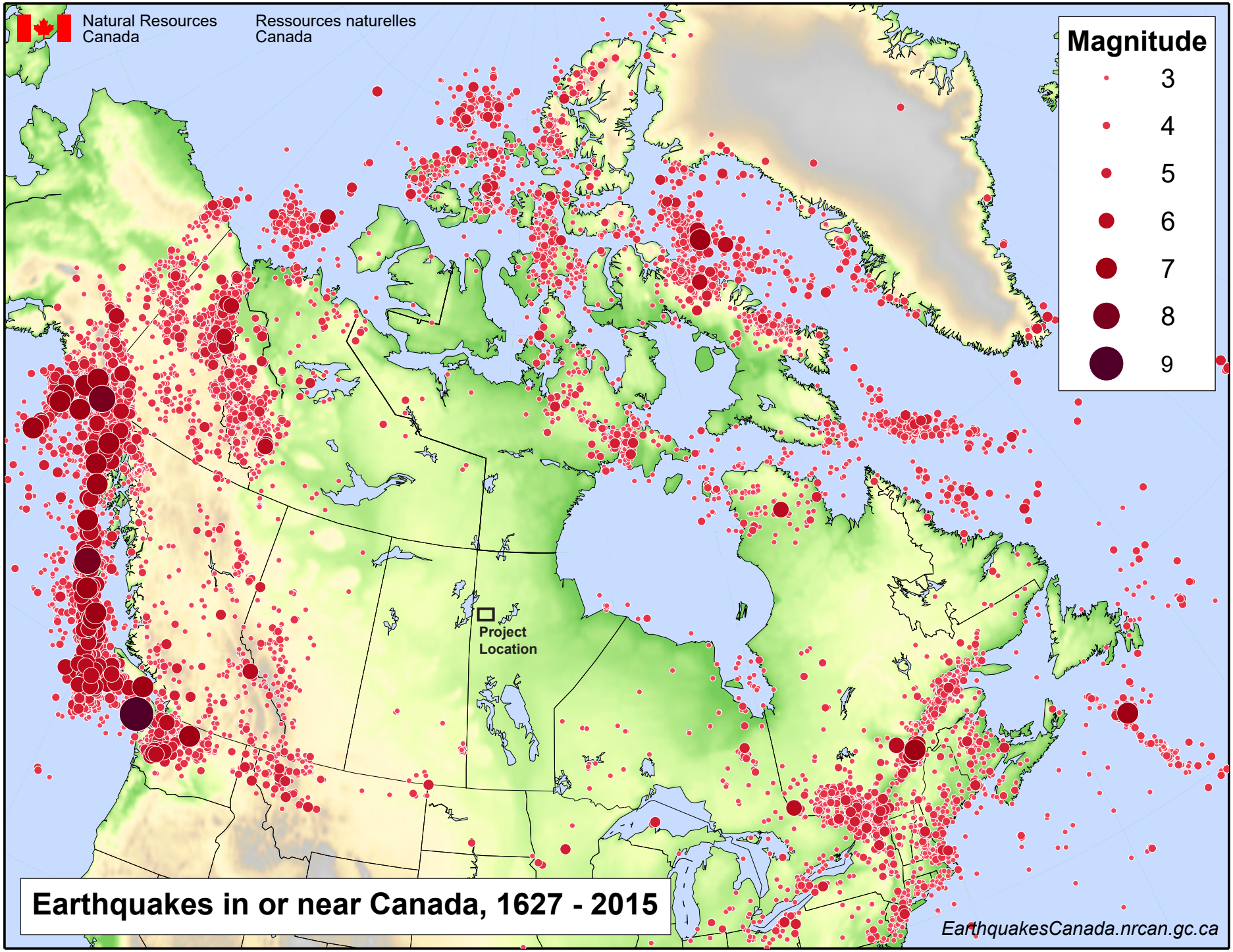
Appendix 21A FIGURES



Source: NRCan 2018

Figure 21A-1

ALAMOS GOLD INC.

Lynn Lake Gold Project Environmental Impact Statement Chapter 22 - Assessment of Potential Accidents or Malfunctions

Stantec

Prepared by:

Stantec Consulting Ltd.

May 25, 2020

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Acronyms and Abbreviations

Alamos	Alamos Gold Inc.
ARD	acid rock drainage
CEAA, 2012	*Canadian Environmental Assessment Act, 2012*
EIS	Environmental Impact Statement
ERSPCP	Emergency Response and Spill Prevention and Contingency Plan
ExMP	Explosive Management Plan
HCN	hydrogen cyanide
LAA	Local Assessment Area
m, m^3	metres, cubic metres
MDMER	Metal and Diamond Mining Effluent Regulations
ML	metal leaching
PAG	potentially acid generating
PDA	Project Development Area
PR	provincial road
RAA	Regional Assessment Area
SO_2	sulphur dioxide
t/d	tonnes per day
TMF	tailings management facility
VC	valued component

22.0 ASSESSMENT OF POTENTIAL ACCIDENTS OR MALFUNCTIONS

22.1 INTRODUCTION

In accordance with Section 6.6.1 of the Final Environmental Impact Statement (EIS) Guidelines, and Section 19.1 (a) under the *Canadian Environmental Assessment Act, 2012* (CEAA 2012; Appendix 4A), the environmental assessment of a designated project must address environmental effects of accidents or malfunctions that may occur in relation to the Project. Accidents or malfunctions are events that occur outside the normal planned function or activity of the Project. Through good planning and design and the adoption of safety measures, the risks of accidents or malfunctions can be reduced or controlled. An Emergency Response and Spill Prevention and Contingency Plan (ERSPCP) will be developed to help mitigate the effects of accidents or malfunctions should they occur (Chapter 23).

22.2 APPROACH

The following approach was used to identify and assess potential accidents or malfunctions for the Project:

- Identify potential accidents or malfunctions that could occur during general construction, operation, and decommissioning (Section 22.4).
- Identify the safety measures and mitigation that will be implemented to reduce or control the potential of each accident or malfunction (Section 22.4).
- Assess the potential residual adverse effects (after safety measures and mitigation have been applied) on valued components (VCs) that would result from each accident or malfunction (Section 22.5).
- Determine the significance of residual effects (after safety measures and mitigation have been applied) of each accident or malfunction (Section 22.6).

Project effects of accidents or malfunctions are described for VCs where applicable, and the residual effects are characterized, and significance determined using the same methods and thresholds used for Project environmental effects.

22.3 THE INFLUENCE OF ENGAGEMENT ON THE ASSESSMENT

Details on the engagement activities completed to date are provided in Chapter 3. Engagement activities with the Indigenous communities, community, and regulators included open houses, targeted meetings, presentations, and site visits. Traditional Knowledge/Traditional Land Use information was considered during preparation of this assessment and has been incorporated into the accidents and malfunctions assessment, where applicable. Concern was raised regarding the protection of resources based on potential effects of vehicle accidents along provincial road (PR) 391, increased traffic on this highway, and the transportation of hazardous materials. Adverse effects resulting from a vehicle accident are assessed

below in Sections 22.4.5 and 22.4.10. Additionally, although not specifically related to accidents and malfunctions, some concerns are also applicable to the assessment of accidents and malfunctions for the Project. General concerns were raised regarding the potential effects of industrial development on the land, water, and wildlife due to mining. Concern about deleterious substances entering a waterbody was noted, as well as the potential effects to fishing due to poor water quality resulting from Project activities. These concerns were considered in the assessment of accidents and malfunctions. Tailings and mine rock management was noted to be of high importance during an open house. Improper management of tailings and mine rock has the potential to result in an accidental event; therefore, is considered as part of this assessment.

22.4 DESCRIPTION OF POTENTIAL ACCIDENTS OR MALFUNCTIONS

Based on the design of the Project, professional judgment, and experience with other mining projects, the following potential accidents or malfunction scenarios (Table 22-1) have been identified as having the potential to occur during the Project, if the Project were not carefully planned and carried out. These potential accidental event scenarios are described below. Environmental sensitivity mapping has been developed to identify pathways and areas adjacent to Project activities sensitive to these accident and malfunction scenarios (e.g., wetlands and watercourses) (Maps 22-1a to 22-2c).

Table 22-1 Potential Accidents or Malfunction Scenarios

Potential Accident or Malfunction	General Description
Tailings Management Facility (TMF) Malfunction	Malfunction of the TMF could lead to the release of untreated tailings solids and water.
Release of Untreated Contact Water	Malfunction of the seepage and contact water collection system and site water management pond could lead to the release of untreated contact water into the receiving environment.
Ore Milling and Processing Plant Accident or Malfunction	Malfunction of a component of the processing system could result in the release of liquids, reagents, or gases.
Sewage Treatment Plant Malfunction or Discharge Pipeline Failure	Malfunction of the sewage treatment system would result in the release of untreated effluent, domestic sewage, or reagents. Failure of the treated effluent discharge pipeline would result in the release of treated effluent.
Fuel and Hazardous Materials Spill	Failure of the storage and dispensing facilities for gasoline and diesel fuels, would result in the release of petroleum-based pollutants. Failure of the onsite storage and handling facilities for hazardous materials would result in the release of these materials (e.g., mill reagents required for ore processing). Collision or mechanical malfunctions involving construction equipment, mining equipment, or transport trucks may result in the release of hazardous materials such as mill reagents, hydraulic fluid and fuel, or other non-hazardous materials such as construction material.
Open Pit Slope Failure	Slope failure in the open pit would result in areas adjacent to the open pit slumping into the open pit, and potential unintended expansion of the Project footprint.

Table 22-1 Potential Accidents or Malfunction Scenarios

Potential Accident or Malfunction	General Description
Ore, Overburden and Mine Rock Storage Area Slope Failure	Failure of materials storage area slope would result in the release of mine rock, overburden, or ore outside the storage areas.
Over-blasting	Uncontrolled or unmanaged blasting would cause damage resulting from dust and fly rock extending beyond defined boundaries and result in excess noise and vibration to the surrounding properties.
Fire/Explosion	A fire or explosion may result in the destruction of Project infrastructure and vegetation and natural features within or beyond the Project Development Area (PDA), and the release of smoke, combustion gases and ash.
Vehicle Accident	Accidental collisions from the operation of Project vehicles or heavy equipment could result in human or wildlife mortality or injury.

22.4.1 Tailings Management Facility Malfunction

A tailings management facility (TMF) will be constructed at the MacLellan site. The TMF will receive tailings via a slurry pipeline from the ore processing plant located approximately 1.5 km from the TMF. The TMF dams will be raised progressively in stages to provide additional storage capacity. It is projected that three dam raises will be required during the operating period. The final two raises will be completed in back-to-back years.

The TMF site selection process was carried out in accordance with Environment Canada's *Guidelines for the Assessment of Alternatives for Mine Waste Disposal* (Environment Canada 2011). The TMF site was selected in consideration of environmental constraints, including potential triggering of a *Metal and Diamond Mining Effluent Regulations* (MDMER) Schedule 2 amendment; the use of natural topography for containment; existing land tenure; the spatial footprint of the Project; and the benefits of having tailings contained in a single facility. The design of the TMF does not overlap spatially with fish-bearing waters. The TMF will be near Payne Lake, which raises the potential issue of additional mass loading through seepage and, therefore, elevated arsenic and ammonia. The potential effects for acid rock drainage (ARD) and metal leaching (ML) to reach the environment will be mitigated by collecting and containing seepage/runoff and/or covering the tailings (wet and/or dry covers). Addition of a circuit for removal of sulphides from tailings and containment of produced concentrate will also be considered.

Reclaim water from the TMF will be used as a source water for ore milling and processing. Tailings and excess water from the ore milling and processing plant will be returned, via pipes, to the TMF. Based on current modelling and engineering feasibility studies, under normal operating conditions, water from the TMF will be required to meet mill reclaim demand; however, it is not anticipated that discharge from the TMF will be released directly into the environment. If discharge is required, it will be treated to meet applicable federal and provincial regulatory requirements prior to discharge to the environment.

The potential consequences associated with a failure of TMF dams during operation were classified as "High" by Golder (2019) based on the Canadian Dam Association Dam Safety Guidelines, which considers

the population at risk, potential loss of life, environmental effects, and economic losses (Ausenco Engineering Canada Inc. (Ausenco) 2019 [in progress]). For example, the analysis considers the potential loss of wildlife / fish habitat along Minton Lake and further downstream, possible washout of PR 391, and/or large financial costs for cleanup and remediation downstream.

Containment structures for the TMF will be designed in accordance with the Canadian Dam Association Dam Safety Guidelines (CDA 2013, 2014). The design earthquake for a “High” classification tailings dam is the 1 in 2,475-year event (CDA 2014).

The risks associated with the TMF during construction and operation that may result in adverse environmental effects include the following:

- Water management issues, associated with both the quantity and quality of the inflows to the TMF, could result in excess water stored in the TMF that would require treatment and discharge to the environment to maintain dam containment.
- Damage to the dam liner due to improper construction or installation could result in excess seepage, overwhelming the downstream sumps and causing uncontrolled discharge to the environment.
- A failure of the tailings dam would result in the uncontrolled release of water and/or tailings into the environment.

A failure of the tailings dam would result in the uncontrolled release of water and/or tailings into the environment, resulting in residual adverse effects on surface water, fish and fish habitat, groundwater, vegetation and wetlands, wildlife, and wildlife habitat. The potential also exists for subsequent residual adverse effects on land and resource use, including traditional uses, and archaeological or cultural heritage resources where they exist. There is also potential for subsequent residual adverse effects on human health. The evaluation of potential effects is provided in Section 22.5.

While the potential consequences associated with a failure of TMF dams during operation were classified as “High” by Golder (2019), the likelihood and overall risks associated with the TMF during construction and operation have been classified as low in recognition of contingency planning and the implementation of engineering and quality controls during the design, construction, and operational phases to mitigate these risks. During operation, Alamos will implement a systematic performance monitoring program, critical to maintaining the physical integrity of the dams and ancillary structures at the TMF. Additional detail on the monitoring program is provided in Section 22.5.1.1. The TMF will be equipped with an emergency spillway to allow safe routing of flows from precipitation to prevent dam overtopping (Ausenco 2019 [in progress]). The design flooding event for the operation of the Project was selected as 1/3 between the 1 in 1000-year and the probable maximum flood, according to the Canadian Dam Association Dam Safety Guidelines. The design flooding event for the post-closure (passive) phase of the Project was selected as 2/3 between the 1 in 1000-year and the probable maximum flood.

22.4.2 Release of Untreated Contact Water

Contact water is surface water or groundwater that contacts mine workings or interacts with mine rock material. Contact water will be collected through a variety of drainage ditches, pipes and sump pits and directed to either the TMF or site water management ponds. Collection ditches will be constructed around Project infrastructure to manage contact water. Water collected in the sumps and/or small ponds and during open pit dewatering will be pumped to water management ponds located at each site and discharged directly to the environment if it meets applicable federal and provincial regulatory requirements. If it does not meet federal and provincial regulatory requirements, the water will be treated prior to discharge.

At the Gordon site, contact water collection includes the following:

- Mine water composed of dewatering flows from the Gordon open pit.
- Site runoff water composed of surface runoff from the stockpiles and seepage resulting from infiltration of precipitation through the stockpile surfaces.

At the MacLellan site, contact water collection includes the following:

- Mine water, composed of dewatering flows from the MacLellan open pit.
- Tailings water from the process plant.
- TMF water, composed of direct precipitation on the tailings pond, surface runoff from the tailings beach, and seepage through the TMF dams that is assumed to be collected and pumped back to the TMF.
- Site runoff and seepage water from the process plant area, mine rock storage area and stockpiles.

General site surface runoff from disturbed areas will be allowed to drain naturally to collection ditches that will convey the water to collection sumps. The water from the plant site stockpiles, topsoil stockpile, overburden stockpile, and approximately 55% of the mine rock storage area will be pumped from the collection sumps to the collection pond for storage prior to discharge to the environment (toward the Keewatin River at the MacLellan site). The remaining runoff from the mine rock storage area will be pumped to the TMF for storage. Water collected in the pond at the Gordon site will be discharged to Farley Lake. The overall water management concept is to divert non-contact water to reduce the amount of contact water to be managed and to collect the contact water for conveyance to the collection pond where sediment control can be provided prior to the release of water to the environment.

Geochemical testing and water quality modelling is ongoing; however, analysis of preliminary sampling results indicate that tailings contain potentially acid-generating (PAG) material and have leaching potential for arsenic and metals (i.e., copper, iron, chromium, and lead). The potential effects for ARD and ML to reach the environment will be mitigated by collecting and containing seepage/runoff and/or covering the tailings (wet, including water, and/or dry covers).

At each site's water management pond, water quality will be monitored. If necessary, the water will be treated to meet applicable federal and provincial regulatory requirements prior to discharge to the

environment, including the authorized limits of deleterious substances specified in Schedule 4 of the MDMER. The means of contact water treatment, if required, will be determined as part of detailed design engineering at a later stage of the Project. At a minimum, the water management ponds will be sized to provide enough retention time capacity for the settling of suspended solids.

Wherever contact water is stored, there exists potential for seepage. Foundation seepage will be controlled via low permeability seepage cutoffs. A downstream seepage collection system, consisting of a series of sumps in combination with a buried weeping tile or rockfill finger drain system, will be installed during the starter dam construction. Seepage water associated with the TMF will be collected and pumped back to the TMF.

Damage to the dam liner due to improper construction or installation could result in excess seepage, overwhelming the downstream sumps and causing uncontrolled discharge to the environment and incurring additional costs for environmental rehabilitation. Accidental discharge from the collection, or seepage of mining effluent has the potential to cause changes to groundwater, surface water and sediment quality, indirect or direct effects on fish (i.e., toxicity, bioaccumulation, avoidance of area, alteration of planktonic and benthic communities). The exposure and weathering of some mine materials may also cause degradation of fish habitat due to acid generation and/or leaching of contaminants into waters frequented by fish.

The likelihood and overall risks associated with the release of untreated contact water during construction and operation have been classified as low in recognition of contingency planning and the implementation of engineering and quality controls during the design, construction, and operational phases to mitigate these risks.

In the unlikely event of a release of untreated contact water due to water management pond or collection system failure or accidental discharge through seepage, the potential may exist for residual adverse effects on groundwater, surface water, and fish and fish habitat. The evaluation of potential effects is provided in Section 22.5.

22.4.3 Ore Milling and Processing Plant Accident or Malfunction

No ore milling or processing will be carried out at the Gordon site. Ore milling and processing will be carried out at the MacLellan site and will include ore crushing; ball milling; pre-thickening; cyanidation for gold recovery (i.e., leaching and carbon-in-pulp); cyanide destruction using a conventional air and sulphur dioxide (Air/SO_2) oxidation process; and carbon stripping and carbon regeneration, followed by electrowinning and refining. The cyanide will be detoxified in the tailings area and a hydrogen cyanide (HCN) gas detector will be present to detect potential HCN gas in the area. HCN detectors will also be present in the leach area in the event of malfunction resulting in a drop of pH and formation of HCN gas.

The Project has been designed to reduce potential effects on surface water quantity and quality by reusing process water, incorporating a closed system for cyanide extraction of gold (limiting exposure within the environment), and managing water to reduce volumes of mine contact water discharging to surface waters. Alamos will use a closed circuit for cyanide use and cyanide destruction in the processing plant (via Air/SO_2 oxidation and precipitation of metals) prior to release to the TMF.

Given cyanide handling activities will occur within the process plant using standard management practices, there are no anticipated releases to the environment. Project activities will be aligned with the International Cyanide Management Code. If a release were to occur during milling or processing, it would be contained within the facility that is designed to meet the capacity to manage a worse-case scenario failure. Therefore, no residual adverse effects on VCs are anticipated and no further effects assessment is required.

22.4.4 Sewage Treatment Plant Malfunction or Discharge Pipeline Failure

For the Gordon site, sewage will be conveyed by gravity through buried pipes to two septic tanks at the truck shop and administration building. It will then be trucked to MacLellan for processing at the MacLellan sewage treatment plant.

Domestic sewage at the MacLellan site will be treated at the sewage treatment facility, which will be designed in accordance with applicable regulatory requirements (e.g., Onsite Wastewater Management Systems Regulation under *The Environment Act* of Manitoba). The average sanitary wastewater flow rate will be approximately 60,000 L/d. At the current stage of Project planning, it has been assumed that a package treatment plant will be required with a discharge consisting of an outfall pipe and diffuser to the selected surface water receiver (likely the Keewatin River). Effluent will be treated to meet applicable regulatory requirements (e.g., Wastewater Systems Effluent Regulations under the federal *Fisheries Act*) prior to discharge to the environment.

The sewage treatment facility will be built to applicable industry standards and codes and will be maintained and inspected on a regular basis. In the event of a malfunction in the sewage treatment plant, untreated sewage may be released within the treatment plant area. However, the treatment plant will be built on a pad and surrounded by ditching to control potential releases. A leak or spill from the discharge pipeline will release treated effluent that meets the applicable standard for release and will be rapidly responded to and cleaned up, as required. Therefore, no residual adverse effects on VCs are anticipated and no further effects assessment is required.

22.4.5 Fuel and Hazardous Materials Spill

A fuel and hazardous material spill could occur at the mine sites and/or during transportation. Diesel and gasoline will be delivered to both the Gordon and MacLellan sites in tanker trucks and dispensed from on-site storage tanks using a bowser system. At the MacLellan site the processing plant fuel station will include four separate pumping stations. The fuel area will contain a sump pump that leads to an oil/water separation device for treatment of spillage. Gasoline fuel storage and distribution at the MacLellan site for light vehicles will include one double walled tank with the capacity of 5,000 L and a single pumping dispenser. The gasoline fuel tank and dispensers and haul truck diesel fuel station will be located on a common concrete pad.

Reagents and other consumables will be received via truck in tankers or on pallets. Regents will be stored in a dry storage facility separately from the reagent mixing area. Reagents will be transported between the storage and mixing areas using a forklift. Reagents will be mixed in a separate area within the processing plant building with bunding to control spillage.

Contractors will be required to safely handle, transport and store waste oils, fuels, and hazardous wastes as recommended by the suppliers and/or manufacturers and in compliance with applicable federal, provincial, or municipal regulations. Tanks will be double walled horizontal cylindrical with piping system in concrete trenches as secondary containment.

Hazardous liquids can be a risk to the environment because of their ability, if not properly contained, to flow in an uncontrolled manner and seep into porous material. Some liquids contain components that are toxic to plants and wildlife. Construction equipment will have to work near watercourses and heavy trucks will be operating on roads that cross waterbodies, so there is the potential for hydraulic hose leaks. To reduce the potential effects of hydraulic fluid spill, biodegradable hydraulic fluid will be used, and regular inspections and maintenance will be carried out. Alamos will develop and implement an ERSPCP to facilitate responses to emergency situations that occur at the Project site (Chapter 23, Section 23.5.1). The plan will include spills and the releases of hazardous substances, including petroleum products, accidents involving hazardous substances, medical emergencies, explosion, and fire. In the event that a spill at the mine sites occurs, the spill would be immediately contained and cleaned up using onsite spill kits and appropriate absorbent materials. In the event of a large spill available resources would be redirected to the spill area to provide response. Spills would have limited potential to affect groundwater, as it is anticipated they would be confined to the soils within the timeframe of a cleanup response and excavated before migrating to the groundwater table. Soils in the vicinity of a spill would be tested for hydrocarbons and excavated as required. There is also potential for air emissions of volatile components of a fuel spill. Adverse effects will be generally localized, and rapidly dispersed and not of high enough concentrations to affect wildlife which will tend to avoid a spill and cleanup activities. Therefore, no releases to the environment (that are not immediately remediated) or residual adverse effects on the VCs are anticipated and no further effects assessment is required for spills occurring at the mine sites.

Vehicle traffic will be required during most phases of the Project, with the potential for spills as a result of vehicle accidents or equipment malfunction. Transportation of most fuels, reagents and combustibles will be by road, and there is a risk of a collision or roll-over leading to the spill of these transported materials. Spills may also occur if equipment malfunctions, or if non-transport vehicles collide, leading to the release of fluids or lubricants from these vehicles onto the ground. A Project-specific ERSPCP (Chapter 23, Section 23.5.1,) will reduce the likelihood of contamination due to spills. However, since reagents and consumables will be transported from outside the PDA, there is potential for spills to have residual adverse effects on surface water, fish and fish habitat, vegetation and wetlands, land and resource use, and current use of lands and resources for traditional purposes. The evaluation of potential effects is provided in Section 22.5.

22.4.6 Open Pit Slope Failure

The Gordon and MacLellan sites will be developed as open pit mine operations. The anticipated depth of the Gordon open pit is approximately 225 m. The anticipated depth of the MacLellan open pit is approximately 450 m. The open pits will be developed in a series of benches based on the pit design parameters with drilling and blasting completed on each bench. The pit slopes will be designed based on industry standards and the results of site-specific geotechnical investigations.

As described in further detail in Ausenco 2019 (in progress), the geotechnical feasibility-level pit slope designs for the two planned open pits was completed by Golder in 2016 and updated in 2019. The main rock masses that will be exposed on the final pit walls in both pit areas are estimated to be strong and of good to very good quality, with anticipated localized poor to fair quality zones due to minor faults and shears (Ausenco 2019 [in progress]). Therefore, large-scale deep-seated rock mass failure is not anticipated. The Keewatin River, located to the west of the pit area, may influence the groundwater pressures exerted on the pit walls (Ausenco 2019 [in progress]). Local instabilities may occur in zones of decreased rock quality, or where blasting damage is concentrated. The recommended slope configurations aim to limit the risk due to kinematic controls, and berm widths are planned to catch small scale failures due to planar, toppling, and wedge blocks.

The Gordon pit area is predominantly characterized by banded iron formation. The intensity and lower frictional strength of the foliation in the iron formation rocks at the Gordon site lead to higher risk of planar failures along the foliation-parallel north and south pit walls. The pit is surrounded by lakes and wetlands, including Farley Lake to the east and Gordon Lake to the west, that may influence pore pressure and seepage into the pit (Ausenco 2019 [in progress]).

Though the rock mass is generally of good quality and strong, the influence of groundwater, particularly from nearby water bodies, can exert pore pressures that may lead to pit slope instabilities. Slope stability modelling for MacLellan showed stable results for the recommended set-back distance of 45 m from the surface water bodies. However, output from the Slide® model showed saturated slope conditions due to the proximity of the surface water bodies, which will require implementation of dewatering and seepage control measures (Ausenco 2019 [in progress]).

A Surface Water Monitoring and Management Plan will be developed to implement drainage ditches to divert the surface water from the slope faces (Ausenco 2019 [in progress]). Surface water that cannot be practically diverted from the slope would be controlled and collected at the crest and toe of benches and discharged appropriately with a series of lined ditches. A summary of the plan can be found in Chapter 23, Section 23.5.5.

Groundwater will be managed by locally installing sub-horizontal drains and by using sumps within the pit and monitored by vibrating wire piezometers. A summary of the Groundwater Monitoring Plan can be found in Chapter 23, Section 23.5.4. In addition, deep dewatering system and/or grouting measures will be employed at the Gordon pit perimeter near the adjacent lakes to reduce the groundwater inflow (Ausenco 2019 [in progress]).

Open pit slope failure could occur due to unanticipated geologic conditions or extreme weather events such as overland flooding. Alamos will undertake regular slope stability inspections during operation to monitor slope performance. Slope failure would be confined to the PDA and may affect Project operation or infrastructure; however, residual adverse effects to VCs would not occur and no further effects assessment is required.

22.4.7 Ore, Overburden and Mine Rock Stockpiles/Storage Areas Slope Failure

Ore will be stockpiled at the Gordon site and used as feedstock for the ore milling and processing plant at the MacLellan site. The current mine plan calls for a peak stockpile of 1.6 Mt at the Gordon site. The Gordon site will also have stockpile areas for removed overburden as well as mine rock. These stockpile/storage areas are proposed to be located to the southwest and south of the open pit. The current mine plan calls for peak stockpile of 0.9 Mt of overburden and 50.1 Mt of mine rock.

Some ore will be stockpiled for future processing at the MacLellan site. An ore stockpile area is planned, located south of the mill. The MacLellan site will also contain stockpile areas for removed overburden as well as mine rock. The overburden stockpile area is proposed to be located to the east of the proposed ore milling and processing plant, while the mine rock storage area is proposed to "wrap around" the south and east sides of the TMF. The current mine plan calls for a peak stockpile of 2.7 Mt of ore, 8.2 Mt of overburden, and 230.9 Mt of mine rock.

The Project may result in the generation of mine rock that could have the potential for ARD and ML. Geochemical testing and water quality modelling is ongoing; however, preliminary sampling results indicate that mine rock from the Gordon site contains PAG materials and shows a leaching potential for arsenic. Mine rock that is classified as PAG and/or ML that is expected to produce runoff may require additional mitigation, such as blending, dry and/or wet covers, and/or treatment. Final required mitigation measures will be determined as the Project plan and detailed engineering design are advanced.

Failure or slumping of the mine material storage areas could result in mine material overflowing the boundaries of the stockpile area from inadequate consolidation and soil shear strength, incorrect stockpile placement, uncontrolled erosion, improper geotechnical monitoring, or inappropriate design considerations. Should a failure occur, material from the stockpile areas could enter adjacent areas to the mine sites, including lakes and streams. A release of material could release contaminants or contact water into surface water and fish habitat. Potential effects to fish and fish habitat may, by extension, also affect local land and resource use, including traditional uses. No disturbance to archaeological resources would be expected as the PDA will be cleared of potential resources prior to construction. The evaluation of potential effects is provided in Section 22.5.

22.4.8 Over-Blasting

The open pits will be developed in a series of benches based on the pit design parameters with drilling and blasting completed on each bench. Blasting will be conducted in accordance with the Explosive Management Plan (ExMP) (for the safe use and storage of explosives and explosive components at the Project sites) and conducted as a series of small daily blasts (Chapter 23, Section 23.5.10). Emulsion explosives with non-electric detonators will be used and stored during mine operations at the MacLellan site. An explosives mixing plant and explosives magazine will be housed separately away from main mine operations. Explosives storage requirements will be determined with the selected explosives supplier and will be established in accordance with the National Standard of Canada document number CAN/BNQ 2910-510 – *Explosives – Quantity Distances*, and the facility will be licensed under the federal *Explosives Act*.

Uncontrolled or unmanaged blasting could cause damage resulting from dust and fly rock extending beyond defined boundaries and result in excess noise and vibration to the surrounding properties. Noise and vibration effects from an uncontrolled explosion would be short in duration. Alamos will develop and implement a Noise Monitoring Plan to monitor and manage the effects of the Project on ambient noise and vibration in accordance with regulatory guidance levels (Chapter 23, Section 23.5.8). Effects from uncontrolled or unmanaged blasting could cause wildlife sensory disturbances (i.e., avoidance behaviors from noise), changes in fish health, growth and survival (e.g., from concussion, flyrock and runoff contaminated with the byproduct of explosives), as well as changes to the composition, abundance, and distribution of periphyton, plankton, and benthic invertebrate communities. Blasting operations will be carried out in accordance with applicable regulations to reduce the potential for an uncontrolled explosion and the PDA was developed to include a buffer around the open pit to buffer VCs from the potential effects of fly rock. No residual adverse effects on VCs are anticipated, and therefore no further effects assessment is required.

22.4.9 Fire/Explosions

The potential for fire or explosion during construction and operation exists due to vehicle or equipment accident or malfunction, uncontrolled explosion, smelter or kiln malfunction, or electrical accident. The ERSPCP provisions related to fire prevention and management will reduce the likelihood of accidents and potential fires to as low a level as is reasonably practical. As part of this plan, fire prevention and suppression systems will be located at each site, including water supplies, sprinklers, fire extinguishers and other firefighting equipment. These facilities will use raw water from local sources. A cleared buffer will be maintained around critical mine infrastructure to impede the spread of fire from a facility fire to the surrounding woodlands and to protect the facilities from a wildfire.

The fire water tank (part of the freshwater tank) is designed to accommodate a fire water inventory with at least 500 m^3, equivalent to two hours fire water supply. The tank is automatically replenished with a water-level triggered pumping system. The fire water tank is served by a single dedicated pump. The fire water piping network is kept pressurized with a smaller single duty fire water jockey pump.

A network of fire hydrants will be located outdoors close to potential site assets. Indoor fire hose cabinets will be located within most buildings. Fire extinguishers will be located indoors at strategic locations. Sprinklers will be installed in office and shop areas, and will include the dry (i.e., changerooms), warehouse and laboratory areas.

Automated fire detection and fire protection systems will be installed in various areas including in the crushing, grinding and process plant buildings, the warehouse and fuel storage areas, and other areas as required (Ausenco 2019 [in progress]). Supplemental hand-held fire extinguishers, each suitable for each area, will be mounted throughout the buildings including motor control centers, control rooms, transformers areas and fuel storage locations. Firewalls and fire rated floors to limit the spread of fire, high temperatures and smoke will be provided as required. Emergency exists will have appropriately illuminated exit signs.

First response firefighting activities will be conducted by the mine rescue team utilizing on-site water trucks and emergency response equipment. Alamos will provide emergency response services sufficient in size and capability to respond to emergency situations at the mine.

An ExMP will be prepared to provide for the safe use and storage of explosives and explosive components at the Project sites (Chapter 23, Section 23.5.10). The management of explosives will be in accordance with environmental protection measures, provincial and federal legislation and guidelines, and corporate policies for explosives. Plans will be prepared prior to the use of explosives at Project sites.

In the event of a fire and/or explosion there is potential for temporary effects to air quality. It is possible that a project fire could spread to surrounding areas. Reasonable precautions will be taken to avoid fires and limit the potential for fires beyond the PDA (e.g., cleared buffers). Employees will be trained in fuel handling, equipment maintenance, and fire prevention and response measures and fire prevention and suppression systems will be maintained on-site. Furthermore, emergency response procedures will be in place to provide timely and effective response to fires, and containment within the PDA. Protocols for communication with local authorities will also be included in these emergency response procedures. Given the implementation of proposed mitigation measures and emergency response procedures, no residual adverse effects beyond the PDA or adverse effects on VCs are anticipated, and therefore no further effects assessment is required.

22.4.10 Vehicle Accidents

PR 391 will be used by personnel, material deliveries, and haulage trucks transporting material to the ore milling and processing plant. A vehicle accident has the potential to cause temporary delays to road traffic, damage to property, or injury or death to individuals involved. Project-related transportation and heavy equipment also have the potential to crush or collide with wildlife.

A Transportation Impact Study was undertaken in 2016, which identified the existing traffic volumes on PR 391 to be extremely low - 150 vehicles per day as a conservative (high) estimate (Stantec 2016). Given that the available capacity is close to 6,000 vehicles per day on equivalent road types, based on a road classification of ‘Secondary Arterial’, with an assumed planned haulage rate of 4,100 tonnes per day (t/d) (equivalent to seven truckloads per hour) there would be little or no capacity-related issues along the road or at intersections with access roads. There is some pedestrian activity along PR 391; while the level of activity is low, it could be altered by Project-related vehicle traffic. In the event of an accidental collisions from the operation of vehicles or heavy equipment, there is potential for human or wildlife mortality or injury. Therefore, there is potential for residual adverse effects on wildlife and wildlife habitat and human health. The evaluation of potential effects is provided in Section 22.5. Potential effects resulting from a spill from a vehicle accident are discussed in the assessment of a fuel or hazardous material spill (Section 22.5.3).

The effects of vehicle collisions with wildlife are assessed in the Wildlife and Wildlife Habitat (Chapter 12).

22.4.11 Summary of Accidents or Malfunctions Screened for Further Assessment

Table 22-2 presents the potential interactions between VCs and the potential accidents or malfunctions. Five accident and malfunction events were identified (Table 22-2) as having potential to cause a residual adverse effect on VCs, if they occurred, and are therefore assessed in Section 22.5.

Table 22-2 Potential Interactions between VCs and Potential Accidents or Malfunctions

Accident or Malfunction Event with the Potential to Cause Residual Adverse Effects	Atmospheric Environment	Groundwater	Surface Water	Fish and Fish Habitat	Vegetation and Wetlands	Wildlife and Wildlife Habitat	Labor and Economy	Community Services and Infrastructure	Land and Resource Use	Heritage Resources	Current Use of Lands and Resources for Traditional Purposes	Human Health	Indigenous Peoples
Tailings Management Facility Malfunction	-	✓	✓	✓	✓	✓	-	-	✓	✓	✓	✓	✓
Release of Untreated Contact Water	-	✓	✓	✓	✓	-	-	-	-	-	-	-	✓
Spills from Vehicle Malfunctions or Transportation Accidents	-	-	✓	✓	✓	-	-	-	✓	-	✓	✓	✓
Ore, Overburden, and Mine Rock Storage Area Slope Failure	-	-	✓	✓	-	-	-	-	✓	-	✓	-	✓
Vehicle Accidents	-	-	-	-	-	✓	-	-	-	-	-	✓	✓

In the case where a major accidental event or malfunction resulted in Project operations to be temporarily suspended, there is potential for a low magnitude adverse effect to local and regional economies by effects to wages, government revenues, and depending on the length of the suspension, gross domestic product. There may also be increased localized spending with short-term benefit to nearby communities, including businesses supplying goods and services in support of the emergency responses. Effects to the economic environment would be short-term in duration and likely reversible within a month, therefore, residual effects to labor and economy from an accident or malfunction are not discussed further.

While emergency response capabilities at the mine site (e.g., firefighting and health care) will be sufficient for most accidents, a major accident may require support from Lynn Lake or other surrounding communities. However, such support would not be frequent and would not put an excessive demand on these other capabilities. Effects to community services and infrastructure would be short-term in duration and likely reversible within a month; therefore, residual effects to community services and infrastructure from an accident or malfunction are not discussed further.

In the event of an accidental event or malfunction, there is potential for adverse residual effects to Indigenous Peoples. This includes effects to Indigenous health conditions, Indigenous socio-economic conditions, and Indigenous physical and cultural heritage, current use of lands and resources for traditional purposes (hereafter referred to as 'Current Use') and Indigenous or Treaty Rights in accordance with the requirements described in both federal and provincial guidance documents for the Project. The community of Marcel Colomb First Nation is located within the Project LAA and RAA, and members of other Indigenous communities engaged on the Project may choose to live and work within the LAA and RAA or travel to areas within the LAA or RAA to access services, to take up temporary employment, engage in cultural activities, or to harvest country foods. The ability to exercise or practice Indigenous or Treaty rights, including harvesting rights and integral practices, traditions, and customs, depends upon the health of the land to support these practices. The potential effects of an accidental event on asserted or established Indigenous or Treaty rights are derived directly or indirectly from the physical effects of the Project on the environment. Consequently, the pathways are similar for potential effects for the exercise and practice of Indigenous or Treaty rights (including the availability of and access to traditionally harvested resources and traditional sites and areas), as well as for the conditions that support the exercise of rights (including Indigenous health, Indigenous socio-economic conditions, and Indigenous physical and cultural heritage). Overall, with the implementation of mitigation measures and emergency response procedures, residual Project effects on the exercise or practice of Indigenous or Treaty rights in the LAA are expected to reflect the residual effects predicted for Current Use, including the availability of and access to traditionally harvested resources and traditional sites and areas, as well as for the conditions that support the exercise of rights (including Indigenous health, Indigenous socio-economic conditions, Indigenous physical and cultural heritage).

The assessment of accidental events and malfunctions for Indigenous Peoples is related to the conclusions of the assessments of related biophysical and socio-economic VCs, including Human Health, Land and Resource Use, Community Services, Infrastructure and Wellbeing, Labour and Economy, Heritage Resources, and Current Use. Residual effects on these related VCs are discussed below and similar residual effects are predicted on the health, social conditions, and physical and cultural heritage of Indigenous peoples. For example, Indigenous health conditions may be affected through changes to the availability of wildlife, fish, and plants that are harvested for country foods and the perceived quality of country foods, which are assessed in Current Use. Therefore, residual effects to Indigenous Peoples from an accident or malfunction are not discussed further.

22.5 EFFECTS ASSESSMENT OF POTENTIAL ACCIDENTS OR MALFUNCTIONS

22.5.1 Tailings Management Facility Malfunction

22.5.1.1 Project Design and Safety Measures to Reduce Environmental Effects

A TMF will be constructed at MacLellan site in three stages: 'Stage 1', 'Stage 2', and 'Ultimate'. At each stage, the TMF dams will be raised progressively to provide additional storage capacity (volume of tailings is 2.0 Mm^3, 9.3 Mm^3, and 23.1 Mm^3, respectively). Dams associated with the TMF will be constructed on a bedrock foundation (Golder 2019). It is assumed at this time that the TMF dams will consist of a low

permeability core constructed of suitable material with internal bedding and filter zones, and upstream and downstream shells of granular material. The dams will have an upstream slope of 3H:1V, a downstream slope of 2H:1V, and a crest width of 10 m. The starter dam crest elevation has currently been set at 362.5 m above mean sea level, with an average dam height of 10 m and length of approximately 5 km. The materials selected for the construction of the TMF dam are not susceptible to frost or subject to the effects of freeze – thaw cycles (Golder 2019). The TMF is designed to mitigate for malfunctions with the presence of collection ditches and sump pits. Liquid tailings would be collected by collection ditches and sump pits and pumped back into the TMF. TMF dam design is further described in Ausenco 2019 (in progress) and Golder 2019, and was derived in consideration of the tailing deposition and water management plans.

The accumulation of water in the TMF was modelled assuming average annual precipitation conditions over the life of the mine. During the operational phase, water will be pumped from the TMF pond via a reclaim pump station for the operation of the process plant (Ausenco 2019 [in progress]). An emergency spillway will be raised progressively to correspond with raising of the TMF dams to avoid dam overtopping. The outlet channel is provided with a stilling basin to promote energy dissipation and avoid erosion and scouring due to high flow velocities.

During operation, the implementation of a systematic performance monitoring program is critical to maintaining the physical integrity of the dams and ancillary structures at the TMF. Such a program will include environmental monitoring together with regular visual inspections of the facility and monitoring of piezometric levels within the containment dams. The program will be developed during the detailed design and construction stage of the Project and it will be reviewed on a regular basis to account for changes in the performance or operation of the TMF. Details of the program is provided below.

Independent Review/Inspection Programs

The various components within the TMF will be regularly inspected by qualified personnel associated with an independent engineering firm, familiar with the design and operating requirements. The results of the monitoring program will form the basis for determining maintenance and remediation measures that may be required from time to time. It is common practice to implement such programs on three levels: routine observations (daily), detailed inspections (quarterly and annually), and formal dam safety reviews (five to seven years depending on the dam hazard classification). Detailed inspections will also be conducted following snow melt and after unusual events such as heavy rainstorms, windstorms, and seismic events. Water levels in the TMF pond will be recorded daily and a detailed survey of the tailings surface will be completed annually to assist with tailings deposition planning and construction scheduling.

Dam Instrumentation

The performance of the containment dams can be inferred, in part, from instrumentation placed within the dams and their foundations. Since the dams are of relatively modest height and it is anticipated that they will be constructed on a competent foundation of bedrock, the installation of instrumentation during the construction program is considered not necessary. A dam instrumentation plan based on conditions encountered, and observations made, during construction shall be developed and implemented, if it is necessary, following construction. Factors that will be considered in the development of the instrumentation

plan include conditions and difficulties encountered during construction, and the results of construction monitoring of fill materials and fill placement.

At a minimum, it is anticipated that instrumentation will be required to monitor piezometric levels of underlying foundation soils at each of the dams. Settlement plates, installed to a depth that penetrates the maximum expected frost depth, will be installed on the crest of dams along with the piezometers to monitor settlement. Inclinometers will also be installed to monitor lateral deformations within the dam.

Initially, water level measurements in the piezometers will be taken at bi-weekly intervals. Once stabilized, the monitoring frequency will likely be reduced to monthly readings, provided that abnormal conditions have not been observed during the initial monitoring period. Additional instrumentation and/or more frequent monitoring may be required if unusual conditions are indicated by the initial monitoring or by observations recorded during facility inspections.

Groundwater Monitoring

Some seepage through and under the dams at the TMF can be anticipated. It is expected that most of the seepage from the dams can be collected in ditches and conveyed to small sumps and, if necessary, pumped back into the TMF. The remainder would be lost to the groundwater flow regime.

A network of groundwater monitoring wells will be installed downstream of each of the dams during the initial construction program. It is recommended that an additional monitoring well be installed outside the TMF to serve as an indicator of background groundwater quality. The location and number of additional monitoring wells to be installed in the future will be determined based on the performance and results of the initial monitoring wells.

Groundwater is at or close to ground surface over most of the site and a layer of low permeability upper bedrock is present. Apart from flow along discrete structural features in the bedrock (e.g., faults, jointing), it is anticipated that groundwater flow is likely to occur within the upper slightly weathered bedrock zone. It is therefore suggested that the monitoring wells be installed to monitor these potential flow pathways. Prior to well installation, the locations and design of the monitoring wells will be reviewed based on information obtained during construction. As necessary, the detected seepage can be directed back into the TMF via pump-back wells.

In addition to groundwater monitoring, surface water quality monitoring will be done in waterbodies downstream and around the TMF.

The likelihood of a TMF dam failure will be assessed during detailed Project design; however, Alamos will develop contingency planning and implement engineering and quality controls during the design, construction, and operational phases to comply with applicable design standards and best practices.

22.5.1.2 Emergency Response Measures and Capacities

In the event of a TMF dam failure, preliminary emergency response measures would include:

- Stop pumping tailings to the TMF.

- Stop pumping runoff from mine rock storage area to the TMF.
- Notification to authorities, emergency responders, local residents, and Indigenous communities.
- Notification to Engineer of Record.
- Develop a specific remedial action and monitoring plan for the event and initiate remedial action.

Additional information on preliminary emergency response measures and capacities is discussed in Chapter 23 and will be further developed during detailed Project design. Emergency response measures will be prepared in accordance with federal and provincial legislation and guidelines, and corporate policies and procedures for the protection of human health and the environment (including species at risk). Measures will be prescribed for the provision of emergency response planning, training, responsibilities, cleanup equipment, and materials, and contact and reporting procedures.

22.5.1.3 Environmental Effects Assessment

Malfunction or overflow of the tailings management facility may result in the release of water and tailings solids into the environment. At the 'Ultimate' stage of construction, the TMF will have the capacity to store 23.1 Mm^3 of tailings. While it is currently unknown if the full release of tailings from the 'Ultimate' stage of TMF development represents a credible scenario, it is assumed here as the extreme worst-case basis for a dam failure. This release would result in effects on water quality, with the potential for soil erosion and sedimentation if a dam breach were to occur. The tailings are silty fine sand-sized and are characterized as PAG, though not expected to produce ARD during operations, with a high leaching potential for arsenic and a low leaching potential for metals including copper, iron, chromium, and lead (Ausenco 2019 [in progress]).

Collection ditches are designed to collect overland flow and seepage, intercept shallow groundwater flow, and divert freshwater away from the Project components. The design flooding event for the operation of the Project was selected as 1/3 between the 1 in 1000-year and the probable maximum flood, according to the Canadian Dam Association Dam Safety Guidelines. The design flooding event for the post-closure (passive) phase of the Project was selected as 2/3 between the 1 in 1000-year and the probable maximum flood.

In the event of a TMF dam failure, liquid tailings would be released to the environment, affecting the waterways within the PDA, and the surrounding area. Tailings solids could also be deposited along low-lying areas extending from the breach location, potentially causing localized infilling of vegetated areas and waterbodies. The likelihood of a potential dam breach will be calculated during final design of the TMF. There is minimal ponding near the TMF dams (even under storm events). If breached, the TMF could potentially release material into the Minton watershed, Payne Lake, and to the Keewatin watershed. Depending on the timing and extent of a potential failure, effects to surface water, fish and fish habitat, groundwater, vegetation and wetlands, and wildlife habitat, may occur. Effects on these VCs could then affect local land uses and archaeological and heritage resources as described below. Alamos will develop contingency planning and implement engineering and quality controls during the design, construction, and operational phases to mitigate adverse environmental effects.

Groundwater

A TMF malfunction could affect groundwater quality depending upon the magnitude of the failure and the time elapsed until cleanup. Topography and the horizontal hydraulic gradient in the area of the TMF slope toward the Keewatin River and Minton Lake. It may therefore be expected that the effect on groundwater quality, as a result of a TMF failure, would extend from the TMF toward these surface water features. Localized infiltration would be limited due to surface flow toward the Keewatin River and Minton Lake. Tailings solids may be deposited near the breach location and downgradient low-lying areas but will be cleaned up where possible to limit infiltration and long-term effects to groundwater. Tailings solids deposited in low-lying areas will be cleaned up promptly to limit infiltration and long-term effects to groundwater. If damage to terrestrial vegetation (i.e., forested areas) cannot be remediated, the potential for long-term effects to groundwater quality exists. As discussed in Section 22.5.1.1 , a network of groundwater monitoring wells will be installed downstream of each of the dams to monitor potential flow pathways.

Residual adverse effects on groundwater are predicted to be of high magnitude, within the Local Assessment Area (LAA), long-term, and potentially irreversible if tailings cannot be effectively removed from the ground surface.

Surface Water

A TMF malfunction would have the potential to affect water quality and quantity of nearby waterbodies, depending on the location of the leak or breach. If breached, the TMF could potentially release material into the Minton watershed, Payne Lake, and to the Keewatin watershed. Potential effects to Payne Lake may include substantial water quality and sediment quality alteration. Tailings would likely drop to the bottom of the lake and not move into the channel draining Payne Lake to the Keewatin River. Beaver dams present in this channel would impede fine sediments from reaching the Keewatin River. Water quality in the outlet channel, Keewatin River, and potentially downstream to Cockeram Lake could be affected in the event of a TMF malfunction and it is anticipated that this effect would likely persist for several years. Water quality may also be altered in the Cockeram River (Lobster Lake is one of the headwater lakes of the river), which would likely be altered most of the way downstream to Cockeram Lake. Minton Lake water quality and sediment quality could also be substantially altered, including the unnamed lake immediately downstream of Minton Lake. These waterbodies drain into Cockeram Lake; however, there would be a diminishing effect on sediment and water quality downstream of Cockeram Lake.

A failure of the TMF could also result in deposition and the infilling of the waterbodies with solid tailings and TMF dam materials. This may in turn affect natural drainage patterns. Solids deposition into water bodies may result in long-term water quality effects depending on the speed and effectiveness of cleanup activities.

In addition to groundwater monitoring, surface water quality monitoring will be carried out in the creeks downstream and around the TMF. Furthermore, Alamos will develop contingency planning and implement engineering and quality controls during the design, construction, and operational phases to mitigate affected waterbodies.

Residual adverse effects on surface water are of high magnitude, potentially extending to the Surface water Regional Assessment Area (RAA) dependent on the magnitude of the malfunction, long-term and potentially irreversible within the PDA.

Fish and Fish Habitat

The current design of the TMF (including start-up and Ultimate TMF infrastructure) does not overlap spatially with fish-bearing waters; however, fish and fish habitat exist within the waterbodies surrounding the TMF. Malfunction of the TMF and release of tailings liquids and solids into these waterbodies could affect water quality and quantity, and result in sediment deposition in fish habitat, with consequent change in fish habitat, and potential change in fish health, growth, or survival due to lethal or sublethal effects. Payne Lake and the waterbodies in the Minton Lake watershed are fish-bearing and directly downstream of the TMF that may be affected during a malfunction of the TMF. These waterbodies drain to the Keewatin River and Cockeram Lake, respectively, at points upstream and downstream of the confluence with the Lynn River. Payne Lake supports brook stickleback (*Culaea inconstans*), and the Minton Lake watershed supports northern pike (*Esox lucius*), and white sucker (*Catastomus commersoni*). The Keewatin River between Burge Lake and Cockeram Lake, and Cockeram Lake together support 17 fish species (Chapter 10).

The primary causes of effects on fish and fish habitat would be related to changes in water and sediment quality, sediment deposition, and increased turbidity. There is potential for long-term toxicological effects to fish and benthic invertebrate communities from the take up of contaminants from the sediment given they live in and on the sediment. Contaminants will also move between the sediment and the water. Contaminants may affect fish through these pathways. If a breach were to occur during spawning, sediment deposition could also smother fish eggs, as well as potentially alter physical substrate characteristics such that substrates are no longer suitable for spawning. Benthic and aquatic plant communities may be lost which may take a long time to recover or require rehabilitation of disturbed areas. This disturbance has the potential to affect the productivity of fish and fish habitat, depending on the magnitude and location of the release. The populations would eventually return to pre-breach levels (in decades) but there would likely be a persistent contamination of fish tissue and fish health due to long-term contamination of bottom sediments. No aquatic species of conservation concern have been documented or are expected in the Fish and Fish Habitat LAA based on known fish species distributions (Volume 4, Appendix J). However, lake sturgeon (*Acipenser fulvescens*), which are listed as “endangered” by COSEWIC, may be present in the Fish and Fish Habitat RAA. Currently available data suggest that lake sturgeon do not frequent the Keewatin River (Chapter 10).

Residual adverse effects on fish and fish habitat are of high magnitude, potentially extending beyond the LAA, and be medium-term and potentially irreversible.

Vegetation and Wetlands

The release of tailings from TMF malfunction would cause the release of tailings into local vegetation communities, which may result in native plant communities being lost or altered and/or direct loss of wetland area or change in wetland form. Changes in water levels due to liquid tailings may also have a limited and

temporary effect on vegetation and wetlands. The magnitude of adverse effects would depend on the size and location of the TMF malfunction. As noted in Chapter 10, Section 10.4.3, no rare ecological communities were identified within the Vegetation and Wetlands LAA, therefore effects to plant communities of conservation concern are not anticipated.

Alamos will develop contingency planning and implement engineering and quality controls during the design, construction, and operational phases to mitigate affected vegetation and wetland plant communities. Tailings solids would be removed where possible, and residual solids would be stabilized and/or covered onsite, allowing for natural filtration by the vegetation itself as it reestablishes after reclamation. Depending on the magnitude of the TMF malfunction, natural vegetation will generally reestablish over subsequent growing seasons.

Residual adverse effects on vegetation and wetlands are moderate to high in magnitude, within the Vegetation and Wetlands LAA, medium to long-term, and potentially irreversible depending on the effectiveness of reclamation.

Wildlife and Wildlife Habitat

TMF malfunction may result in the direct loss or alteration of wildlife habitat, increased mortality risk, and/or changes to wildlife health. During Project construction and operation, the PDA is not expected to provide habitat for most wildlife species as the vegetative cover will have been removed and Project activities will create ongoing sensory disturbances. As noted above, there is potential for water quality to be affected in Cockeram Lake, which is used by waterfowl and ungulates (e.g., moose), and therefore may affect their habitat. The risk of wildlife mortality and wildlife habitat loss in the event of a TMF malfunction would be reduced within the PDA (given wildlife was unlikely to be present within the PDA), but adverse effects on wildlife and wildlife habitat may extend into the Wildlife and Wildlife Habitat LAA depending upon the size and location of the TMF malfunction. If a TMF malfunction reaches the Wildlife and Wildlife Habitat LAA, solid tailings and contaminated liquids may infiltrate low-lying areas or nearby vegetation; however, these effects would be limited with prompt reclamation and stabilization, and the vegetation would be expected to reestablish after one to two growing seasons. Wildlife population stability at the Wildlife and Wildlife Habitat LAA or RAA level is not expected to be affected by TMF malfunction.

Residual adverse effects on wildlife and wildlife habitat are moderate in magnitude, within the LAA, medium to long-term, and potentially irreversible.

Land and Resource Use and Current Use of Lands and Resources for Traditional Purposes

A release of tailings from the TMF has the potential to affect land and resource uses such as hunting, trapping, gathering, and fishing. Flooding and infilling caused by the release of liquid and solid tailings could temporarily restrict travel and resource use within the Land and Resource Use/Current Use LAA. This effect would dissipate once flood waters recede and solid tailings were remediated.

Residual adverse effects on vegetation communities, fish and fish habitat, and wildlife and wildlife habitat could occur due to TMF malfunction, as described in the sections above. These effects could in turn affect

land and resource use in the PDA and potentially the Land and Resource Use/Current Use LAA. An effect on fish and wildlife habitat could result in localized reductions in fish and wildlife abundance, health or condition that could limit the quality of the fishing, trapping, and hunting resources within the PDA. However, land and resource use are not anticipated within the PDA during Project construction and operation.

Residual adverse effects on land and resource use are predicted to be moderate magnitude, limited to the Land and Resource Use/Current Use LAA, medium- to long-term and potentially irreversible.

Heritage Resources

The potential for effects on heritage resources may include disruption of known or unknown heritage sites and would depend upon the size and location of the TMF malfunction and the proximity to known and potential heritage resources. Known heritage resources exist along the east bank of the Keewatin River. The known heritage resources are greater than one kilometer from the TMF. In the unlikely event of TMF malfunction there would be localized temporary flooding, sedimentation, and erosion near the TMF.

In a conservative assessment, residual adverse effects on heritage resources are not anticipated due to their distance from the TMF.

Human Health

In the event of a TMF failure, water discharges could increase chemicals of potential concern (COPC) concentrations in soil, water, and sediment. This can lead to increases of these chemicals in secondary environmental media including vegetation, wild meat, and fish tissue. Possible changes in water and country food quality may affect the health of human receptors who live in either region and who may engage in hunting, trapping, traditional and recreational activities. Increases in metal concentrations in soil resulting from a failure/breach of the TMF could affect terrestrial vegetation and the wildlife that feeds on that vegetation and thereby increase health risks for people who harvest these terrestrial foods. While this could occur, the health risks associated with this failure/breach is expected to be low. In the event of a TMF failure, remediation measures may include capping and/or removing the affected soils, thereby limiting potential contact for wildlife and associated health risks. Furthermore, the terrestrial area affected would likely be small and would represent a small fraction of the home range of larger mammals, such as moose; therefore, their exposures to affected soils would be limited. If soils were not remediated, vegetation would likely take time to re-establish if it could grow on the tailings at all. In the absence of vegetation, terrestrial mammals (small and large) would not frequent the area and therefore would not be exposed to the metals in the tailings. As such, there would be no health risk for people who eat terrestrial country foods. As noted above, although fish populations would eventually return to pre-breach levels (in decades), there would likely be a persistent contamination of fish tissue due to long-term contamination of bottom sediments. Alamos will develop contingency planning and implement engineering and quality controls during the design, construction, and operational phases to mitigate effects on fish and the subsequent risk to human health due to fish consumption.

Residual adverse effects on human health would be of low magnitude, potentially extending beyond the Human Health LAA, and be medium-term and potentially irreversible.

22.5.2 Release of Untreated Contact Water

22.5.2.1 Project Design and Safety Measures to Reduce Environmental Effects

As discussed in Section 22.4.2, contact water is collected through a variety of drainage ditches, pipes and sump pits and directed to either the TMF or site water management ponds. An accidental release of contact water or seepage of contact water from the contact water collection system into the environment has potential to result in changes to groundwater, surface water and fish and fish habitat.

The overall water management concept is to divert non-contact water to reduce the amount of water to be managed at the site and to collect the contact water for conveyance in a collection pond where sediment control can be provided prior to its release to the environment. An active storage volume of 30,000 m^3 has been assumed for the collection pond. Based on this volume, additional settling will be required through mitigation techniques such as flocculation or physical methods (e.g., silt curtains and/or baffles) to avoid exceeding the discharge limits set under the MDMER for total suspended solids concentrations. At each site's water management pond, water quality will be monitored. The water management ponds in the current mine plan have been sized in consideration to the retention time for the settling of suspended solids. Identification of the discharge locations for each site will be confirmed during detailed engineering.

The TMF will also be used as a collection pond for a portion of the site contact water runoff and mine dewatering flows. The facility has an emergency spillway and seepage collection system. Seepage through the TMF dams is assumed to be collected and pumped back to the TMF (i.e., no net seepage loss). For the dams founded on bedrock with poor conditions, a 10 m deep grout curtain will be provided along the entire length of the dam alignment to reduce the seepage. Seepage from the tailings may have concentrations exceeding the MDMER limits for cyanide and arsenic. The current plan is to collect and pump seepage back to the TMF during operation. Cut-off walls under the TMF dams will reduce the risk of groundwater contamination.

The Project may result in the generation of mine rock that could have the potential for ARD and ML. Geochemical testing and water quality modelling is ongoing; however, preliminary sampling results indicate that the mine rock contains PAG material and has leaching potential for arsenic and metals (i.e., copper, iron, chromium, and lead). Mine rock that is classified as PAG and/or ML that is expected to produce runoff may require additional mitigation, such as blending, dry and/or wet covers, and/or treatment. Final required mitigation measures will be determined during final design.

22.5.2.2 Emergency Response Measures and Capacities

In the event of the release of untreated contact water due to failure of the contact water collection system, where feasible, preliminary emergency response measures include pumping water back into the collection system and repairing the containment structure. Additional information on preliminary emergency response measures and capacities is discussed in Chapter 23 and will be further developed during detailed Project design. Emergency response measures will be prepared in accordance with federal and provincial legislation and guidelines, and corporate policies and procedures for the protection of human health and the environment (including species at risk). Measures will be prescribed for the provision of emergency

response planning, training, responsibilities, cleanup equipment, and materials, and contact and reporting procedures.

22.5.2.3 Environmental Effects Assessment

The contact water collection systems and site water management ponds will be used at each site to store contact water until it is treated to meet applicable federal and provincial regulatory requirements prior to discharge to the environment. A failure or seepage of the water collection system and site water pond (with an active storage volume of 30,000 m^3) would result in the release of untreated contact water. A worst-case release of untreated contact water has currently not been estimated; these estimates will be undertaken as part of detailed engineering design and contingency planning. Given that the water collection system is located throughout the PDA, including near waterbodies, a release of untreated contact water to the environment has the potential to adversely affect groundwater, surface water quality, fish and fish habitat, and vegetation and wetlands. Waterbodies in the Surface Water/Fish and Fish Habitat LAA at the MacLellan site that could potentially be affected are Payne Lake, Lobster Lake, Minton Lake, Cockeram River, and the unnamed lakes both downstream and upstream of Minton Lake.

Groundwater

A release of untreated contact water would have the potential to affect groundwater quality, depending upon the magnitude of the failure and the time elapsed until cleanup. A release of untreated contact water has the potential to affect groundwater and surface water quality where groundwater discharges to surface water. No groundwater supply wells will be present in the PDA or LAA/RAA during operation, and the release of untreated contact water is not predicted to be released to areas where groundwater supply users are identified. A discussion of potential effects related to seepage from the TMF during routine Project activities is provided in Chapter 8, Section 8.4.3.3.

Residual adverse effects on groundwater are predicted to be moderate in magnitude, occur mainly in the PDA but may extend to the Groundwater LAA, short-term, and reversible.

Surface Water

There are potential effects to surface water quality through excess seepage or accidental release of contact water from mine rock stockpiles, collection ditches, and/or from contact water collection systems. The magnitude of adverse effects would depend on the location of the release and quantity of contact water discharged.

Analysis of results of initial geochemical testing and water quality modelling indicate that the mine rock contains PAG material and has leaching potential for arsenic and metals (i.e., copper, iron, chromium, and lead). Waterbodies in the Surface Water/Fish and Fish LAA at the MacLellan site that could potentially be affected are Payne Lake, Lobster Lake, Minton Lake, Cockeram River, and the unnamed lakes both downstream and upstream of Minton Lake. Standard mitigation measures are proposed to reduce potential effects on surface water related to seepage (e.g., collection of runoff and groundwater seepage from the TMF).

Contact water will be treated to meet applicable federal and provincial regulatory requirements prior to discharge to the environment, including the authorized limits of deleterious substances specified in Schedule 4 of the MDMER.

Residual adverse effects to surface water are predicted to be low in magnitude, localized to the Surface Water/Fish and Fish LAA, short-term in duration, and reversible.

Fish and Fish Habitat

Given the low magnitude of adverse environmental effects to surface water quality, a release of untreated contact water would not be expected to result in lethal or sub-lethal effects on fish due to changes in water quality. Depending on the volume of contact water released, there is potential for the physical disturbance of fish habitat, including alteration of existing habitat due to erosion of bank material and the suspension and deposition of eroded material. Fish, including eggs, if present during the event, could be affected by sedimentation through partial or total loss of a fish population, temporary changes in benthic community composition, and/or alteration of the availability of benthic food sources. Potential effects are considered temporary, because benthic and fish communities would be expected to recover from such an event. Waterbodies in the Surface Water/Fish and Fish LAA at the MacLellan site that could potentially be affected are Payne Lake, Lobster Lake, Minton Lake, Cockeram River, and the unnamed lakes both downstream and upstream of Minton Lake. Species potentially present in these waterbodies include brook stickleback, northern pike, white sucker, longnose sucker (*Catostomus Catostomus*), yellow perch (*Perca flavescens*), spottail shiner (*Notropis hudonius*), lake chub (*Couesius plumbeus*), gadidae burbot (*Lota lota*), and slimy sculpin (*Cottus cognatus*).

Residual adverse effects on fish and fish habitat are predicted to be moderate in magnitude, limited to the Surface Water/Fish and Fish LAA, medium-term and reversible.

Vegetation and Wetlands

A release of untreated contact water would have the potential to affect vegetation and wetlands, depending upon the magnitude of the failure and the time elapsed until cleanup. Effects may include direct loss or alteration of native vegetation communities, species of conservation concern or traditional use plant species. There is also potential for direct loss or alteration of wetland area or alteration of surface or groundwater flow patterns.

Vegetation and/or wetlands adversely affected by a release of untreated contact water would be addressed by the implementation of containment measures and the restoration of affected areas and the cleanup of released material, if feasible. Affected vegetation and wetlands would reestablish over time through natural dispersion from unaffected portions of either the same community, or adjacent wetland communities, usually within one to two growing seasons, depending on the scale of the release.

Residual adverse effects on vegetation and wetlands are predicted to be moderate in magnitude, occur mainly in the PDA but may extend to the Vegetation and Wetlands LAA, short-term, and reversible.

22.5.3 Fuel and Hazardous Materials Spill

22.5.3.1 Project Design and Safety Measures to Reduce Environmental Effects

Several traffic safety measures will be implemented to reduce the potential for vehicle malfunctions or accidents as a result of the Project. These include, but are not limited to, the following:

- Project vehicles will be driven by trained and competent drivers who will use approved routes.
- Highway laws will be obeyed, including seasonal weight restrictions, speed limits, traffic signage and requirements for permit for oversized loads.
- Project vehicles will be manually inspected on a daily basis to confirm there are no problems.
- Mine roads will be properly constructed and maintained.
- Internal speed checks will be carried out by mine security.
- Mine vehicles will be required to have beacon lights and flagging.
- Radio controlled roads on MacLellan and Gordon sites.
- Access to the mine sites will not be permitted or public vehicles.

Waste oils, fuels, and hazardous wastes will be safely handled and transported as recommended by the suppliers and/or manufacturers and in compliance with applicable federal, provincial, or municipal regulations (e.g., the Hazardous Waste Regulation under the *Dangerous Goods Handling and Transportation Act* of Manitoba, *Canadian Environmental Protection Act* and associated regulations, and the *Transportation of Dangerous Goods Act* and associated regulations).

22.5.3.2 Emergency Response Measures and Capacities

Alamos will provide emergency response services sufficient in capacity and capability to respond to emergency situations at the mines. Alamos will cooperate with local officials in the incident investigation process and conduct an internal incident investigation. Remedial action will be taken by Alamos in accordance with the results of the investigations. An ERSPCP will be prepared to facilitate response to emergency situations that occurs at the Project sites which will include spills and the releases of hazardous substances, including petroleum products, accidents involving hazardous substances. Additional information on preliminary emergency response measures and capacities is discussed in Chapter 23 and will be further developed during detailed Project design. Emergency response measures will be prepared in accordance with federal and provincial legislation and guidelines, and corporate policies and procedures for the protection of human health and the environment (including species at risk). Measures will be prescribed for the provision of emergency response planning, training, responsibilities, cleanup equipment, and materials, and contact and reporting procedures.

22.5.3.3 Environmental Effects Assessment

In the event of a vehicle malfunction or collision, a spill could result in the release of a hazardous substance, depending on the contents of the vehicles or the nature of the failure. The main access to the sites will be via the existing PR 391. PR 391 is an all-weather road connecting Thompson, Manitoba, and Lynn Lake. PR 391 will be used by personnel, material deliveries, and haulage trucks transporting material from the Gordon site to the ore milling and processing plant at the MacLellan site. The potential need for upgrades to PR 391 and/or weight exception requirements to support the Project will be discussed with the highway authority (i.e., Manitoba Infrastructure).

Run-of-mine (ROM) ore (i.e., raw/unprocessed ore that is intended for immediate processing rather than stockpiling) from the Gordon site will be transported via highway trucks to the mill feed storage area and crushing plant at the MacLellan site. Based on an assumed haulage rate of 4,100 t/d, the Project is estimated to require up to seven truckloads per hour between the Gordon and MacLellan sites during the first six years of mining operations.

The potential for adverse environmental effects is dependent on the collision or failure location as well as the materials being released into the environment. A vehicle malfunction or collision could have a localized adverse effect on surface water and fish and fish habitat should the collision or failure occur close to a waterbody with sufficient materials released to the environment in such a way as to permit deposition of the material into the waterway (e.g., topography and soils conducive to flows). Effects on these VCs may also therefore affect the use and access of land and water resources for recreational and traditional uses.

The potential fate and effects of a spill of hazardous material (i.e., hydrocarbons) are described. Spills of sodium cyanide or ammonium nitrate are considered to be less likely as these substances are transported in solid form and shipments are less frequent. As such, in the unlikely event of a spill of these solids, it would be expected that the spilled material could be cleaned up and removed from the spill site without entering a watercourse. The worst probable case for a hazardous material spill would likely be a spill of petroleum hydrocarbons into the Hughes River at the Gordon site or the Keewatin River at the MacLellan site during the winter and summer low flows. Given the general floating characteristics, the petroleum hydrocarbons would be transported downstream into connecting waterbodies and to riparian areas. Some fuel constituents are hydrophobic and would likely move from the water to the sediment environment.

Natural processes of dispersion and volatilization would immediately decrease the concentrations of fuel constituents in the water and cleanup efforts will remove remaining accessible fuel. Natural degradation processes, mediated by microbes and other organisms, use hydrocarbons as substrates for growth and metabolism, and in doing so breakdown and remove hydrocarbons from the environment (Singer et al. 2004).

The extent of the spill is dependent on fuel type, weathering (evaporation and emulsification), and watercourse flow rates. The rates of evaporation are greatest immediately after the spill, then slow considerably over time. Gasoline would be expected to evaporate more quickly than diesel fuel.

The Gordon site is in the Hughes River watershed and the MacLellan site is in the Keewatin River watershed. Even in periods of low flow, the Hughes River and Keewatin River will disperse and mix the fuel

which could lead to decreases in water quality for several kilometers downstream. Both rivers ultimately drain into Granville Lake, upstream of Southern Indian Lake within the Churchill River watershed. A hydrocarbon spill has the potential to affect water and sediment quality within these watersheds. There are also potential effects to algae, plankton, benthic invertebrates, and fish species. The Keewatin River supported a large assemblage of fish species (14 species): northern pike, brook stickleback, white sucker, longnose sucker, yellow perch, lake chub, spottail shiner, longnose dace (*Rhinichthys cataractae*), lake whitefish (*Coregonus clupeaformis*), cisco (*Coregonus artedi*), burbot, slimy sculpin, logperch (*Percina caprodes*), and trout-perch (*Percopsis omiscomaycus*).

A worst-case spill of a hazardous substance from vehicle malfunction or collision has not currently been estimated; these estimates will be undertaken as part of detailed engineering design and contingency planning. However, the volume of hazardous material is anticipated to be limited based on the requirements of the Project and regular deliveries on an ongoing basis. In the event of a spill, hazardous materials will be contained and remediated as part of the ERSPCP, as noted above. If a spill entered a waterbody, an assessment would be undertaken and site-specific remedial action developed in collaboration with regulators to restore the waterbody, including potential offsetting for harmfully affected fish and fish habitat.

Surface Water

A vehicle collision or mechanical failure resulting in a spill of fuel or hazardous material that could cause a localized change in surface water quality if the event occurred near a waterbody. A change in surface water quantity may occur in the event of an aggregate spill into a watercourse resulting in a temporary sedimentation and flow impediment until cleanup can occur. In the event of a vehicle malfunction or collision, emergency response procedures would be deployed to reduce adverse effects in the vicinity of the event, including releases of hazardous materials into watercourses or waterbodies.

Residual adverse effects on surface water are predicted to be moderate to high in magnitude, limited to the Surface Water LAA, short-term in duration and reversible.

Fish and Fish Habitat

A vehicle collision or mechanical failure resulting in a spill of fuel or hazardous material near fish habitat may lead to localized fish mortality. Fish mortality could range from a few fish (not affecting the sustainability and productivity of a fishery), to larger scale levels of fish mortality (which could have a temporary effect on localized fish populations), depending on the location of the event, the size of the spill and the toxicity of the materials being transported. Chronic or acute toxicity to fish populations can result in changes in fish health, growth, or survival (e.g., number of fish mortalities, fish tissue metal concentration, fish community composition). Fish populations affected by mortality from contaminated material are anticipated to reestablish themselves within one or two generations.

Residual adverse effects on fish and fish habitat are predicted to be moderate to high in magnitude, limited to the Fish and Fish Habitat LAA, short-term and reversible.

Vegetation and Wetlands

A vehicle collision or mechanical failure resulting in a spill of fuel or hazardous material would have the potential to affect vegetation and wetlands, depending upon the location of the failure and the time elapsed until cleanup. Effects may include direct loss or alteration of native vegetation communities, species of conservation concern or traditional use plant species. There is also potential for direct loss or alteration of wetland area or alteration of surface or groundwater flow patterns.

There is no Project disturbance planned along PR 391 between the Gordon and MacLellan sites but there will be increased traffic from the Project. Project-related transportation at both sites are not expected to interact with vegetation and wetlands because vegetation clearing will occur at the site preparation stage of construction for the entire PDA. In the event of a spill, mitigation measures such as the use of silt fencing will be in place to avoid effects to vegetation and wetland plant communities, by reducing deleterious substances from entering adjacent to wetlands or waterbodies.

Land and Resource Use and Current Use of Lands and Resources for Traditional Purposes

In the event of a vehicle collision or mechanical failure resulting in a spill of fuel or hazardous material may affect the viability of, restrict access to, or cause loss of areas used for recreation or traditional use (such as fishing, trapping or hunting) in the area surrounding the accident site, should the affected area be used for recreational or resource use activities. Residual adverse effects on vegetation communities, fish and fish habitat, and wildlife and wildlife habitat could occur due to the spill of fuel or hazardous material. These effects could in turn affect land and resource use in the PDA and potentially the LAA. An effect on fish and wildlife habitat could result in localized reductions in fish and wildlife abundance, health or condition that could limit the quality of the fishing, trapping, and hunting resources within the PDA. However, land and resource use are not anticipated within the PDA during Project construction and operation. Fish populations affected by mortality from contaminated material would reestablish themselves within one or two generations. Effects would be temporary and localized, with limited effect on overall fishing within the Land and Resource Use/Current Use LAA. Ungulates and other wildlife species could be potentially affected through contact, inhalation, or ingestion of the material. However, wildlife would likely avoid the spill area due to noise from Project activities and activities associated with cleanup efforts.

Residual adverse effects on land and resource use and traditional uses are predicted to be moderate magnitude, limited to the Land and Resource Use/Current Use LAA, short-term, and reversible.

Human Health

In the event of a spill from a vehicle, discharges could increase COPC concentrations in soil, water, and sediment. This could lead to increases of these chemicals in secondary environmental media including vegetation, wild meat, and fish tissue. In the absence of mitigation and emergency response measures, potential changes in water and country food quality may affect the health of human receptors who live in either region and who may engage in hunting, trapping, traditional and recreational activities. Although fish populations would eventually return to pre-spill levels (in one or two generations), there is potential for

persistent contamination of fish tissue and fish health due to long-term contamination of bottom sediments. Alamos will develop contingency planning and implement engineering and quality controls during the design, construction, and operational phases to mitigate affected fish and fish habitat.

Residual adverse effects on human health would be of moderate magnitude, potentially extending beyond the Human Health LAA, and be medium-term and reversible.

22.5.4 Ore, Overburden, and Mine Rock Storage Area Slope Failure

22.5.4.1 Project Design and Safety Measures to Reduce Environmental Effects

As described in Section 22.4.7, ore, overburden, and mine rock storage areas will be required at both sites.

The stability of the overburden and mine rock storage stockpiles for both the MacLellan and Gordon sites was undertaken by Golder (2015). Analysis of results indicated that the minimum factor of safety requirements are met based on the guidelines provided by Hawley and Cunning (2017).

22.5.4.2 Emergency Response Measures and Capacities

Emergency response measures and standard operating procedures for slope failure will be developed during detailed Project design. Emergency response measures will be prepared in accordance with federal and provincial legislation and guidelines, and corporate policies and procedures for the protection of human health and the environment (including species at risk). Measures will be prescribed for the provision of emergency response planning, training, responsibilities, cleanup equipment, and materials, and contact and reporting procedures.

22.5.4.3 Environmental Effects Assessment

Slope failure has the potential to occur at the ore and overburden stockpiles; however, given the volume of material proposed to be stored in these areas, slumping and release of material is anticipated to be localized to the PDA. The overburden stockpile on the Gordon site is located south of Gordon Lake.

A large-scale failure of a mine rock stockpile could result in slumping and release of mine rock and therefore potentially the release of ARD/ML runoff as well as habitat alteration and/or disruption. A release of material from a worst-case slope failure has not currently been estimated; these estimates will be undertaken as part of detailed engineering design and contingency planning. The results of preliminary geochemical testing indicate that the Project may result in the generation of mine rock that could have the potential for ARD and ML. ARD/ML run-off could result in potential effects to groundwater quality, surface water quality, and changes in fish and fish habitat.

Storage area slopes will be designed to maintain stability, where even in a conservative case scenario slope failure is anticipated to have a limited potential for release beyond the PDA; however, there is potential for material to enter the Surface Water/Fish and Fish Habitat LAA. A large-scale slope failure of the mine rock stockpile would have a localized effect on surface water and fish and fish habitat. Effects on these VCs

could also impede the use and access of land and water resources for recreational and traditional uses in localized areas.

Surface Water

Mine rock has the potential to affect surface water quality if released into lakes and streams in the immediate vicinity and downstream of the Gordon and MacLellan sites. There is an unnamed Keewatin River tributary near the mine rock storage area at the MacLellan site. Gordon Lake and Farley Lake and their inlets are located downslope from proposed mine rock storage areas at the Gordon site. Pump Lake and its outlet to Simpson Lake is the closest lake to the proposed mine rock storage area. Susan Lake is also located in the watershed adjacent to the proposed mine rock storage area.

Analysis of the results of preliminary geochemical testing indicate that the Project may result in the generation of mine rock that could have the potential for ARD and ML and associated changes to pH and release of contaminants. The release of materials into surface water may lead to localized turbidity and suspended sediments.

Residual adverse effects on surface water are predicted to be moderate in magnitude, localized to the Surface Water/Fish and Fish Habitat LAA, short-term, and reversible.

Fish and Fish Habitat

An unexpected increase in suspended solids from a slump or stockpile failure into a water body has the potential to cause acute mortality in fish, with sediment deposition resulting in potential affects to spawning habitats. Mortality of fish would be a one-time event and risk of mortality is not anticipated to persist over time. Furthermore, fish communities would be anticipated to recover over time.

At the MacLellan site, Payne Lake is located north of the proposed mine rock storage area and brook stickleback are known to be present in this lake. Minton Lake is located south (downstream) of the mine rock storage area – known to contain brook stickleback and northern pike. No aquatic species of conservation concern have been documented or are expected in the LAA based on known fish species distributions. Lake sturgeon, which are listed as “endangered” by COSEWIC, may be present in the Surface Water/Fish and Fish Habitat RAA. Currently available data suggest that lake sturgeon do not frequent the Keewatin River.

In the event of a slope failure, emergency response procedures would be undertaken; however, material may be left in place if it is considered to cause further disturbance during the removal of material. If left in place, it is anticipated that fish habitat could be restored to ecologically functional habitat naturally or through remedial measures.

Residual adverse effects on fish and fish habitat are predicted to be moderate magnitude, limited to the Surface Water/Fish and Fish Habitat LAA, short-term, and potentially reversible.

Land and Resource Use and Current Use of Lands and Resources for Traditional Purposes

A failure of a mine rock or overburden slope could affect fishing for recreational and traditional purposes and trapping (e.g., aquatic furbearers) in a localized area, should the affected area be used for such activities. Access to fishing and trapping areas may be limited for a short duration if remedial activities are proposed, and fish and aquatic furbearer populations may be temporarily disrupted. If materials are left in place, fish and aquatic furbearer habitat will be restored to their natural state through remedial measures, which would limit the localized effect on fishing and trapping over the long term.

Residual adverse effects on land and resource use and traditional uses are predicted to be low magnitude, limited to the Land and Resource Use/Current Use LAA, short-term, and reversible.

22.5.5 Vehicle Accidents

22.5.5.1 Project Design and Safety Measures to Reduce Environmental Effects

Several traffic safety measures will be implemented to reduce the potential for vehicle malfunctions or accidents as a result of the Project. These include, but are not limited to, the following:

- Project vehicles will be driven by trained and competent drivers who will use approved routes.
- Highway laws will be obeyed, including seasonal weight restrictions, speed limits, traffic signage and requirements for permit for oversized loads.
- Project vehicles will be manually inspected on a daily basis to confirm there are no problems.
- Proper construction and maintenance of mine roads.
- Internal speed checks will be carried out by mine security.
- Merging lines on highway turnoffs to mine sites, in coordination with Manitoba Infrastructure.
- Mine vehicles will be required to have beacon lights and flagging.
- Radio controlled roads on MacLellan and Gordon sites.
- Access to the mine sites will not be permitted or public vehicles.

22.5.5.2 Emergency Response Measures and Capacities

Alamos will provide emergency response services sufficient in capacity and capability to respond to emergency situations at the mines. Alamos will cooperate with local officials in the incident investigation process and conduct an internal incident investigation. Remedial action will be taken Alamos in accordance with the results of the investigations. Additional information on preliminary emergency response measures and capacities is discussed in Chapter 23 and will be further developed during detailed Project design. Emergency response measures will be prepared in accordance with federal and provincial legislation and

guidelines, and corporate policies and procedures for the protection of human health and the environment (including species at risk). Measures will be prescribed for the provision of emergency response planning, training, responsibilities, cleanup equipment, and materials, and contact and reporting procedures.

22.5.5.3 Environmental Effects Assessment

The mine sites will be accessed via existing access roads off PR 391, which will be used by personnel, material deliveries, and haulage trucks transporting material to the ore milling and processing plant. Based on a conservative assumed haulage rate of 4,100 t/d, the Project is estimated to require seven truckloads per hour between the Gordon and MacLellan sites during the first six years of mining operations. Increased vehicle traffic from Project-related activities has the potential to result in human and/or wildlife injury or mortality.

Between 2008 and 2012 for PR 391 in the Wildlife RAA there were a total of five collisions, including three collisions involving run off the road incidents and two involving collisions with wildlife. With a conservative (high) estimate of 150 vehicles per day in the period from 2008 to 2012, the collision rate was calculated to be 0.57 collisions per million vehicle kilometers travelled (MVKT) (Stantec 2016). This rate is well below the rate where concern is raised about collision experience, typically over 1.00 collision per MVKT; however, the history indicates that there needs to be awareness raised about safe winter driving and presence of wildlife (Stantec 2016). The presence of Project-related vehicles has the potential to increase the number of collisions on PR 391, resulting in temporary delays to road traffic, damage to property, or injury or death to individuals involved, including potential injury or mortality to wildlife.

Wildlife and Wildlife Habitat

Vehicle-related wildlife mortality has the potential to affect a wider range of species, including migratory birds, species at risk and species of conservation concern, and large mammals. Vehicles will abide by posted speed limits and multi-passenger vehicles will be used, where practical, to reduce the potential for wildlife-vehicle collisions. Residual effects from a vehicle accident on wildlife is further described in Chapter 12, Section 12.4.3.

Human Health

A vehicle accident has the potential to result in injury to or loss of life. There is some pedestrian activity along PR 391; while the level of activity is low, it could be altered by a haul program. Although public injury or mortality as a result of a trucking accident cannot be ruled out, the likelihood is very low given the mitigation and emergency response prescribed above. In addition to the mitigation measures noted above, as part of the Transportation Impact Study, it is recommended a signing policy be applied for the duration of the haul program as well as consideration given to delivering a safety awareness program for both drivers and area residents (Stantec 2016).

In the unlikely event of a vehicle collision resulting in serious injury or loss of life, residual adverse effects on human health would be high in magnitude and irreversible.

22.6 SUMMARY

Residual adverse effects from accidents or malfunctions to VCs are characterized in Section 22.5. The Project is planned and designed to avoid accidents or malfunctions through the adherence to accepted design codes and standards. In the event of an accident or malfunction, emergency response procedures will be implemented reducing adverse effects to the environment. Chapter 23 further describes environmental management plans applicable to the Project, which will include communication roles and responsibilities, training requirements, and mitigation/response measures in the event of an unplanned accident or malfunction.

In the unlikely event of a major industrial accident or malfunction involving a large-scale release into the environment (e.g., major TMF failure with discharges of tailings into local waterbodies and other habitats outside the PDA, or spill from vehicle malfunction or collision into a waterbody), there is a potential for significant residual adverse effects to surface water and fish and fish habitat. Chapter 9, Section 9.1.6 and Chapter 10, Section 10.1.6 contain significance definitions. In the event of a TMF failure it is anticipated that surface water quality would result in a measurable change such that water quality guidelines are exceeded to an extent that toxicological effects to fish and aquatic life are expected to occur at the community or population level. A significant effect may also occur in the unlikely event of major accident resulting in a loss of life (i.e., vehicle accident). However, mitigation and conformity with industry standards (e.g., dam design and monitoring and emergency response and contingency planning) make a significant effect unlikely to occur. This determination of significance has been made with a high level of confidence for the most commonly expected accidents and malfunctions such as small to medium sized spills contained within the confines of the mine facility and easily cleaned up. A moderate level of confidence has been assigned for larger scale and far less likely events such as a TMF failure or tanker spill outside the confines of the mine. This lower level of confidence is based on the qualitative assessment of the fate and behavior associated with a major accident event and the many variables that would determine the ultimate scale and nature of the effects. Given this lower level of predictability, a worst-case assumption has been made in the determination of significance. The likelihood of a TMF dam failure, while understood to be extremely low, will be quantified during detailed Project design; however, Alamos will develop contingency planning and implement engineering and quality controls during the design, construction, and operational phases to mitigate adverse environmental effects. Alamos will design critical components of mine infrastructure to relevant design codes and criteria so that risk falls within acceptable ranges for lifecycle performance.

22.7 REFERENCES

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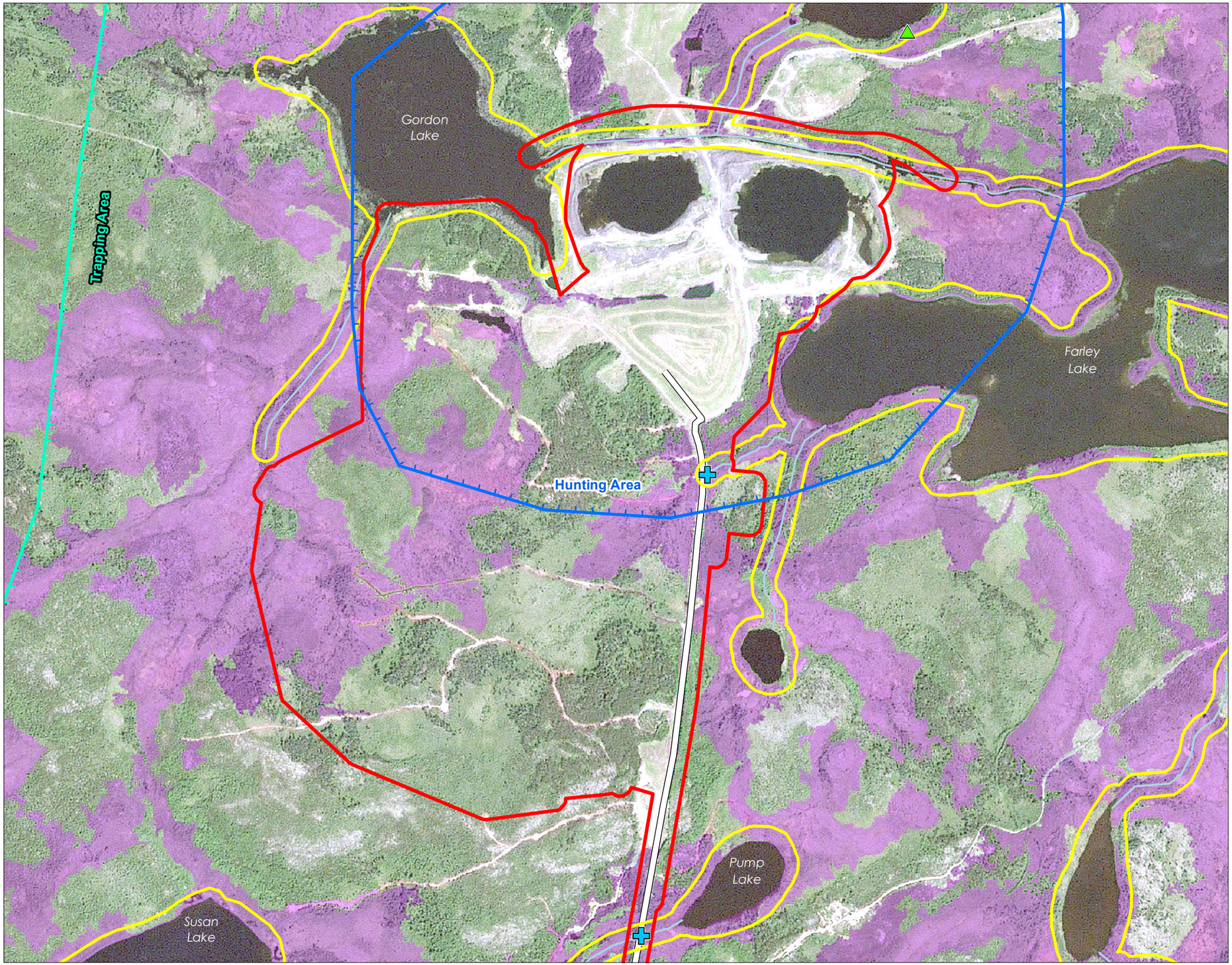


Stantec

Alamos Gold Inc.

Project Infrastructure

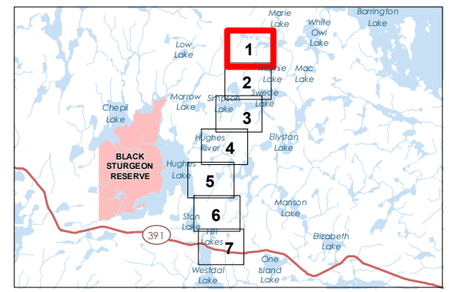
- Project Development Area

Environmentally Sensitive Sites

- Watercourse Crossing Location
- Rare Plant Location
- Water Features 30m Buffer
- Hunting Area
- Trapping Area
- Wetland Area (interpreted from satellite imagery)

Landbase

- Existing Access Road
- Watercourse



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Notes

1. Coordinate System: NAD 1983 UTM Zone 14N
2. Base Data Sources: Government of Manitoba and Government of Canada.
3. Imagery: SPOT-7 imagery, BlackBridge Geomatics Corp. July 2015.

Project Location
Lynn Lake, Manitoba

Prepared by ACampigotto on 2020-04-03
Technical Review by ASomers on 2020-04-03
Senior GIS Review by GKroupa on 2020-04-03

Client/Project
ALAMOS GOLD INC.
Lynn Lake Gold Project

111473008

Map No.
22-1a

Title
Environmentally Sensitive Sites at the Gordon site

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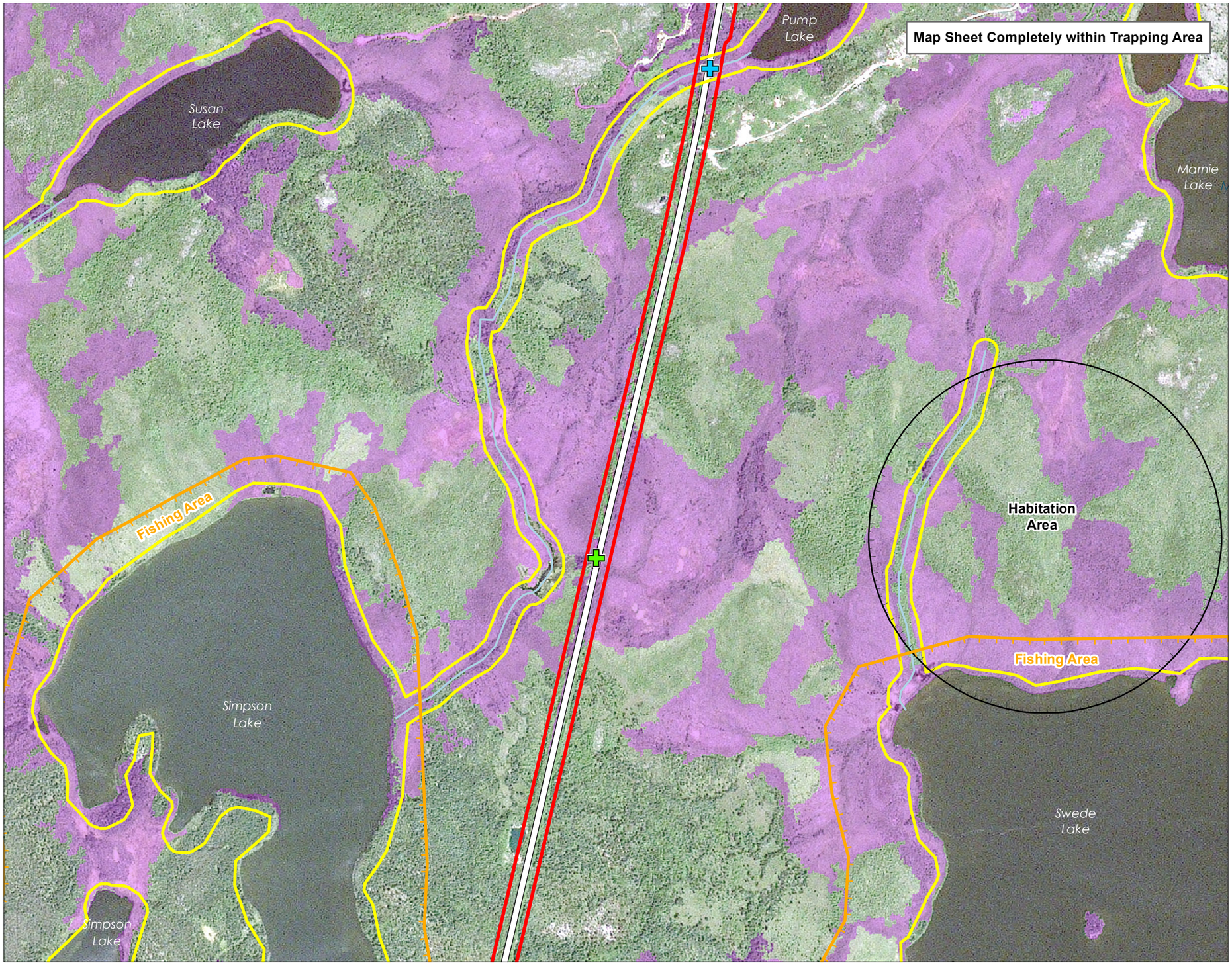


Stantec

Alamos Gold Inc.

Project Infrastructure

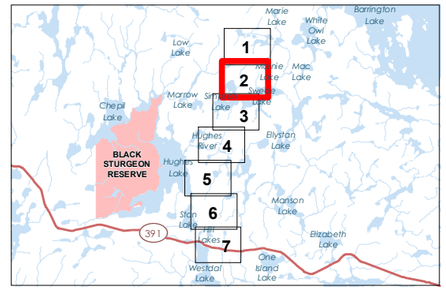
- Project Development Area

Environmentally Sensitive Sites

- Watercourse Crossing Location
- Ephemeral Stream
- Water Features 30m Buffer
- Fishing Area
- Habitation Area
- Wetland Area (interpreted from satellite imagery)

Landbase

- Existing Access Road
- Watercourse



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Project Location
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Prepared by ACampigotto on 2020-04-03
Technical Review by ASomers on 2020-04-03
Senior GIS Review by GKroupa on 2020-04-03

Client/Project
ALAMOS GOLD INC.
Lynn Lake Gold Project

111473008

Map No.
22-1b

Title
Environmentally Sensitive Sites at the Gordon site

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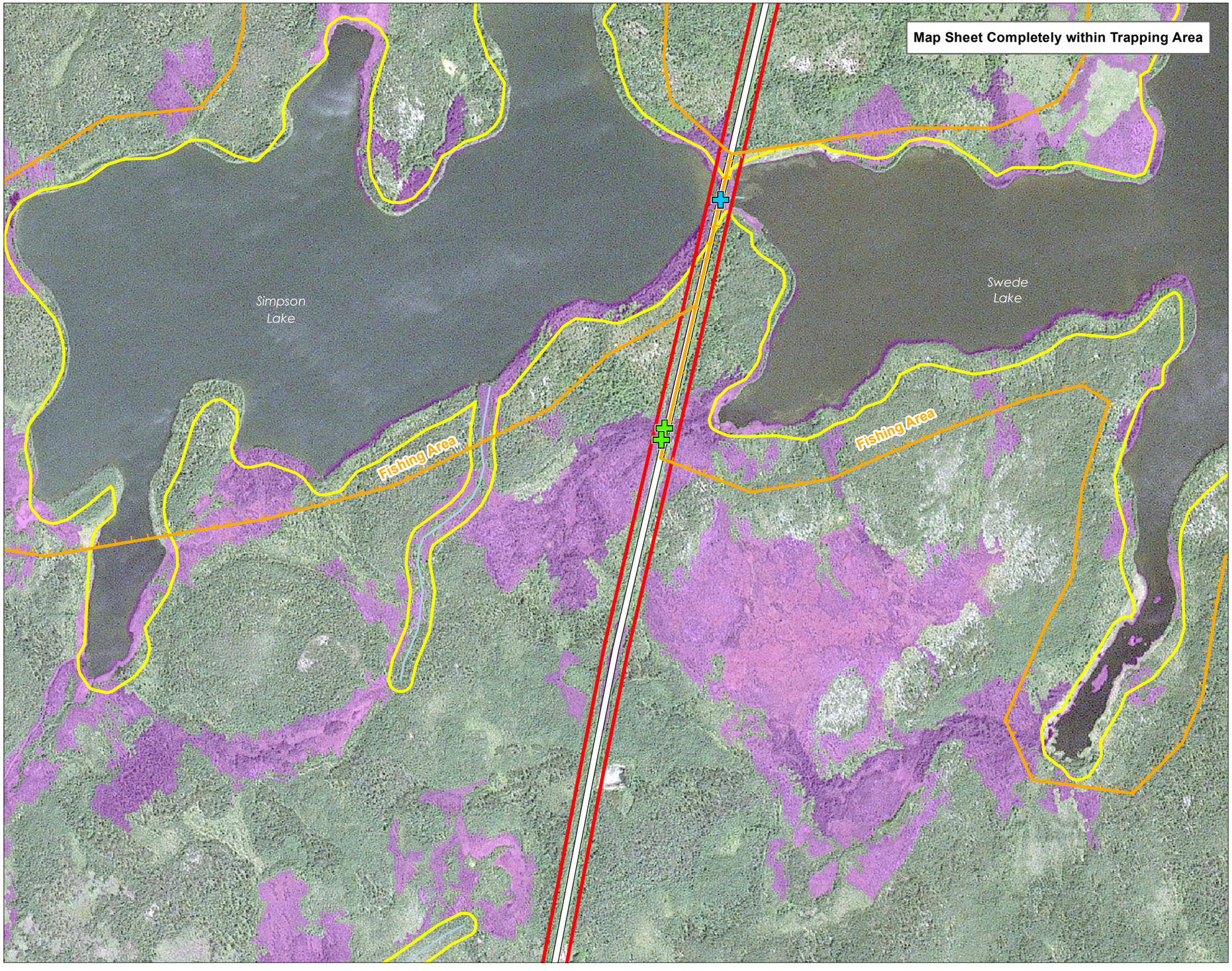


Stantec

Alamos Gold Inc.

Project Infrastructure

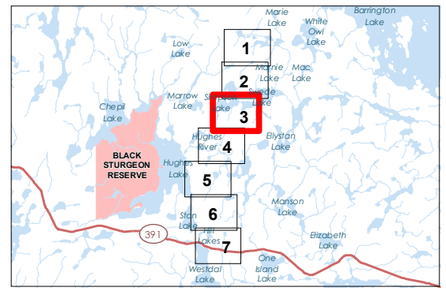
- Project Development Area

Environmentally Sensitive Sites

- Watercourse Crossing Location
- Ephemeral Stream
- Water Features 30m Buffer
- Fishing Area
- Wetland Area (interpreted from satellite imagery)

Landbase

- Existing Access Road
- Watercourse



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Project Location
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Prepared by ACampigotto on 2020-04-03
Technical Review by ASomers on 2020-04-03
Senior GIS Review by GKroupa on 2020-04-03

Client/Project
ALAMOS GOLD INC.
Lynn Lake Gold Project

111473008

Map No.
22-1c

Title
Environmentally Sensitive Sites at the Gordon site

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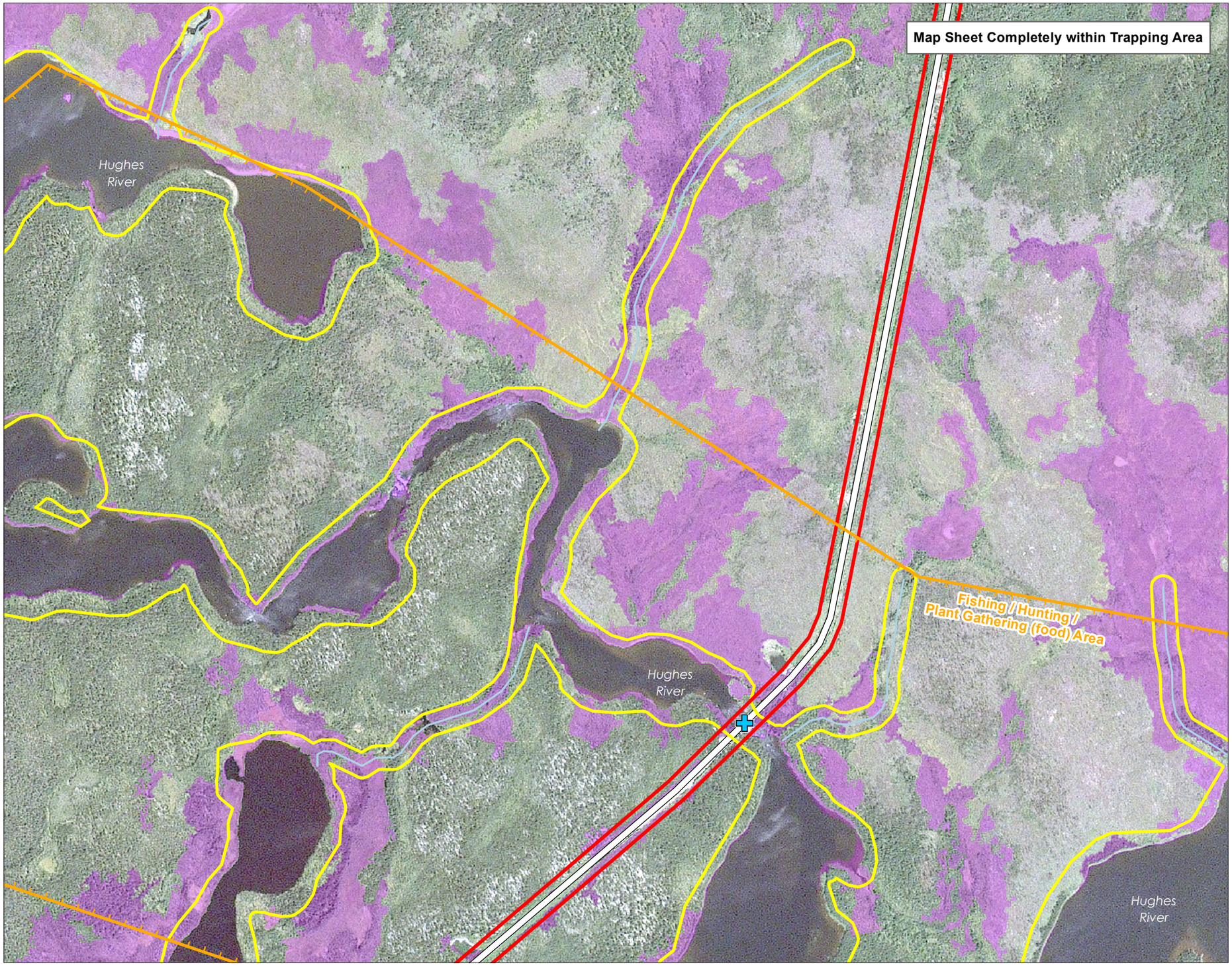


Stantec

Alamos Gold Inc.

Project Infrastructure

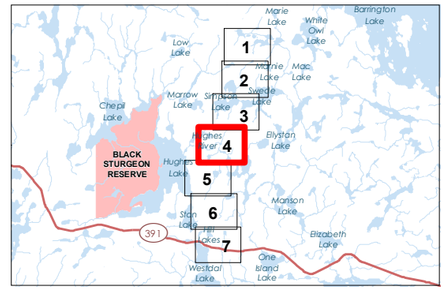
- Project Development Area

Environmentally Sensitive Sites

- Watercourse Crossing Location
- Water Features 30m Buffer
- Fishing / Hunting / Plant Gathering (food) Area
- Wetland Area (interpreted from satellite imagery)

Landbase

- Existing Access Road
- Watercourse



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Project Location
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Client/Project
ALAMOS GOLD INC.
Lynn Lake Gold Project

111473008

Map No.
22-1d

Title
Environmentally Sensitive Sites at the Gordon site

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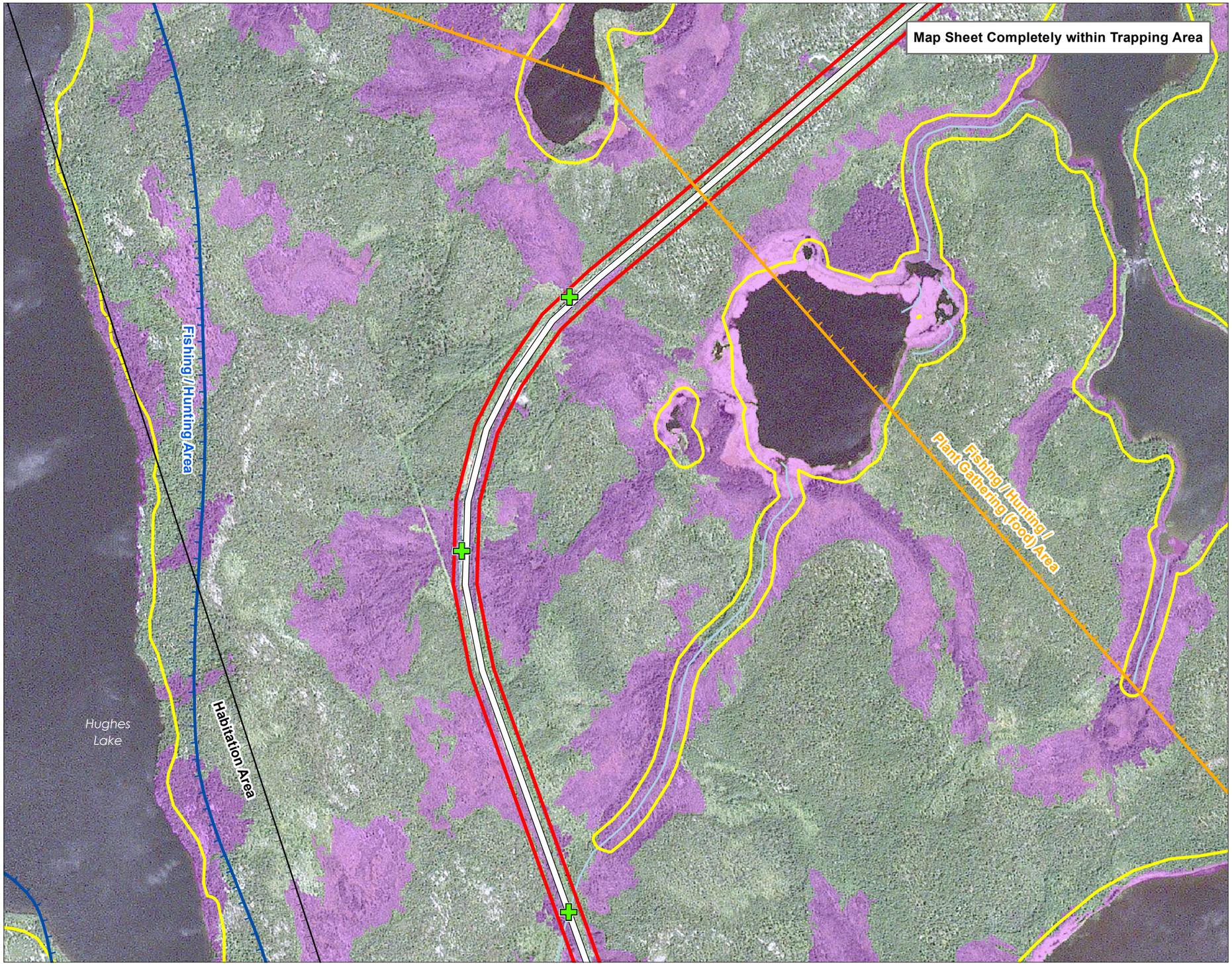


Stantec

Alamos Gold Inc.

Project Infrastructure

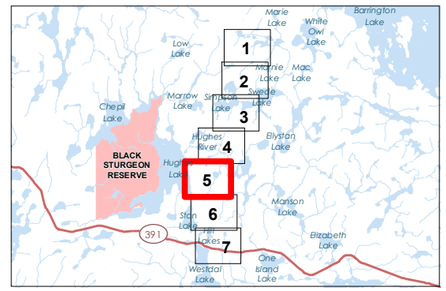
- Project Development Area

Environmentally Sensitive Sites

- Ephemeral Stream
- Water Features 30m Buffer
- Habitation Area
- Fishing / Hunting / Plant Gathering (food) Area
- Fishing / Hunting Area
- Wetland Area (interpreted from satellite imagery)

Landbase

- Existing Access Road
- Watercourse



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Project Location
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Client/Project
ALAMOS GOLD INC.
Lynn Lake Gold Project

111473008

Map No.
22-1e

Title
Environmentally Sensitive Sites at the Gordon site

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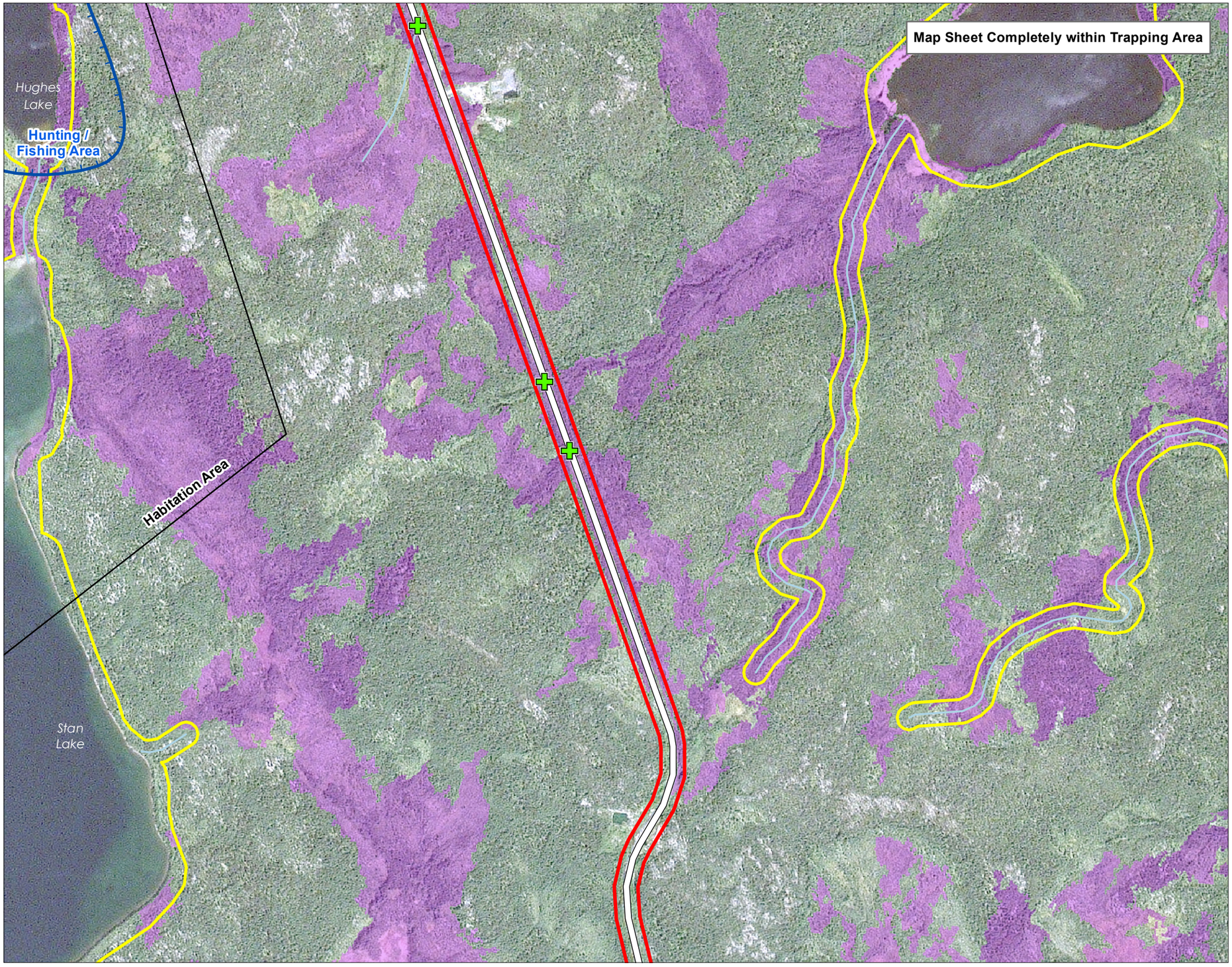


Stantec

Alamos Gold Inc.

Project Infrastructure

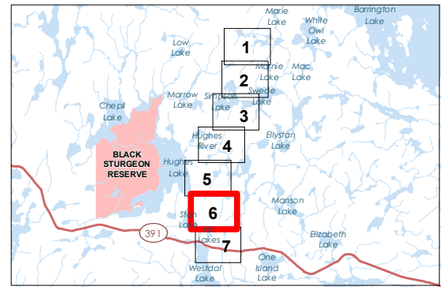
- Project Development Area

Environmentally Sensitive Sites

- Ephemeral Stream
- Water Features 30m Buffer
- Habitation Area
- Fishing / Hunting Area
- Wetland Area (interpreted from satellite imagery)

Landbase

- Existing Access Road
- Watercourse



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Project Location
Lynn Lake, Manitoba

Prepared by ACampigotto on 2020-04-03
Technical Review by ASomers on 2020-04-03
Senior GIS Review by GKroupa on 2020-04-03

Client/Project
ALAMOS GOLD INC.
Lynn Lake Gold Project

111473008

Map No.
22-1f

Title
Environmentally Sensitive Sites at the Gordon site

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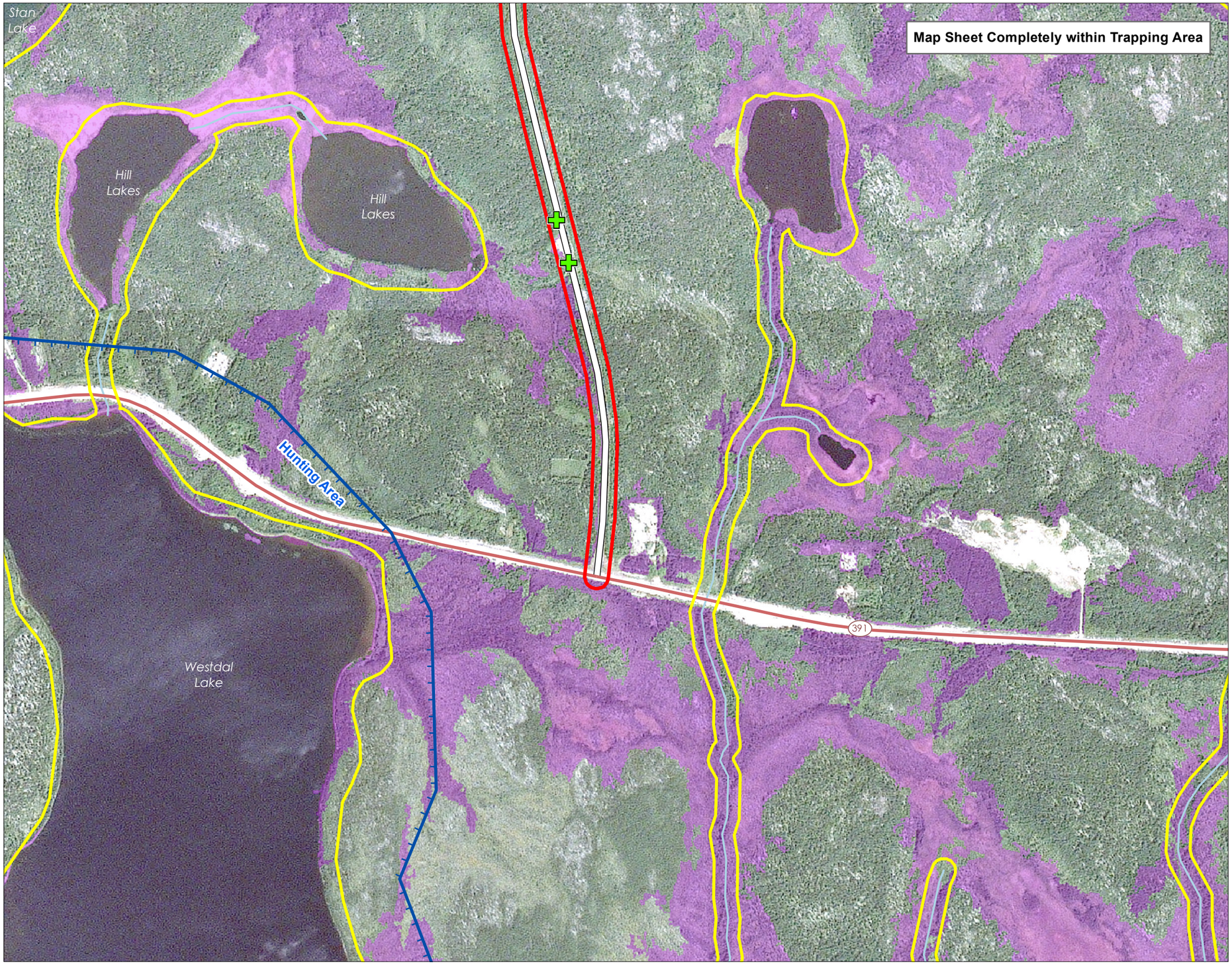


Stantec

Alamos Gold Inc.

Project Infrastructure

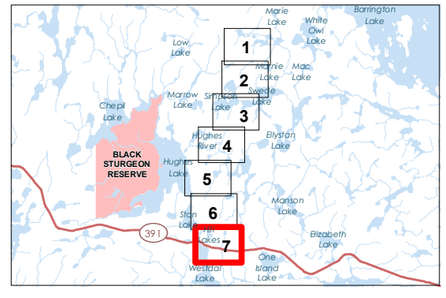
- Project Development Area

Environmentally Sensitive Sites

- Ephemeral Stream
- Water Features 30m Buffer
- Hunting Area
- Wetland Area (interpreted from satellite imagery)

Landbase

- Existing Access Road
- Highway
- Watercourse



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Project Location
Lynn Lake, Manitoba

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Technical Review by ASomers on 2020-04-03
Senior GIS Review by GKroupa on 2020-04-03

Client/Project
ALAMOS GOLD INC.
Lynn Lake Gold Project

111473008

Map No.
22-1g

Title
Environmentally Sensitive Sites at the Gordon site

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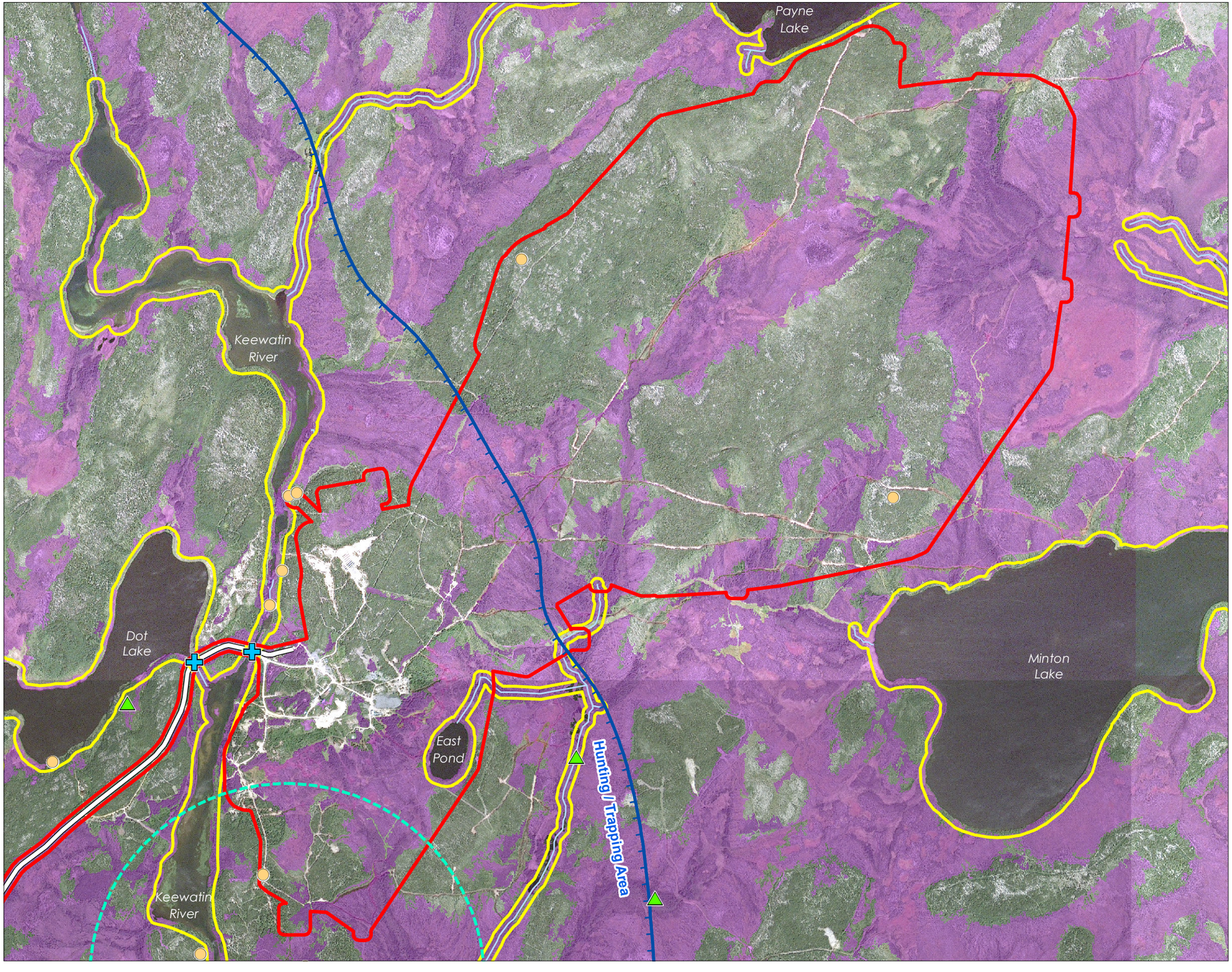


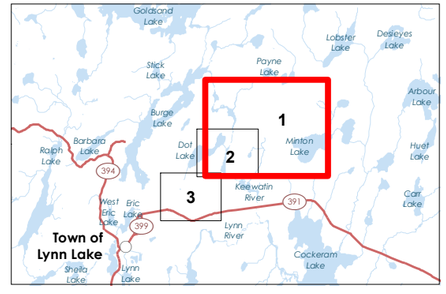
Stantec

Alamos Gold Inc.

Project Infrastructure
- Project Development Area

Environmentally Sensitive Sites
- Archaeological Site
- Watercourse Crossing Location
- Rare Plant Location
- Bald Eagle Nest 1000m Buffer
- Water Features 30m Buffer
- Hunting / Trapping Area
- Wetland Area (interpreted from satellite imagery)

Landbase
- Existing Access Road
- Watercourse



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2. Base Data Sources: Government of Manitoba and Government of Canada.
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Project Location
Lynn Lake, Manitoba

Prepared by ACampigotto on 2020-04-03
Technical Review by ASomers on 2020-04-03
Senior GIS Review by GKroupa on 2020-04-03

Client/Project
ALAMOS GOLD INC.
Lynn Lake Gold Project

111473008

Map No.
22-2a

Title
Environmentally Sensitive Sites at the MacLellan site

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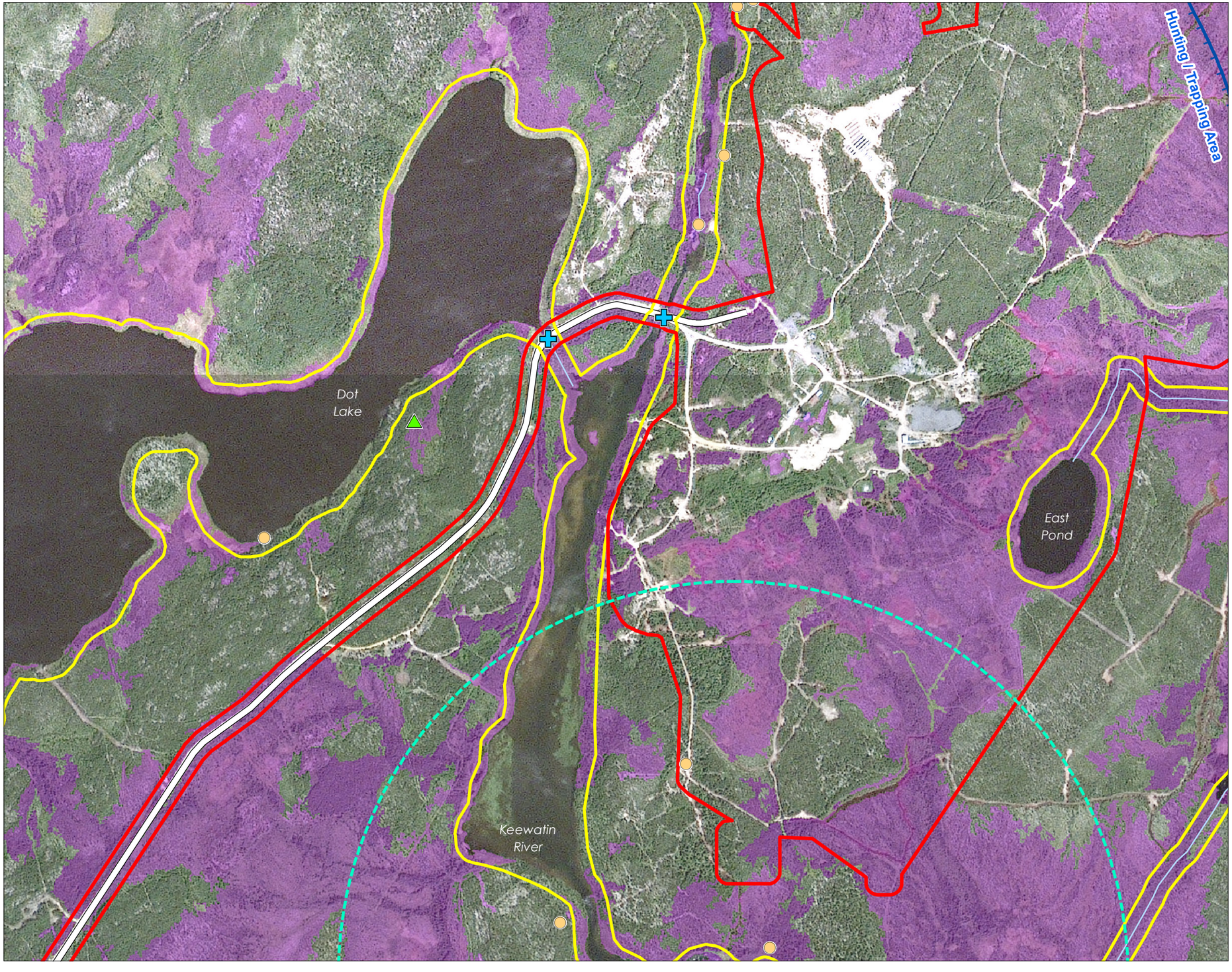


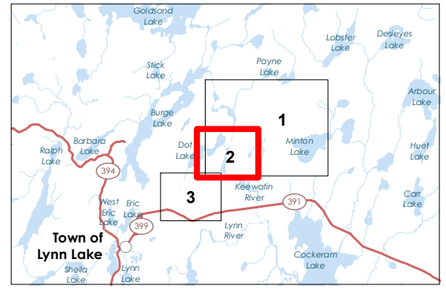
Stantec

Alamos Gold Inc.

Project Infrastructure
- Project Development Area

Environmentally Sensitive Sites
- Archaeological Site
- Watercourse Crossing Location
- Rare Plant Location
- Bald Eagle Nest 1000m Buffer
- Water Features 30m Buffer
- Hunting / Trapping Area
- Wetland Area (interpreted from satellite imagery)

Landbase
- Existing Access Road
- Watercourse



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3. Imagery: SPOT-7 imagery, BlackBridge Geomatics Corp. July 2015.

Project Location
Lynn Lake, Manitoba

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Technical Review by ASomers on 2020-04-03
Senior GIS Review by GKroupa on 2020-04-03

Client/Project
ALAMOS GOLD INC.
Lynn Lake Gold Project

111473008

Map No.
22-2b

Title
Environmentally Sensitive Sites at the MacLellan site

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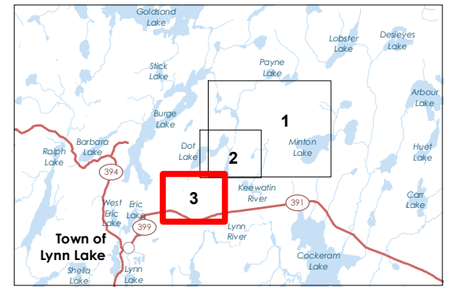
Stantec

Alamos Gold Inc.

Project Infrastructure
- Project Development Area

Environmentally Sensitive Sites
- Bald Eagle Nest 1000m Buffer
- Water Features 30m Buffer
- Hunting / Trapping Area
- Wetland Area (interpreted from satellite imagery)

Landbase
- Existing Access Road
- Highway
- Watercourse



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3. Imagery: SPOT-7 imagery, BlackBridge Geomatics Corp. July 2015.

Project Location
Lynn Lake, Manitoba

Prepared by ACampigotto on 2020-04-03
Technical Review by ASomers on 2020-04-03
Senior GIS Review by GKroupa on 2020-04-03

Client/Project
ALAMOS GOLD INC.
Lynn Lake Gold Project

111473008

Map No.
22-2c

Title
Environmentally Sensitive Sites at the MacLellan site

G:_GIS Project Folders\111473009 LGP EA\figures\Accidents and Malfunctions\Map22-2c_ESS Sites MacLellan_20200401.mxd Revised: 2020-04-13 By: ACampigotto

ALAMOS GOLD INC.

Lynn Lake Gold Project Environmental Impact Statement Chapter 23 - Environmental Management and Monitoring

Stantec

Prepared by:

Stantec Consulting Ltd.

May 25, 2020

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Acronyms and Abbreviations

Alamos	Alamos Gold Inc.
AQMP	Air Quality Management Plan
ARD/ML	acid rock drainage and metal leaching
CCP	Conceptual Closure Plan
DFO	Fisheries and Oceans Canada
EA	environmental assessment
EEM	environmental effects monitoring
EEMP	Environmental Effects Monitoring Plan
EIS	environmental impact statement
EMMP	Environmental Management and Monitoring Program
FHOP	Fisheries Habitat Offsetting Plan
GCDWQ	Guidelines for Canadian Drinking Water Quality
GHG	greenhouse gas
GHGMP	Greenhouse Gas Management Plan
GWMP	Groundwater Monitoring Plan
HCRPP	Heritage and Cultural Resources Protection Plan
MDMER	Metal and Diamond Mining Effluent Regulations
MRMP	Mine Rock Management Plan
MRSA	mine rock storage area
MWQSOG	*Manitoba Water Quality Standards, Objectives, and Guidelines*
$PM_{2.5}$	fine particulate matter with an aerodynamic diameter less than 2.5 µm
PM_{10}	respirable particulate matter with an aerodynamic diameter less than 10 µm
SAR	species at risk

SARA	*Species at Risk Act*
SMRP	Soil Management and Rehabilitation Plan
TSP	Total suspended particulate
VWMP	Vegetation and Weed Management Plan
WMMP	Wildlife Monitoring and Management Plan

23.0 ENVIRONMENTAL MANAGEMENT AND MONITORING

Alamos Gold Inc. (Alamos) is committed to achieving its sustainability principles and objectives (Chapter 1). In meeting this goal, environmental management, and monitoring plans will be prepared and implemented under the Environmental Management and Monitoring Program (EMMP) to address environmental protection and follow-up requirements for the Project.

The purpose of this chapter is to outline how Alamos will implement, manage, and report on environmental protection measures, follow-up, and other monitoring programs as well as regulatory requirements and other commitments identified in the Environmental Impact Statement (EIS) for each identified VC requiring follow-up and monitoring. Ultimately, these plans will be developed to also include applicable conditions from various approvals and authorizations following the environmental assessment (EA) process to consolidate regulatory requirements and company commitments throughout the Project life cycle.

Ultimately, Alamos is responsible for the implementation of the measures and commitments outlined in the EMMP. Accountability and compliance with the EMMP will be enforced with contractors and subcontractors through construction contracts.

23.1 OVERALL CONTEXT AND OBJECTIVES

The EMMP sets out the scope for developing and implementing environmental management, follow-up, and monitoring programs. The environmental management plans describe the various commitments to manage potential effects. The follow-up program has the following objectives:

- To verify the accuracy of the effects assessment.
- To determine the effectiveness of measures implemented to mitigate the adverse effects of the Project.
- To monitor compliance with regulatory approvals, permits and authorizations.

Follow-up programs are typically recommended where there is uncertainty in the Project residual or cumulative effects prediction or known effectiveness of mitigation measures, or where there is a particular risk. In cases where there is uncertainty about effects outcomes, adaptive management measures are applied. Adaptive management is a planned process for responding to uncertainty or to an unanticipated or underestimated Project effect. Information learned from monitoring actual Project effects is applied and compared to predicted effects. Where a variance between the actual and predicted effects occurs, a determination is made as to whether modifications or other actions are necessary to revise the existing mitigation measures. In cases where there may be no other mitigating options available, the appropriate information will be shared with the applicable regulatory authorities in a timely manner.

The goal of the monitoring program is to provide information to guide any necessary measures and controls to reduce the potential for environmental degradation during the Project phases, and to provide defined action plans and emergency response procedures related to human and environmental health and safety. The EMMP and associated plans demonstrate Alamos's commitment to an appropriate process of

environmental protection and management of adverse effects through effective implementation of mitigation measures.

23.2 ADAPTIVE MANAGEMENT

As discussed in the Final EIS Guidelines (Appendix 4A), “adaptive management is not considered as a mitigation measure, but if the follow-up program indicates that corrective action is required, the proposed approach for managing the action should be identified”. Adaptive management is a planned and systematic process and intervention mechanism for continuously improving environmental management practices and adjusting monitoring by learning from outcomes. Adaptive management provides the flexibility to address/accommodate new circumstances, to adjust monitoring, implement new mitigation measures or modify existing measures. The Project will identify and correct incidents with appropriate measures aimed to prevent reoccurrence and/or similar occurrences. The Adaptive Management Framework (Appendix 23A, Figure 23A-1), provides a formalized approach to:

- Track and monitor activities.
- Report and as needed investigate incidents, including non-conformance and non-compliance events.
- Develop and implement corrective and preventive actions.
- Continue monitoring and update relevant plans within the EMMP.

Alamos is committed to the continual improvement of its environmental management and performance. As part of the Adaptive Management Framework, the EMMP and associated plans will be assessed regularly to verify implementation and the continued suitability, adequacy and effectiveness. The review will identify elements of the EMMP and associated plans in need of revision and evaluate performance against established performance objectives.

The objectives of a review are to:

- Maintain compliance with regulatory requirements.
- Identify opportunities for improvement in the management plan.
- Incorporate community considerations.

The review will include:

- The EMMP and constituent plans.
- Legislation, approvals, environmental compliance approval changes.
- Community complaints, enquiries and corrective actions.
- Community and regulatory liaison and feedback.

23.3 COMMUNICATION SHARING AND REPORTING

Alamos is committed to open and transparent engagement throughout the Project's life. Opportunities will be provided to discuss interests and resolve issues related to the Project. Alamos will maintain ongoing communication with Indigenous communities, stakeholders, provincial regulators, including other provincial and federal departments, as necessary regarding implementation of the Project's EMMP through construction and operation, and into decommissioning. As results become available from the follow-up and monitoring program, they will be shared with Indigenous communities, stakeholders, and regulators in a fashion, frequency, and format determined to be appropriate to the applicable audience. The reporting will be used to inform the adaptive management framework.

A communication mechanism for providing data will be established to distribute information and accept inquiries from Indigenous communities, the public, and stakeholders. Alamos maintains a local office/presence in Lynn Lake that facilitates ongoing communications with members of the local community, stakeholders, and interested government officials (on an as needed basis). Alamos will maintain an office at the mine site and will consider maintaining a smaller office in Lynn Lake during Project operation to further facilitate communication.

23.4 ENGAGEMENT AND CONSIDERATION OF INDIGENOUS KNOWLEDGE

Engagement for the Project has been an ongoing process that will continue with local Indigenous communities, government agencies, the public, and stakeholders for the life of the Project. The engagement process related to follow-up and monitoring will consider input from Indigenous communities and stakeholder groups in the process of follow-up and monitoring for the Project. Engagement considerations related to follow-up and monitoring for the Project is evident in the feedback received in the following:

- One Indigenous community expressed an interest in being involved with environmental monitoring activities prior to Project development and two Indigenous communities expressed interest in providing guides for water monitoring programs.
- Another Indigenous community expressed interest in third party monitoring and testing of water in the Hughes River.
- Surface and groundwater monitoring have been a concern expressed by communities, including at the Winnipeg Open House in 2015 and in discussions with one Indigenous community.

Alamos will work with Indigenous communities and stakeholders, including local and regional government agencies, in the design and implementation of follow-up programs, and evaluation of follow-up results and subsequent updates to the program. Alamos will further work with Indigenous communities in monitoring on a go-forward basis, where appropriate.

Alamos plans to meet with interested Indigenous communities to discuss concerns identified through traditional land and resource use studies for the EA and how concerns, to the extent possible, will be addressed and mitigated. Alamos also plans to develop resource protection plans in collaboration with

potentially affected Indigenous communities with respect to ongoing environmental management and monitoring plans. Alamos will meet with communities upon request during the operations phase.

Alamos will share and discuss anticipated effects of the Project and the efficacy of proposed mitigation with Indigenous communities. If the need for follow-up and monitoring related to Indigenous Peoples is identified, Alamos will discuss with engaged Indigenous communities. Specific community engagement strategies will be established in collaboration with the individual groups.

23.5 ENVIRONMENTAL MONITORING AND MANAGEMENT PLANS

The follow-up program during Project construction will include an inspection component that involves observations and measurements for Project components or activities. The active work sites will be inspected for compliance with applicable license, permit or other approval terms and conditions, and adherence to general and specific mitigation measures. Incidents of non-compliance will be reported to the construction supervisor, contractor and as required the applicable regulatory authority (e.g., Manitoba Conservation and Climate). The process of environmental inspection allows for making a quick response in the event of an incident or changing environmental conditions. Incidents such as accidents and malfunctions (i.e., spills, fires, explosions, collisions) and environmental damage will be reported immediately to the construction supervisor and applicable regulatory authority. Incidents will be dealt with immediately and followed up with inspection reports. Summary reports from follow-up programs will be submitted on a regular basis to regulatory authorities, as required.

Monitoring is the continuation of observation, measurement or assessment of environmental conditions at and surrounding the Project, its components or activities. As noted in Section 23.1, two types of monitoring are typically undertaken for environmental assessments: environmental monitoring to verify the accuracy of predictions and implemented mitigation measures; and compliance monitoring for verification of practices or procedures to meet legislated requirements. Monitoring will be carried out on select VCs using environmental indicators and measurable parameters identified in the EIS. Components to be monitored will be determined based on regulatory instrument requirements as per legislation (e.g., *Metal and Diamond Mining Effluent Regulations* (MDMER), Species at Risk scientific permit), environmental importance, sensitivity and vulnerability, and license requirements. Monitoring plans where applicable will describe sampling procedures, quality control and assurance programs, laboratory methods and protocols, laboratory accreditations, and reporting requirements. Results from monitoring will be used through an adaptive management process to adjust mitigation measures and to modify plans on an ongoing basis, if required. Engagement of Indigenous communities in monitoring will be incorporated into the monitoring plans where appropriate and applicable. Reports from monitoring programs will be submitted annually to regulatory authorities and shared with interested Indigenous communities and stakeholders.

Approximately 18 follow-up plans for the EMMP will be prepared to address important management issues, regulatory requirements, and corporate commitments identified in the EIS related to the Project generally, and to identified VCs (Section 23.6). The plans will identify risks to valued components, and outline measures and means planned to protect the environment.

The plans will describe the management actions, roles and responsibilities, evaluation mechanisms, updating requirements, and reporting schedules. The plans will also provide details on the location, design, methods (e.g. parameters to be measured), applicable regulatory instruments, and schedule for the follow-up and monitoring programs. The documents/plans that will be prepared prior to the start of Project construction are outlined in the subsections below.

23.5.1 Emergency Response and Spill Prevention and Contingency Plan

The purpose of the Emergency Response and Spill Prevention and Contingency Plan is to facilitate responses to emergency situations that occur at the Project sites.

- The objective of the plan is to provide for emergency preparation and response and spill prevention and contingency planning in accordance with federal and provincial legislation and guidelines, and corporate policies and procedures for the protection of human health and the environment.
- The scope of the plan will include spills and the releases of hazardous substances, including petroleum products, accidents involving hazardous substances, medical emergencies, explosion and fire.
- Measures will be prescribed for the provision of emergency response planning, training, responsibilities, cleanup equipment and materials, and contact and reporting procedures.

23.5.2 Soil Management and Rehabilitation Plan

The purpose of the Soil Management and Rehabilitation Plan (SMRP) is to outline how suitable soil excavated at the sites will be stockpiled for later use in Project rehabilitation during decommissioning and implementation of a revegetation program. Monitoring soil stockpiles for regulated weeds during construction and operation will be conducted annually during the growing season. Corrective measures to control the spread of regulated weeds will be conducted in accordance with the Vegetation and Weed Management Plan (see also Section 23.5.12). Rehabilitation activities will primarily take place during the decommissioning/closure phase. The SMRP will also identify and manage soil affected by existing or historical activities for the development of the Project.

23.5.3 Mine Rock Management Plan

The purpose of the Mine Rock Management Plan (MRMP) is to guide the handling, storage, and management of mine rock for the Project. The MRMP will outline procedures and test methods to classify the acid rock drainage and metal leaching (ARD/ML) potential and geochemical properties of the materials. Criteria for the management of mine rock will be proposed, including for the identification of mine rock that can be used for construction.

23.5.4 Groundwater Monitoring Plan

The purpose of the Groundwater Monitoring Plan (GWMP) is to:

- Provide a framework for monitoring potential changes in groundwater quantity and quality in relation to the Project.
- Verify the effectiveness of mitigation measures that have been implemented to protect groundwater quantity and quality.
- Describe requirements for provincial and federal groundwater quantity and quality compliance monitoring and reporting.

The approach to groundwater management and monitoring (i.e., program basis, objectives, methods, locations, and frequencies) as part of follow-up and monitoring is outlined in Chapter 8. Follow-up monitoring results will be compared to applicable regulatory standards and Project specific regulatory approvals.

23.5.5 Surface Water Monitoring and Management Plan

The purpose of the Surface Water Monitoring and Management Plan is to:

- Provide a framework for monitoring surface water quality in near-field, far-field, and reference sites at both sites, and lake level and stream flow monitoring at baseline locations (modified to focus on areas of potential effects) in accordance with regulatory requirements.
- Outline standard management practices for drainage control, dewatering, control of site runoff and seepage, contact-water collection, storage, and reuse, tailings management, water management facilities for collection and treatment, maintenance of drainage patterns and works, progressive rehabilitation to address infiltration and evapotranspiration capacity, and open pit filling at closure.

23.5.6 Waste Management Plan

The purpose of the Waste Management Plan is to provide for effective waste management generated by the Project in accordance with applicable provincial legislation and guidelines and corporate policies. The scope of the plan includes:

- Principles of Reduce, Reuse, Recycle, and Recover.
- Methods for appropriate disposal, recycling, or re-use options for wastes generated.
- Methods for appropriate disposal of hazardous waste.
- Performance tracking for environmental protection measures.

23.5.7 Air Quality Management Plan

The purpose of the Air Quality Management Plan (AQMP) is to monitor and manage the effect of the Project on ambient air quality in accordance with provincial regulatory requirements. The approach to air quality monitoring includes:

- An outline of the mitigation measures and best management practices to reduce air emissions during construction and operation.
- Follow-up and monitoring for air quality consisting of meteorological monitoring (wind speed and wind direction) and continuous ambient particulate matter monitoring (TSP, PM_{10} and $PM_{2.5}$).
- The intent is to confirm that ambient concentrations of TSP, PM_{10} and $PM_{2.5}$ at human receptor locations are not above levels predicted by the EIS, and to assess the effectiveness of the dust mitigation measures and determine the need for more rigorous dust mitigation.

23.5.8 Noise Monitoring Plan

The purpose of the Noise Monitoring Plan is to monitor and manage the effects of the Project on ambient noise and vibration in accordance with regulatory guidance levels and noise targets (i.e., Province of Manitoba, Health Canada). The noise monitoring plan includes:

- Monitoring the effectiveness of Project mitigation measures at the most affected receptor locations (i.e., work camp, First Nation trapline [ID 73] and First Nation trapping area [ID 76]).
- Implementation of an indoor noise monitoring component at the work camp and a vibration air overpressure monitoring component to confirm the effectiveness of mitigation at two receptors (i.e., ID 73 and ID 76).
- Procedures and mechanisms for the receipt of noise complaints.

23.5.9 Greenhouse Gas Management Plan

The purpose of the Greenhouse Gas Management Plan (GHGMP) is to manage Project greenhouse gas (GHG) emissions in accordance with relevant GHG emissions management legislation. The GHGMP will also include policy updates, emission source descriptions, data management framework, effectiveness of mitigation, follow-up and monitoring for GHGs, based on provincial and federal reporting requirements.

23.5.10 Explosives Management Plan

The purpose of the Explosives Management Plan is to provide for the safe use and storage of explosives and explosive components at the Project sites. The management of explosives will be in accordance with environmental protection measures, provincial and federal legislation and guidelines, and corporate policies for explosives. Plans will be prepared prior to explosives being brought onto the Project sites.

23.5.11 Heritage and Cultural Resources Protection Plan

The purpose of the Heritage and Cultural Resources Protection Plan (HCRPP) is to provide protection of archaeological and heritage resources. Alamos and its construction contractors will abide by the requirements issued by the provincial regulator for site avoidance, excavation, and/or heritage resource monitoring.

The approach for monitoring heritage resources, through implementation of the HCRPP consists of construction monitoring to confirm no archaeological resources (as recommended by Manitoba Historic Resources Branch in certain areas) are affected. Where heritage or cultural resources are discovered, appropriate notification, salvage, and documentation will be undertaken, including engagement with Indigenous communities (as appropriate).

23.5.12 Vegetation and Weed Management Plan

The purpose of the Vegetation and Weed Management Plan (VWMP) is to manage clearing and weed management activities on the Project sites during construction in accordance with environmental protection measures and provincial guidelines. The VWMP will prescribe corrective measures (e.g., spraying and hand-pulling) where necessary to control the spread of regulated weeds.

The vegetation and weed management plan will be completed and implemented prior to the commencement of construction. The plan will address methods to be used to monitor for and manage invasive plant species during construction and operation.

23.5.13 Erosion and Sediment Control Plan

The purpose of the Erosion and Sediment Control Plan is to provide environmental protection measures for the aquatic environment and protect watercourses and wetlands from the experiencing effects from mobilization of sediment. The plan will be prepared according to provincial and federal legislation and guidelines, as well as applicable site-specific policies and procedures. Construction monitoring activities will be outlined to assess the effectiveness of erosion and sediment control measures.

23.5.14 Wildlife Monitoring and Management Plan

The purpose of the Wildlife Monitoring and Management Plan (WMMP) is to outline the wildlife monitoring program for construction, operation and decommissioning/closure phases to confirm the effectiveness of proposed mitigation measures and verify EA conclusions for the Project related to wildlife, including migratory birds and SAR, and their habitats.

The approach to wildlife follow-up and monitoring will be based on three phases: pre-construction surveys, construction monitoring, and operation monitoring. Proposed follow-up and monitoring activities will consist of bat hibernacula surveys, remote camera deployment (e.g., woodland caribou), raptor nest inventory, breeding bird and nest sweep surveys, and a traffic-related wildlife mortality program (self-reporting). No permits are expected to be required under the federal SARA with respect to species at risk. In addition, no scientific permit is anticipated to be required under *The Endangered Species and Ecosystems Act* (Manitoba) as no collection or capture of a species at risk as part of monitoring studies is contemplated for the Project.

Project activities relating to water development and control during the construction and operation phases of the Project have the potential to be affected by beaver activity. The WMMP will include measures to manage beaver dam construction activities at the mine sites during Project operation. Beaver dam removal

on Crown land requires a Crown Land Work Permit and beaver dam management activities on fish-bearing waters require compliance with federal *Fisheries Act* regulations.

Site preparation activities (e.g., vegetation clearing) can adversely affect breeding migratory birds in contravention of the federal *Migratory Birds Convention Act, 1994*. Project activities have the potential to result in the disturbance or destruction of migratory birds (including waterfowl and species at risk) or their nests. Project-specific bird nest mitigation measures will be developed as part of an Avian Monitoring sub-plan to the WMMP and implemented.

The Avian Monitoring sub-plan will address project effects and mitigation measures specific to migratory birds (including waterfowl and species as risk). The sub-plan will include mitigation such as, scheduling vegetation clearing and site preparation activities outside the breeding period for migratory birds and will outline how to mitigate the risks to migratory birds in accordance with federal and provincial regulations.

A Wildlife and Tailings Management Facility sub-plan to the WMMP will address project effects and mitigation measures specific to wildlife interactions (including migratory birds, species at risk, amphibians, and mammals) with collection ponds and the TMF. The sub-plan will include managing vegetation around collection ponds and the TMF and consider additional mitigation measures (e.g., fencing, netting, bird/bat deterrents) if monitoring identifies concerns regarding wildlife, including migratory bird use of these areas.

23.5.15 Fish Habitat Offsetting Plan

Alamos plans to apply for a *Fisheries Act* authorization to Fisheries and Oceans Canada (DFO) following the technical review of this EIS. The application will include a Fish Habitat Offsetting Plan (FHOP), which will identify effective measures to offset unavoidable harmful alteration, disruption, or destruction of fish habitat. The FHOP will include offsetting for the loss of the existing diversion channel between Gordon Lake and Farley Lake and for the loss of East Pond and its outlet. Changes in flow in Farley Creek and loss of the fish habitat in East Pit and Wendy Pit may or may not be considered harmful alteration, disruption, or destruction of fish habitat. The status of these changes will be determined through additional hydrological modelling and consultation with DFO as part of the technical review of this EIS as well as through the *Fisheries Act* authorization application process.

Options to offset the harmful alteration, disruption, or destruction of fish habitat due to Project activities include habitat creation, restoration or rehabilitation, and research. Options have been identified through engagement with federal and provincial regulators as well as local Indigenous communities. Options identified to date have been screened against biological, engineering, management, and financial criteria. Offsetting measures included in the August 28, 2019 *Fisheries Act* authorization application, which will be carried forward to the FHOP, were developed to a detailed conceptual stage. These options were:

- To replace the existing diversion channel with a new diversion channel with features to increase its habitat value.
- To replace two culverts at the Burnt Timber Mine access road crossing of Waban Creek, which prevent upstream and downstream fish passage, with a bridge to restore unimpeded fish passage.

- To complete a research program on lake sturgeon in the Hughes River, with the objectives of assessing the status of juvenile lake sturgeon recruitment and genetic composition in the Hughes River in comparison with other Management Units in the Churchill River basin and Manitoba. Lake sturgeon in the Hughes River are an important fishery for members of the Marcel Colomb First Nation as well as being listed as “endangered” by the Committee on the Status of Endangered Wildlife in Canada.

Additional offsetting measures may be developed for the FHOP if needed to counterbalance the potential harmful alteration, disruption or destruction of fish habitat associated with changes to Farley Creek and the existing East and Wendy pits.

The approach to fish habitat monitoring includes compliance and effectiveness monitoring in offsetting habitats that may include monitoring of physical attributes, riparian vegetation survival, fish presence/absence, water quality and/or fish utilization. The Project is not expected to require an amendment to Schedule 2 of the MDMER for the deposition of tailings into water frequented by fish.

23.5.16 Fish Salvage Plan

A plan for salvaging fish from the Wendy and East pits, diversion channel and East Pond was developed in liaison with DFO and according to best management practices and outlined as part of the *Fisheries Act* Authorization submission. A Live Fish Handling Permit for the handling or storage of live fish during inventory, monitoring, or salvage operations is required under *The Fisheries Act* (Manitoba) from MCC and will be secured prior to dewatering activities.

23.5.17 Environmental Effects Monitoring Plan (EEMP)

An Environmental Effects Monitoring Plan (EEMP) will be developed to address the monitoring of discharge water in compliance with federal and provincial regulatory requirements. While direct discharge of mine water from the TMF is not anticipated, guidance received from Environment and Climate Change Canada noted that the MDMER will apply if the Project results in any seepage or discharge of mine water.

The approach to environmental effects monitoring is two-fold:

- If discharge is required from the TMF at the MacLellan site, the water will first be treated to meet the relevant provincial and federal regulatory requirements (i.e., MDMER) prior to discharge.
- Each of the site’s water management ponds will be monitored for water quality, and if necessary, the water treated to meet applicable provincial and federal regulatory requirements prior to discharge to the environment. Treatment will be based on the relevant section in Schedule 4 of the MDMER stipulating authorized limits of deleterious substances.

23.5.18 Conceptual Closure Plan

The purpose of the Conceptual Closure Plan (CCP) is to provide direction in the development of the rehabilitation strategy for the Project sites at the end of their life cycle or in the case of unplanned premature

closure (Appendix 23B). The objective of rehabilitation is to restore the sites to a satisfactory condition in accordance with provincial legislation and guidelines by:

- Stabilizing Project sites physically, chemically, and biologically encouraging terrestrial and aquatic repopulation.
- Providing reasonable paths for surface drainage.
- Discharging water in compliance with effluent surface water and groundwater quality criteria.
- Revegetating ground disturbance areas, where practical.
- Establishing self-sustaining vegetative covers over select mine waste, where practical.

The approach to monitoring will address physical stability, water chemistry, and aquatic and terrestrial elements as follows:

- Physical stability monitoring – open pit walls; historical underground mining openings; mine rock, overburden and ore storage areas; TMF embankments; water management structures; and surface infrastructure. Water chemistry monitoring – surface water monitoring (pit lake water, TMF, receiving waterbodies and watercourses upstream and downstream of discharge flows); groundwater monitoring (around open pits, in vicinity of Gordon and Farley lakes and Keewatin River, and monitoring wells upgradient and downgradient of TMF, mine rock storage areas (MRSAs), and other material stockpiles); and water quality (general parameters, anions, metals).
- Aquatic and terrestrial monitoring – benthic invertebrate survey; fish community survey; fish tissue sampling for metals; supporting water and sediment quality sampling; toxicity testing; and success of revegetation (mine rock storage areas, TMF, and process plant area).

A detailed Closure Plan that conforms with *The Mines and Minerals Act* Mine Closure Regulation must be submitted prior to the commencement of advanced exploration and mining operations. The detailed Closure Plan will be developed once the detailed design process progresses.

23.6 VALUED COMPONENT-SPECIFIC FOLLOW-UP AND MONITORING PROGRAMS

Follow-up and monitoring is undertaken to verify the accuracy of the EA predictions and to determine the effectiveness of measures taken to mitigate adverse environmental effects (including cumulative effects) of the Project. This is particularly relevant where there is substantial uncertainty or risk related to effects predictions and/or required by approval conditions. The form and frequency of follow-up and monitoring reporting, where required, will be determined as the Project progresses. Table 23-1 provides an overview of the conceptual EA follow-up and monitoring programs by VC.

Table 23-1 EA Follow-up and Monitoring Program Elements

Targeted VCs	Applicable Regulatory Instrument with Monitoring Program Requirement	Effects Basis	Overview of Follow-up / Monitoring Program / Studies	Associated Plans
Atmospheric Environment (Chapter 6)	Manitoba Ambient Air Quality Criteria	Change in air quality – ambient concentrations Change in atmospheric greenhouse gases – GHG emissions	Monitoring to confirm ambient air and meteorological conditions (wind speed, wind direction) and off-site concentrations (TSP, PM_{10}, $PM_{2.5}$) for fugitive dust emission. Implementation of Greenhouse Gas Management Plan.	• AQMP • GHGMP
Acoustic Environment (Chapter 7)	Guidelines for Sound Pollution (Manitoba) Health Canada Noise Guidance Guidelines for Blasting Noise and Vibration (Ontario Ministry of Environment, Conservation and Parks)	Change in noise level – equivalent sound levels, annoyance Change in vibration level – ground borne and air overpressure	Monitoring to confirm effectiveness of mitigation measures at work camp and receptors ID 73 and ID 76. Monitoring indoor noise at work camp and vibration air overpressure at receptors ID 73 and ID 76.	• NMP
Groundwater (Chapter 8)	Guidelines for Canadian Drinking Water Quality Canadian Water Quality Guidelines – Freshwater Aquatic Life Ontario Ministry of Environment GW 3 Criteria Manitoba Water Quality Standards, Objectives and Guidelines	Change in groundwater quantity and/or flow Change in groundwater quality	Monitor groundwater levels and groundwater quality at key Project locations during operations. Monitoring wells established at select locations around the open pits; monitoring wells/drive point piezometers at select lakes and tributaries; monitoring wells upgradient, cross gradient, and down gradient of TMF (MacLellan), MRSAs, and historical MRSAs (Gordon). Groundwater quality samples from monitoring wells. During closure, monitoring will be continued to document groundwater recovery levels as the open pits fill.	• GWMP

Table 23-1 EA Follow-up and Monitoring Program Elements

Targeted VCs	Applicable Regulatory Instrument with Monitoring Program Requirement	Effects Basis	Overview of Follow-up / Monitoring Program / Studies	Associated Plans
Surface Water (Chapter 9)	Metal and Diamond Mining Effluent Regulations (MDMER) Environmental Effect Monitoring (EEM)	Change in surface water quantity Change in surface water quality	Monitoring of surface water quantity and quality in near-field, far-field, and reference sites at both sites including (pit lake water, TMF sediment pond, receiving waterbodies and watercourses upstream and downstream of discharge flows. Lake level and stream flow monitoring at baseline locations in accordance with regulatory requirements.	• SWMP
Fish and Fish Habitat (Chapter 10)	Fisheries Act Authorization (anticipated) MDMER Environmental Effect Monitoring (EEM) *The Fisheries Act* (Manitoba)	Change in fish habitat Change in fish health, growth or survival	Compliance and effectiveness monitoring in habitat offsets. Lake and level and stream flow monitoring. Periodic habitat mapping in lakes with altered levels. Fish impingement/entrainment surveys. MDMER environmental effects monitoring. Water quality monitoring. Benthic macro-invertebrates monitoring. Fish tissue sampling.	• FHOP • Fish Salvage Plan
Vegetation and Wetlands (Chapter 11)	*The Environment Act* (Manitoba) *The Noxious Weeds Act* (Manitoba)	Change in landscape diversity Change in community diversity Change in species diversity Change in wetland functions	Monitoring of soil stockpiles for regulated weeds during construction and operation annually during growing season. Monitoring of transplanted species of conservation concern, if they cannot be avoided. Post-reclamation monitoring undertaken 5 years after revegetation to determine success (issues arising prior to the 5-year mark will be addressed as that time).	• SMRP • VWMP

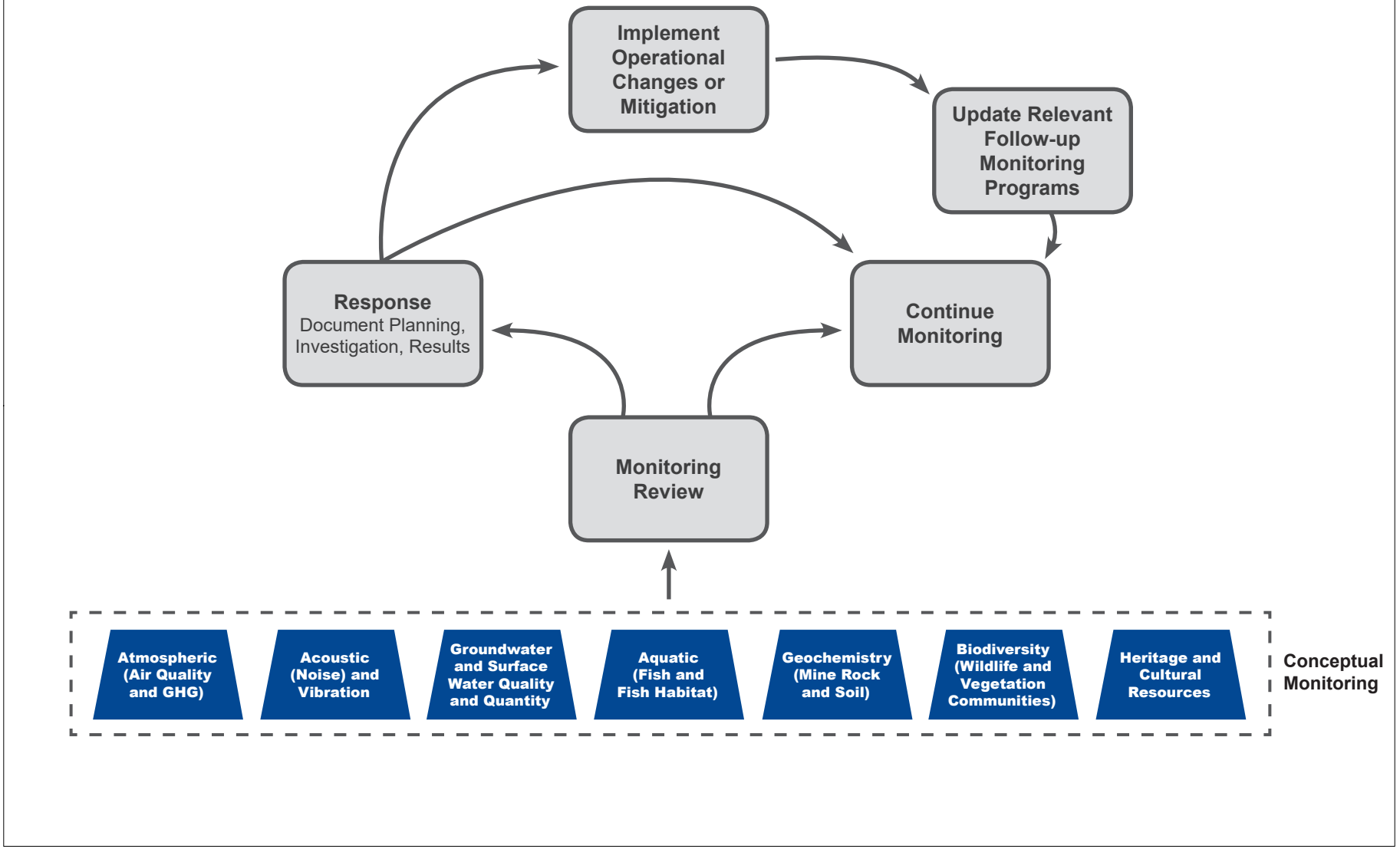
Table 23-1 EA Follow-up and Monitoring Program Elements

Targeted VCs	Applicable Regulatory Instrument with Monitoring Program Requirement	Effects Basis	Overview of Follow-up / Monitoring Program / Studies	Associated Plans
Wildlife and Wildlife Habitat (Chapter 12)	N/A	Change in habitat Change in mortality risk Change in wildlife health	Pre-construction surveys involving bat hibernacula, raptor nest inventory, and breeding bird and nest sweeps. Remote camera monitoring through construction and operation. Self-reporting program until Project end.	• WMMP
Labour and Economy (Chapter 13)	N/A	Change in regional labour force Change in regional business Change in regional economy	No follow-up and monitoring program is anticipated.	• N/A
Community Services and Infrastructure (Chapter 14)	N/A	Change in housing and temporary accommodation Change in local services and infrastructure Change in transportation services and infrastructure	No follow-up and monitoring program is anticipated.	• N/A
Land and Resource Use (Chapter 15)	N/A	Change in land use Change in recreation Change in resource use	No follow-up and monitoring program is anticipated.	• N/A
Heritage Resources (Chapter 16)	*The Heritage Resources Act* (anticipated) Authorization by Historic Resources Branch, Manitoba Sport, Culture and Heritage	Change to heritage resources	Implement a Heritage and Cultural Resources Protection Plan during construction and operation.	• HCRPP

Table 23-1 EA Follow-up and Monitoring Program Elements

Targeted VCs	Applicable Regulatory Instrument with Monitoring Program Requirement	Effects Basis	Overview of Follow-up / Monitoring Program / Studies	Associated Plans
Current Use of Lands for Traditional Purposes (Chapter 17)	N/A	Change in availability of resources currently used for traditional purposes Change in access to resources currently used for traditional purposes Change to traditional cultural and spiritual sites and areas Change to the environment affecting cultural value or importance associated with current use	Current use data collected in the LAA will be updated on an ongoing basis throughout the life cycle of the proposed Project. Monitoring programs will be developed through engagement with Indigenous Communities.	• N/A
Human Health (Chapter 18)	N/A	Change in human health	Nothing beyond what is already planned for atmospheric environment, surface water or fish and fish habitat.	• N/A
Indigenous Peoples (Chapter 19)	N/A	Change to Indigenous health conditions Change to Indigenous socio-economic conditions Change to Indigenous physical and cultural heritage	Follow-up and monitoring requirements specific to Indigenous Peoples have not yet been identified; approach will be based on sharing the results of other relevant monitoring with Indigenous communities as part of the ongoing Indigenous Community Engagement Plan.	• N/A

Appendix 23A FIGURES



ALAMOS GOLD INC.

Stantec

Client/Project	111473008
ALAMOS GOLD INC.	
Lynn Lake Gold Project	Prepared by ACampigotto on 2020-01-14
	Reviewed by BKrawchuk on 2020-01-014
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Adaptive Management Framework	

Appendix 23B CONCEPTUAL CLOSURE PLAN

ALAMOS GOLD INC.

Lynn Lake Gold Project
Conceptual Closure Plan

Stantec

Prepared by:

Stantec Consulting Ltd.

May 25, 2020

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1.0 INTRODUCTION

The Lynn Lake Gold Project (LLGP; or "the Project") consists of two primary deposit sites, which are both located near Lynn Lake, Manitoba: the 'Gordon' site and the 'MacLellan' site. Alamos Gold Inc. (Alamos) intends to construct (redevelop), operate and eventually close/reclaim open pit gold mines at both of these historical mine sites.

Alamos proposes to develop new mine infrastructure at the MacLellan site, including an open pit, a central ore milling and processing plant, associated infrastructure, ore stockpiles and a mine rock storage area (MRSA), and a tailings management facility (TMF). Infrastructure at the Gordon site will be limited to the open pit, ore stockpiles, an MRSA, and minor supporting infrastructure for equipment storage and maintenance. There will be no tailings storage at the Gordon site. Maps 3a and 3b (Appendix A) show the development areas at both sites within in which this infrastructure will be located.

The following reports on Stantec's work in relation to a Conceptual Closure Plan for the Project.

1.1 REVIEW OF REGULATORY REQUIREMENTS

A document entitled *General Closure Plan Guidelines* for mining operations in Manitoba was produced by a committee of government and industry representatives. The document summarizes the requirements of the *Manitoba Mines and Minerals Act C.C.S.M. c. M162 (MMMA)* with respect to closure. This document has been used as a guide to prepare this Conceptual Closure Plan (CCP). This CCP is not intended to meet all the requirements for a Closure Plan as required under the *MMMA*, but is provided to:

- Support the EIS/EA process by outlining reasonable rehabilitation and monitoring measures to be implemented during closure.
- Support engagement activities during the development of the Closure Plan.
- Provide the basis for future planning and design updates that will be completed to support the filing of a Closure Plan with the Manitoba Mines Branch during the permitting period of the Project.
- Demonstrate Alamos' commitment to consider closure operations during the planning and operational stages of the Project.

An outline of anticipated monitoring is provided and will form the basis for determining when final close out of the Project is achieved. This monitoring will be further informed through the operation phase of the Project as model predictions are verified with monitoring and specific testing programs to be implemented to verify closure designs. A final Closure Plan that conforms to the *MMMA* will likely be prepared during the latter half of the operating mine life.

1.2 CONCEPTUAL CLOSURE PLAN OBJECTIVES

Facilities that will be present at the Gordon and MacLellan sites at decommissioning/closure and will require rehabilitation include:

- Plant sites
- Surface infrastructure (offices, maintenance shops, storage)
- Open pits
- Surface water flow trenches and sumps
- MRSAs
- TMF (MacLellan site only)
- Overburden stockpiles
- Ore stockpiles/pads
- Access roads
- Pipelines.

The primary objectives of rehabilitation and closure activities are to establish Project sites that have:

- Been stabilized physically, chemically, and biologically, to encourage terrestrial and aquatic repopulation.
- Reasonable paths for surface drainage.
- Discharge water that meets effluent surface water and groundwater quality criteria.
- Revegetated areas of ground disturbance, where practical.
- Self-sustaining vegetative covers over select mine waste (tailings and mine rock), where practical.

End land use goals will be further defined through the EA and post-permitting process (i.e., ongoing engagement) and by as-built conditions during operation.

After closure activities have been completed, a post-closure monitoring program will be carried out to verify that the closure objectives and criteria have been met and confirm that the Project can proceed to final close out status (Permanent Closure).

1.3 KEY STAKEHOLDERS

The key stakeholders who potentially have an interest in, or may be affected by, the Project include:

- Indigenous communities.
- Town of Lynn Lake; local residents and property business owners.
- The public that use the land and surrounding area for recreation, including hunting and fishing.
- Government agencies, including the Mines Branch who is responsible for approving the Closure Plan.

2.0 PROJECT INFORMATION

2.1 PROJECT PROPONENT

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2.2 PROJECT LOCATION

The Gordon site is located 55 km (by vehicle) east of the town of Lynn Lake (14U 412400E 6307800N), and the MacLellan site is located 8 km (by vehicle) northeast of Lynn Lake (14U 380900E 6307500N). The distance between the Gordon and MacLellan sites is approximately 30 km. Lynn Lake is located approximately 820 km northwest of Winnipeg.

Through the acquisition of Carlisle Goldfields Limited, Alamos obtained the rights to existing mining claims and provincial leases issued by the Mines Section of the Manitoba Mines and Geological Survey Branch of the Resource Development Division of Agriculture and Resource Development (formerly Manitoba Growth, Enterprise, and Trade). The proposed Project infrastructure at the Gordon and MacLellan sites, excluding a portion of the Gordon access road and a portion of the MacLellan access road will be located within the boundaries of those mining claims and leasehold lands,, which are registered with the provincial Mines Branch in the name of Carlisle Goldfields Limited, a wholly-owned subsidiary of Alamos.

The proposed preliminary layouts for the redeveloped Gordon and MacLellan sites are shown on Maps 3a and 3b (Appendix A).

2.3 PREVIOUS SITE DISTURBANCES AND PROPOSED OPERATIONS

2.3.1 Gordon Site

2.3.1.1 Previous Site Disturbances

The Gordon site was operated as a dual-pit open pit operation from 1996 to 1999. After closure, the Gordon site underwent a reclamation process. Current infrastructure includes a 15-km gravel access road, a bridge across the Hughes River, two mine rock storage areas and two overburden storage areas that have been capped, and two water-filled open pits (Map 2a). Buildings and structures from the historical operations have been removed.

2.3.1.2 Proposed Operations

Open Pit

Mining will be through surface means including a single open pit. Ore will be transported from the Gordon site to the MacLellan site for processing. The infrastructure at the Gordon site will be limited to the open pit, three ore stockpiles and one overburden stockpile, a MRSA, and minor supporting infrastructure for equipment storage and maintenance (Map 3a).

Run-of-mine (ROM) ore (i.e., raw/unprocessed ore that is intended for immediate processing rather than stockpiling) from the Gordon site will be transported via highway trucks to the mill feed storage area and crushing plant at the MacLellan site for short-term storage and initial crushing before it is used as feedstock for the adjacent ore milling and processing plant.

The proposed mine operation is a conventional open pit with shovel and truck removal of the mine rock and ore produced during blasting. The anticipated ultimate depth of the Gordon open pit is approximately 225 m. The open pit will be developed in a series of benches based on the pit design parameters with drilling and blasting completed on each bench.

The Gordon site will provide ore as mill feed starting in Year 1 through to Year 6 of Project operation. Some ore will be stockpiled on site during pre-production years. The mining rate (including ore destined for immediate milling and processing, as well as ore, overburden, and mine rock to be stockpiled) at the Gordon site is planned to peak at 16.0 Mt/year or approximately 50,000 t/day (rounded for seasonal considerations and to account for downtime) in Year 2. Mine operations at the Gordon site are planned to cease after Year 5. The transfer of Gordon ore, however, will continue into Year 6.

Ore, Overburden and Mine Rock Stockpiles/Storage Areas

Ore will be stockpiled at the Gordon site and used as feedstock for the ore milling and processing plant at the MacLellan site. The peak stockpile size at the Gordon site will be 1.6 Mt. The ore stockpile area is proposed to be approximately 33,800 m^2, located south of the open pit at the Gordon site (Map 3a). Depletion of this stockpiled material is anticipated in Year 6.

ROM ore from the Gordon site will be transported to a pad directly adjacent to the ore milling and processing plant at the MacLellan site for short-term storage before it is used as feedstock for the plant.

The Gordon site will also have stockpile areas for removed overburden and mine rock. These stockpile/storage areas are proposed to be located to the southwest and south of the open pit. Table 2-1 provides the estimated maximum volumes of each material stockpile based on the mine plan for the Gordon site.

Table 2-1 Approximate Quantity of Mine Materials for the Gordon Site (Peak Stockpile Size

Project Site	Ore Stockpiles		Overburden		Mine Rock	
	Tonnage (Mt)	Volume (Mm^3)	Tonnage (Mt)	Volume (Mm^3)	Tonnage (Mt)	Volume (Mm^3)
Gordon	1.6	0.7	0.9	0.5	50.1	22.3
Notes: Mine rock and ore stockpiled densities assumed to be 2.25 t/m^3. Overburden stockpile swelled density assumed to be 1.7 t/m^3. Mine rock volumes based on a bulking factor of 1.3. Overburden volumes based on a bulking factor of 1.1.						

Table 2-2 provides the general characteristics of each stockpile/storage area (i.e., height, bench configuration and overall slope). Final configurations will be developed based on detailed engineering.

Table 2-2 Proposed Configurations for Stockpiles/Storage Areas at the Gordon Site

Stockpile	Maximum Surface Area (m^2)	Maximum Total Height (m)	Maximum Overall Slope (H:V)
Ore	33,800	10	1.33H:1V
Overburden	123,300	15	2.5H:1V
Mine Rock	618,100	50	2.5H:1V

Seepage/runoff collection ditches will be constructed around the perimeter of each stockpile/ storage area and directed to a series of sumps and/or small ponds at topographic lows. Water collected in the sumps and/or small ponds will pumped to a site water management pond for management and/or treatment (if required) prior to discharge.

The Project may result in the generation of mine rock that could have the potential for acid rock drainage (ARD) and metal leaching (ML). Preliminary sampling results indicate that mine rock from the Gordon site contains potentially acid generating (PAG) materials.

A soil cover is planned over the mine rock to promote revegetation. Available soil materials at the Gordon and MacLellan sites are sandy, and runoff enhancement compared with the open rock is not expected to be significant.

Water Development and Control

Alterations to stream channels which affect fish mobility and fish habitat are considered Class 2 developments under section 3(9) of the CD Regulations pursuant to *The Environment Act* of Manitoba and are therefore subject to provincial EA and licensing requirements. The Project will not require any natural watercourse re-alignments to accommodate Project components.

As part of the proposed development at the Gordon site, the existing built diversion channel from Gordon Lake to Farley Lake will require adjustment to the north (Map 3a). The channel has been designed to safely pass the 1 in 100-year return period storm and will take long-term fish passage and habitat between Gordon and Farley lakes into consideration. Water management structures such as diversion ditches and interceptor wells will be constructed to collect, divert, and release non-contact water to the environment.

No amendment(s) to Schedule 2 of the MDMER are anticipated to be required for the Project. The mine rock storage areas at the Gordon site, and the mine rock storage areas and TMF at the MacLellan site, have been sited outside of and away from fish-bearing watercourses.

In August 2019, Alamos formally requested a paragraph 35(2)(b) *Fisheries Act* authorization from Fisheries and Oceans Canada (DFO) for the “serious harm to fish” that will occur in the existing diversion channel at the Gordon site and in East Pond at the MacLellan site (discussed in Section 2.3.2.5). Any *Fisheries Act* authorization will not be issued by DFO until after the CEAA decision on the Project.

Fuel Storage and Distribution System

Tanker trucks will deliver diesel and gasoline fuels to the Gordon site on an as-needed basis for use by heavy equipment and Project vehicles, as well as for the site generators. Propane will be considered for space heating. Fuels will be stored in approved above-ground storage tanks equipped with secondary containment in accordance with provincial regulations and standards. Fuel storage and distribution infrastructure will be constructed in accordance with applicable legislation requirements (e.g., the Storage and Handling of Petroleum Products and Allied Products Regulation under *The Dangerous Goods Handling and Transportation Act* of Manitoba). Stationary and mobile mine equipment will be fueled with a fuel-dispensing truck.

2.3.2 MacLellan Site

2.3.2.1 Previous Site Disturbances

The MacLellan site was operated as an underground gold and silver mine between 1986 and 1989. The historical MacLellan site has been in a ‘care and maintenance’ phase since 1989 with very little reclamation having taken place. The site consists of a 4.6-km gravel access road, power transmission line (abandoned pole line), and infrastructure from the former underground mine, such as a head frame, hoist house, shaft, access ramp, maintenance and other storage buildings, core shack and racks, vent raise, and mine water settling ponds (Map 2b).

2.3.2.2 Proposed Operations

Open Pit

Mining at the MacLellan site will be through surface means including a single open pit. Alamos proposes to develop mine infrastructure at the MacLellan site, including a central ore milling and processing plant, associated infrastructure, ore and overburden stockpiles, a mine rock storage area, and a TMF. An existing 4.6 km access road will be used to access the site. Upgrades to the existing access road will be required involving the removal of existing granular material and placement of new heavier pavement structure and new compacted granular material. The existing side ditches will be cleared or reconstructed based on a suitable design. With the proposed development of this site, the existing former head frame, hoist house and maintenance building will be demolished.

The MacLellan resource will be developed as an open pit mine operation. The anticipated depth of the MacLellan open pit is approximately 450 m. The open pit will be developed in a series of benches based on the pit design parameters with drilling and blasting completed on each bench. The pit slopes will be designed based on industry standards and the results of site-specific geotechnical investigations.

Mining operations after Year 5 will take place exclusively at the MacLellan site, with an expected peak mining rate of 28.0 Mt/year (in Years 6 and 7).

Ore will be stockpiled at the MacLellan site, and used as feedstock for the ore milling and processing plant when ore production is less than the plant capacity. The peak stockpile at the MacLellan site will be 2.7 Mt. The ore stockpiles at the MacLellan site are planned to be active until the end of mine operation.

Mill Feed Storage Area and Crushing Plant

Run of mine (ROM) ore from both sites will be transported to a pad directly adjacent to the ore milling and processing plant at the MacLellan site (Map 3b) for short-term storage before it is used as feedstock for the plant.

A truck dump and crushing circuit is proposed to be located south of the ore milling and processing plant at the MacLellan site and accessed by the open pit road. The crushing circuit will feed the ore milling and processing plant. Ore will be transported to the ore milling and processing plant by a conveyor system. Potential dust emissions will be reduced through dust containment (e.g., enclosure) and collection systems.

Ore Milling and Processing Plant

Ore milling and processing will be carried out at the MacLellan site. The ore milling and processing plant is designed to process 7,500 t/day of ore, with a maximum potential process rate of 8,250 t/day of ore. Ore will first be crushed in a two-stage crushing circuit comprising a primary jaw crusher, followed by a secondary cone crusher. Processing will continue with semi-autogenous grinding, then further grinding in a closed-circuit ball mill and cyclone circuit. The fine-ground product will then enter a pre-leach thickener feed box to be thickened from 33% to 51% solids. This will be in preparation for the downstream pre-aeration, leaching, and carbon-in-pulp (CIP) steps.

The cyanidation process for gold recovery will begin in the leach tank circuit, which will consist of four tanks in a series. Each tank will be interconnected with launders to allow slurry to flow sequentially to each tank in the train, and each tank will be equipped with a dual-impeller mechanical agitator to provide uniform mixing of slurry, lime slurry, sodium cyanide, and oxygen. From the last tank in the leach circuit, the slurry will flow to the first CIP tank in the adsorption circuit, which will consist of six adsorption tanks in series.

Pulp will flow continuously from the first tank to the last, while carbon will be pumped counter current from the last tank to the first. The countercurrent process will be repeated until carbon, progressively loaded with gold, advances to the first CIP tank, where it will be washed and transferred to the acid wash column. The carbon will be acid washed and residual acid on the carbon, if any, will be neutralized with both the acid and neutralization solutions being discharged to the tailings pump-box.

The washed and loaded carbon will then be transferred to the elution column, where it will be stripped of gold and silver by reversing the adsorption kinetics using a sodium hydroxide and cyanide solution (approximately 3% each by volume). After completion of the elution process, stripped carbon will be fed into the carbon regeneration kiln feed hopper and the regenerated carbon will be ready for re-introduction to the CIP circuit.

Gold and silver will be recovered from the pregnant solution in three electrowinning cells by stainless steel framed cathodes, after which the gold sludge will be smelted and refined into gold doré bars ready for transport to a certified facility for further processing. The slurry from the last CIP tank will be sent to the cyanide detoxification circuit (Air/SO_2 oxidation process) for cyanide destruction prior to being discharged to the tailings pump-box and then to the TMF.

The TMF is proposed to be located approximately 1.5 km from the ore milling and processing plant (Map 3b). Water demand at the ore milling and processing plant will be met with reclaimed water from the TMF to reduce the need for fresh surface water demand. Dewatering water from the open pit and other mine contact water (i.e., water, surface water or groundwater, that contacts mine workings or interacts with mine rock material) will be collected in a site water management pond for management and/or treatment (if required) prior to discharge.

Ore, Overburden and Mine Rock Stockpiles/Storage Areas

Some ore will be stockpiled for future processing at the MacLellan site. One ore stockpile area is planned for the MacLellan site, located adjacent to the mill (Map 3b). Based on the mine plan, the ore stockpile will be approximately 115,500 m^2 in area.

The MacLellan site will also contain stockpile areas for removed overburden and mine rock. The overburden stockpile area is proposed to be located to the west of the rock storage area, while the MRSA is proposed to “wrap around” the south and east sides of the TMF. Table 2-3 provides the estimated maximum volumes of each material at the MacLellan site based on the mine plan.

Table 2-3 Approximate Quantity of Mine Materials for the MacLellan Site (Peak Stockpile Size)

Project Site	Ore Stockpile		Overburden		Mine Rock	
	Tonnage (Mt)	Total Volume (Mm^3)	Tonnage (Mt)	Volume (Mm^3)	Tonnage (Mt)	Total Volume (Mm^3)
MacLellan	2.7	1.2	8.2	4.8	230.9	102.6
Notes: Mine rock and ore stockpiled swelled densities assumed to be 2.25 t/m^3. Overburden stockpile swelled density assumed to be 1.7 t/m^3. Mine rock volumes based on a bulking factor of 1.3. Overburden volumes based on a bulking factor of 1.1.						

Table 2-4 provides the general characteristics of each stockpile/storage area (i.e., surface area, height, and overall slope).

Table 2-4 General Characteristics of Each Stockpile/Storage Area at the MacLellan Site

Stockpile	Maximum Surface Area (m^2)	Maximum Total Height (m)	Maximum Overall Slope (H:V)
Ore	115,500	30	1.33H:1V
Overburden	181,800	30	2.5H:1V
Mine Rock	3,561,300	45	2.5H:1V

Seepage/runoff collection ditches will be constructed around the perimeter of each stockpile/storage area and directed to a series of sumps and/or small ponds at topographic lows. Water collected in the sumps and/or small ponds will be pumped to a site water management pond (the TMF collection pond) for management and/or treatment (if required) prior to discharge.

The results of preliminary geochemical testing indicate that the Project may result in the generation of mine rock that could have the potential for ARD and ML. Contact water from this mine rock pile will be captured and diverted to the open pit at closure.

Transportation of Ore

Ore mined at the MacLellan site will remain on-site. Transportation of ore from the Gordon site is described in Section 2.3.1.1.

Tailings Management Facility

The proposed location of the TMF is shown on Map 3b. The site was selected in consideration of technically and economically feasible alternatives, environmental constraints, the use of natural topography for containment, existing land tenure, the spatial footprint of the Project, and the benefits of having tailings contained in a single facility. The final TMF site selection considered ECCC's Guidelines for the Assessment of Alternatives for Mine Waste Disposal (Environment Canada 2011).

Following discussions with DFO and ECCC in September 2016, the preliminary TMF design was revised to avoid the potential deposition of mine tailings into watercourses or waterbodies frequented by fish. The revised design of the TMF does not overlap spatially with any fish-bearing waters. The design of the TMF for the Project is based on the design criteria provided in Table 2-5.

The TMF will be constructed in three stages: Stage 1, Stage 2 and Ultimate. The volume of tailings progressively stored at each stage is 2.0 Mm^3, and 9.3 Mm^3, 23.1 Mm^3, respectively. The TMF dams will be raised progressively to provide additional storage capacity. It is projected that three dam raises will be required during the operating period. The final two raises will be completed in back to back years.

The TMF dams will consist of a low permeability core constructed of suitable rockfill materials (i.e., clean, non-acid generating, relatively free draining) with internal bedding and filter zones, and upstream and downstream shells of granular material. Most of the dam materials are expected to be locally available from borrow sources. The dams will have an upstream slope of 3H:1V, a downstream slope of 2H:1V, and a crest width of 10 m. The starter dam crest elevation has been set at 362.5 m above mean sea level, with a dam height of 10 m and length of 4,150 m. Containment structures for the TMF will be designed in accordance with the Canadian Dam Association *Dam Safety Guidelines* (CDA 2013, 2014).

Table 2-5 Tailings Management Facility (Ultimate Footprint) Design Basis

Item	Quantity	Units
Mineral Reserve	35	Mt
Tailings/Ore Ratio	1.0	-
Tailings Production	35	Mt
Design Mill Rate	7,500	t/day
Specific Gravity	3.0	-
Deposition Method	Spigot/End of Pipe	-
% Solids	47.7%	-
Average Void Ratio	1.0	-
Deposited Dry Density	1.5	t/m^3
Tailings Volume Requirement	23.1	Mm^3

Based on available information regarding subsurface soils, it has been assumed that foundation seepage will be controlled via low permeability seepage cutoffs. A downstream seepage collection system, consisting of a series of sumps in combination with a buried weeping tile or rockfill finger drain system, will be installed during the starter dam construction to capture seepage at the toe of the dam and will be pumped back to the TMF collection pond.

Rockfill and aggregate for construction will be sourced from non-acid generating (NAG) mine rock and from local quarries and borrow pits near the Project. These quarries and borrow pits will be determined as detailed design proceeds and evaluated for geotechnical and environmental suitability.

Water Development and Control

No watercourse re-alignments are required, and no fish-bearing streams will be overlain with mine rock, the TMF, or other associated mine infrastructure at the MacLellan site. As a result, no amendment to Schedule 2 of the MDMER is anticipated. However, it is expected that a small pond ('East Pond') located south of the proposed open pit will drain as a result of development of the open pit (Map 2b). The pond is shallow, freezes to the bottom in winter, and does not directly support any Commercial, Recreational or Aboriginal fish species as was defined under the *Fisheries Act* prior to its amendment in 2019.

Alamos formerly requested a *Fisheries Act* Authorization from DFO in August 2019 for the serious harm to fish that will occur with the East Pond at the MacLellan site. DFO will not issue an authorization until after an IAAC decision is made on the Project.

It is expected that approximately 60-70 m^3/day of fresh water will be withdrawn from the Keewatin River for use as potable water and 40 m^3/hour of fresh water will be withdrawn from the Keewatin River for use as process (make-up) water once there is sufficient water in the TMF to supply reclaim water. Construction and operation of the 10-inch high-density underground water withdrawal pipeline is not anticipated to result in substantial changes to water level, flow, or pH in the Keewatin River. There may be a temporary increase in turbidity during pipeline construction; this will be mitigated through development and implementation of a Project-specific Erosion and Sediment Control Plan that includes consideration of in-water and shoreline activities associated with pipeline construction. The screen intake will be designed in accordance with the DFO *Freshwater Intake End of Pipe Fish Screen Guideline* (1995). Water management structures (i.e., diversion ditches) will be constructed to collect, divert, and release non-contact water to the environment.

Fuel Storage and Distribution System

Tanker trucks will deliver diesel and gasoline fuels to the MacLellan site on an as-needed basis for use by heavy equipment and Project vehicles. Propane will be considered for space heating. Fuels will be stored in approved above-ground storage tanks in the truck shop and fueling station west of the processing plant and will be equipped with secondary containment in accordance with provincial regulations and standards. Fuel storage and distribution infrastructure will be constructed in accordance with applicable legislation requirements (e.g., the Storage and Handling of Petroleum Products and Allied Products Regulation under *The Dangerous Goods Handling and Transportation Act* of Manitoba). Stationary and distant mine equipment will be fueled with a fuel-dispensing truck.

3.0 PROJECT SCHEDULE

The tentative Project schedule and approximate duration of the key Project phases are as follows:

- Construction (i.e., site preparation, physical construction/equipment installation, pre-production, and commissioning) is scheduled to begin in 2022 and is expected to take approximately 2 years to complete. Some limited pre-production may occur during this period. Project construction activities will be carried out concurrently at both mine sites.
- Operation (i.e., ore and mine rock extraction, processing, and waste management) is scheduled to begin in Q1 2024 and is expected to take approximately 13 years to complete.
    - Mining operations are expected to commence at both sites in Year 1 (i.e., 2024). Mining at the Gordon site will be undertaken for five years while mining at the MacLellan site will be undertaken for the entire life of the Project (i.e., 13 years).
    - The ore stockpiled during mine operations (both sites) will provide additional feedstock to the ore milling and processing plant located at the MacLellan site during the Project.
- Closure phase will commence at the cessation of operations:
    - Active Closure is scheduled to begin in 2029 (Year 6) at the Gordon site and in 2037 (Year 14) at the MacLellan site, and is expected to take approximately 5-6 years to complete at each site.
    - Post-Closure includes the time period that the active rehabilitation measures are complete, but monitoring is still required.
    - Permanent Closure occurs when the site is stable, and monitoring is no longer required.

Operations are due to cease at the Gordon site after six years of operation, and the majority of the closure activities at the site will be completed during the remaining six years of operations at the MacLellan site. Closure activities at the MacLellan site will be completed during the initial six years after closure of that site.

4.0 ACTIVE AND POST-CLOSURE

The following sections provide details on the closure activities that will be completed for the main Project components. It is anticipated that the majority of the closure activities will be carried out during Active Closure and will take six years after cessation of operations. Post-Closure describes the time after Active Closure but does not imply that monitoring and maintenance may cease. Relinquishment of the property to the Crown is referred to as Permanent Closure.

Maintenance and monitoring will continue through Post Closure while water quality is not of sufficient quality to allow unabated discharge to the environment. Permanent Closure can be considered to be complete when surface water quality is within the pertinent guidelines and discharge will be allowed. Monitoring and maintenance will cease at this point.

Spillways that discharge to the pits are permissible to manage contact water, however spillways that discharge to natural water features may only be in use when water quality is within regulatory limits.

It is anticipated that the overburden stockpiles will be the major source of fill for closure activities. The material within the stockpiles will be the near surficial materials from within the footprint of the open pits and will be a mixture of organics and the underlying till material.

The following Sections provide a summary of the anticipated rehabilitation efforts that will be completed during Active Closure. The activities are similar for the Gordon and MacLellan sites and are therefore described in general terms. The exception is the TMF, of which only one is planned at the MacLellan site. Maps 4a and 4b presents the site features at Active Closure at Gordon and MacLellan respectively.

4.1 PLANT AREAS AND SITE EQUIPMENT

Structures will be demolished to return the site to a vegetated state. Construction materials will be salvaged and recycled as practical. Mining equipment will be removed offsite and sold. Pipelines will be salvaged and used in drainage works where required. Unused pipe will be buried or removed from site and disposed locally.

Building foundations will be razed to below final grade. This will be achieved using hydraulic excavator-mounted pulverizers, busters and hammers. Fill from the overburden stockpile will be used to grade the footprint up to the final design.

The plant area will require scarification prior to seeding, due to the traffic compaction from routine operations. The area will be graded to remove topographic lows that may be susceptible to ponding and promote surficial flow out of the immediate area.

4.1.1 Hydrocarbon Contaminated Soils

Contamination in the subsurface soil is expected around the fuel bays and waste hydrocarbon storage areas. Contaminated soil will need to be removed and replaced with fill from the overburden stockpile. The

impacted soil will likely need to be trucked to a contaminated materials landfill in Winnipeg for disposal. A site investigation will be carried out by a qualified professional to determine the extent of the contamination and the required excavation.

4.2 OPEN PITS

4.2.1 Securing the Pits for Safety

A safety berm will be placed around the perimeter of the open pits to prevent vehicular access, as indicated in the *Guidelines and the Workplace Safety and Health Act W210, Manitoba Regulation 212/2011*. The berm will be made from 2 m high boulders stockpiled during operations and will be placed a minimum 20 m from the edge of the pit. A gap between boulders will be permissible, however the maximum distance will need to be 1.5 m to inhibit vehicular access. If an insufficient number of boulders are available, an earth fill berm with appropriate signage will be completed around the perimeter.

4.2.2 Filling and Discharge

Pit dewatering will be terminated shortly after completion of operations, and the area surrounding the crestal perimeter will be contoured for surface drainage into the pit at both sites.

The pits will be allowed to fill through precipitation and groundwater inflow to provide a water cover to the exposed side slopes. After operations, other surficial mine-contact water will be routed to the pits, and a series of trenches will be excavated at both sites to drain the seepage collection systems for the overburden, ore and MRSAs, and the TMF at the MacLellan site to the pits by gravity. These trench systems are hereby referred to as the closure trench system. A plan view of the trenches is shown in Figure B1 (Gordon) and Figure B3 (MacLellan) and profile views of all the trenches are presented in Figure B2 (Gordon) and Figure B4 (MacLellan). Minor fill earthworks will be required along the proposed alignment of the closure trench systems as indicated on the profile view Figures. The alignment will be reassessed at the end of operations to optimize the grade of the trenches.

The filling process is expected to take between 11 and 21 years at the Gordon and MacLellan sites, respectively under normal climatic conditions. Once the open pits have filled with water to form a pit lake, and water quality has been demonstrated to meet acceptable discharge criteria, Permanent Closure can be considered.

The diversion channel between Gordon and Farley Lakes is expected to remain in place past permanent closure. An outlet between the open pit and the diversion channel, or possibly directly to Farley Lake, will be considered in detailed design.

The water level in the MacLellan pit lake will be controlled after permanent closure by an outlet channel/spillway, which diverts overland flow to the east. The constructed channel will connect to the unnamed channel that drains East Pond to the Keewatin River. Fisheries and Oceans Canada (DFO) have expressed concern that fish migration will occur into the pit lake and requested a design of the outlet channel. DFO also requested that the overflow water from the MacLellan pit be diverted down this channel,

rather than directly to the Keewatin River. The preliminary design of the channel is presented in Golder (2020).

4.3 TAILINGS MANAGEMENT FACILITY (MACLELLAN ONLY)

One TMF, located at the MacLellan site, is proposed for the Project. Tailings will be deposited though conventional spigot methods, and a supernatant pond is expected at the cessation of operations.

The surficial pond will remain at closure to act as a sediment trap. According to the *MMMA*, the pond will need to be drained completely as part of activities to support Permanent Closure.

4.3.1 Dam Safety and Operation

Until the TMF is allowed to discharge unabated to the environment, the TMF will be operated as set out in the TMF's Operations Management and Surveillance manual. According to the *Canadian Dam Association's Mining Dams Bulletin (CDA 2014)*, the TMF may be considered in a state of closure and under passive care once:

- The supernatant pond has been drained.
- The surface of the TMF is passively discharging to the environment.
- It has been shown that the TMF is stable.
- The phreatic surface has come to a naturalized level with the environment.

In accordance with the *CDA Dam Safety Guidelines* (CDA 2013) and the *2014 Mining Dams Technical Bulletin*, a tailings facility that is under passive care will continue to require regular dam safety inspections, dam safety reviews, and maintenance (Section 7.1.2).

4.3.2 Vegetative Cover

A soil cover will be applied to the crest (tailings surface) to provide a reasonable surface for revegetation, reduce dust and improve aesthetics. Due to soft ground conditions, these efforts may have to be carried out during the winter with light-weight equipment. It is not planned to place cover material on the slopes, as regrading will not be possible and revegetation on the bare embankment material (mine rock) is not likely to be successful at the proposed slopes of 1:2.25 (H:V).

It is preferable to use clayey material as the basal layer for any mine waste cover, however suitable material has not been located in site investigation works. The principle source of material will be the overburden stockpile, and a 0.5 m layer is proposed. This material will contain substantial sand and the permeability is likely to be higher than preferable, and it is not yet known how it will perform to improve the quantity and quality of seepage water.

The use and management of available organics and/or topsoil is not yet known. Topsoil will likely be available from windrowed stockpiles around the site from pre-construction stripping, but volumes are not

currently known. It should be assumed that seeding will be directly onto sandy cover material. Seeding directly onto sandy till was done at the nearby El Mine, and it is anticipated that the same strategy will be acceptable for this project.

It is assumed for costing purposes that approximately 75% of the final tailings surface area will be covered and vegetated. The supernatant pond will be retained in Active and Post Closure as a sediment trap during and will therefore not be drained and covered. The supernatant pond will be drained prior to Permanent Closure. Approximately 0.7 Mm^3 of basal material will be required to form the cover and is expected to be available from the overburden stockpile.

4.3.3 TMF Water Management

Supernatant water on the TMF will be pumped to the plant site during operations for use in processing, and seepage is collected within a trench system and directed to seepage collection ponds for pump back to the TMF.

The drainage system that will be constructed around the TMF for water management during operations will remain in place after closure to direct flow to the topographic lows, and the closure trench system will direct flow to the open pit (Figure B3). A spillway in the TMF will be present during operations as an overtopping prevention measure, at a final design elevation of 376.25 m. The invert of the spillway will be lowered at closure to direct water to the closure trench system, and the details for connecting the channels will be confirmed during detailed design. The spillway will be lowered again at Permanent Closure to drain the pond.

The closure trench system connects to the closure trenches around the Mine Rock Storage Area, as discussed further in Section 4.4.2.

4.4 MINE ROCK STORAGE AREAS

Geotechnical slope stability analyses will be carried out by a Qualified Professional Engineer at the time of closure to confirm the stability of the mine rock stockpiles at the Gordon and MacLellan sites. Slope regrading is proposed to allow placement of cover material on the slopes and revegetation to occur.

4.4.1 Seepage and Drainage

After the end of operation, runoff and toe seepage will continue to be collected by the perimeter contact water collection ditches. The closure trench will drain collected seepage water to the pit, as has been proposed for the TMF.

4.4.2 Water Management

The closure trench system will direct seepage water from the MRSA to the pit. Approximately 100 m of trench at the Gordon site (Figure B2) and 350 m at the MacLellan site (Figure B4) will require filling to bring up to grade.

Pipe may need to be recovered from the tailings delivery and water return systems and used in limited lengths along the closure trenches in the following circumstances:

- The water table is intersected
- The trench intersects a wetland designated for habitat re-establishment

The operations and closure trench systems are expected to remain until Permanent Closure. Ultimately, all seepage collection trenches will be backfilled to allow unabated runoff to return to the pre-mine drainage pathways as much as is feasible.

The operations seepage collection trench system includes seepage collection ponds at the topographic lows. It is at these locations that the operations and closure trench systems will be connected.

The ponds will be decommissioned during Active Closure as follows:

1. The ponds will be pumped dry and sediment in the bottom of the collection pond will be tested. If the sediment quality complies with the regulatory requirements, sediment can be mixed with soil/topsoil from construction and use for rehabilitation. Otherwise, it is assumed that the sediment will be deposited in the open pits if approved, or at an offsite approved landfill.
2. Decommissioned pumps and piping (for the return to the TMF during operations) will be removed.
3. The perimeter berm of the seepage collection system ponds will be graded to match surrounding topography and the bottom of the pond will be filled to grade with clean fill (such as overburden or excess material from the perimeter berm).
4. Riprap will be placed, where necessary, at the end of the seepage collections system ditches to prevent scour and allow water to safely flow overland to the nearest receiver.

Disturbed areas adjacent to the ditches will be covered with topsoil and revegetated.

4.5 OVERBURDEN STOCKPILES

The priority for the overburden material will be to form the covers over the MRSAs. The stored overburden will be a mix of material from stripping activities and is considered to be suitable for use as there is a low risk for ARD/ML. Sufficient material will be designated for this purpose before other material is proportioned for other uses. The second priority for the material will be over the plant site and access roads, as these areas will be significantly traffic compacted and may require some additional fill to create a reasonable growth surface. Remaining material will be used at other areas of the site or disposed of in the pit, and it is assumed that all stored overburden will be used as part of closure rehabilitation.

Rehabilitation activities at the overburden stockpile will be minimal after depletion of the stored material. The disturbance area will be seeded, however little contouring activities is expected as the area will be returned to approximately the pre-development topography after the stockpiled material is removed.

It is currently anticipated that there will be adequate overburden stockpiled on site to support the rehabilitation works. Table 4-1 presents the anticipated uses for available material. Minor material will be required for other uses however the predominant use of overburden will be for MRSA covers. Available soil volumes will be considered further through a soil balance during detailed design.

Table 4-1 Material Volumes Required for Active Closure Activities

Facility	Gordon Site - Cover Area (ha)	Gordon Site – Overburden Volume (1000s of m^3)	MacLellan Site – Cover Area (ha)	MacLellan Site – Overburden Volume (1000s of m^3)
TMF	N/A	N/A	140	700
WRD	100	310	350	2,100
Total Material Required for Rehabilitation	**-**	**310**	**-**	**2,800**
Total Material Available	**-**	**To be confirmed**	**-**	**3000[1]**
Note 1: The 4.8 Mm3 of overburden noted to be mined in Table 2-3 includes volumes that are expected to be used during construction. Available overburden at Gordon has not yet been confirmed.				

4.6 ORE STOCKPILES

Ore will be placed on a pad constructed out of NAG waste rock to form the stockpile. All potentially economic rock will be processed in the plant prior to termination of operations, and pad material will be disposed of in the pit or the TMF as approved.

The soils below the ore stockpile will be sampled and soils will be managed accordingly. The ground surface will be graded and seeded.

4.7 SITE ROADS

Intra-site access roads will need to be maintained until relinquishment to allow routine maintenance of site facilities where required. Rehabilitation of haul roads and other intra-site roads will be carried out as part of closure activities for adjacent facilities. The footprint of the roads will be traffic compacted and will need to be scarified prior to seeding of the area.

Both sites are expected to remain open to the public indefinitely for recreational activities such as hunting and trapping. Responsibility for maintenance of the roads after relinquishment has not been finalized and will be discussed with the Town of Lynn Lake and the Province as the project progresses.

4.8 REVEGETATION

The *Mine Closure Plan Guidelines* indicate that vegetation is to be self-sufficient after six (6) years of planting; however, there is no indication of target coverage after this time.

The objectives of the revegetation program are to provide erosion prevention, improve aesthetics, and establish vegetation growth. The surface of the TMF will be revegetated, primarily with grasses. All other disturbed ground will be revegetated based on local needs, but adjacent vegetation communities will likely blend in with these efforts in the long term. These areas include the plant sites, ore stockpile area, the overburden storage areas and other areas that are disturbed as part of operations. It is likely that revegetation on the MRSAs will only be successful on the covered portion.

Revegetation will occur as soon as practical after the termination of operations. Prior to revegetation, the ground surface will be prepared by contouring to final grade, adding soil amendments to support vegetative growth, and implementing erosion protection measures to protect the soil cover until vegetation is established. Areas that are traffic compacted under routine activities, such as access roads and the plant sites, will be scarified prior to the addition of soil amendments. Material from the overburden stockpile and locally windrowed topsoil will be used as available, however most will be needed to form the cover over the waste storage facilities.

Vegetation tests may be carried out at the Gordon site whilst operations are continuing at the MacLellan site. The variables will include topsoil/overburden/nutrient mixture, seed mixture, planting species and fertilization requirements. The selected seed mixture will be comprised of non-invasive species to promote the development of natural revegetation.

Revegetation efforts from the rehabilitation of the historical Farley Lake operations and the nearby EL Mine will be considered.

5.0 PERMANENT CLOSURE

The ultimate aim for Alamos will be to relinquish the sites to the Crown. At this point Alamos will be removed from responsibility for the site, and the Financial Assurance will be returned.

Before the site can be relinquished, it will need to be demonstrated to the Mines Branch that there are sufficient measures in place to protect people, property and the environment for the long term. Specific measures outlined in the *MMMA* include:

- Prevent unauthorized access.
- Secure all openings to the surface.
- Stabilize all surface areas disturbed by the Project.
- Dismantling all buildings, power transmission lines, pipelines and other structures.
- Remove all machinery, equipment and storage tanks from the site.
- Remove all concrete structures, foundations and slabs from the site or cover them with overburden to promote re-vegetation.
- Remove all petroleum products, chemicals and waste from the project site. Test the soil in the immediate vicinity of the storage sites and dispose of contaminated soil.
- Rehabilitate all landfill sites and other waste management sites.
- Manage all areas in which tailings are impounded or waste or overburden is accumulated to ensure stability and erosion control.
- Breach all structures previously used for the control of tailings or water or stabilize the structures against any static or dynamic loading to which they might be subjected.
- Restore all watercourses such that they will sustain themselves in the future without maintenance.
- Remove roads, railways, and paths to promote revegetation.

6.0 UNEXPECTED EARLY CLOSURE

In the event that mining operations are suspended prior to the planned end-of-mine, measures will need to be taken to protect safety, property and the environment. Specific measures outlined in the *MMMA* include:

- Prevent access by unauthorized persons.
- Continue maintenance of all mechanical, hydraulic and waste management systems.
- Continue all monitoring programs.
- The control of all contaminated effluents and securing of all petroleum products, chemicals and waste.
- Complete amendments to tailings and other stockpiles to leave them in a stable and safe condition.

7.0 MONITORING

7.1 PHYSICAL STABILITY MONITORING

Physical stability monitoring is required during Active and Post-Closure for site safety and to demonstrate that land, water and mine waste management structures, and other mine-related structures are stabilizing. Specifically, the following features will require physical stability monitoring:

- open pit walls
- mine rock, overburden and ore storage areas
- TMF embankments
- water management structures
- surface infrastructure.

The following subsections address the monitoring requirements for each of these site features. Table 7-1 provides a summary of the Project components that require physical stability monitoring and the anticipated frequencies. An annual report will be prepared to document the results of the monitoring program and provide recommendations for additional rehabilitation efforts to address concerns or changes to the monitoring program.

The *MMMA* does not provide specific guidance on all monitoring. The majority of the monitoring frequencies in Table 7-1 are based on judgement and are subject to modification as the project proceeds.

Physical stability monitoring will cease once site features are deemed to be stable and the process for Permanent Closure has been completed.

Table 7-1 Physical Stability Monitoring Requirements

Monitored Area	Monitoring Frequency	
	During Active Closure	During Post-Closure
OPEN PIT AND HISTORICAL MINE WORKINGS		
Visual inspection of slopes for stability and changes in drainage patterns	Annually	Every 5 years
Pit Lake Water Levels	Quarterly	Quarterly
Historical Mine Openings	Annually	Every 5 years
TMF		
General facility surveillance	Monthly	Semi-annually
Water levels and pumping rates	Daily during periods of pumping	Daily during periods of pumping
Seepage Collection System	Monthly	Monthly
Water management structures and spillways	Annually	Annually
Dam safety inspection	Annually	Annually
Dam safety review	Every 5 years	Every 5 years
Creek Diversions	Annually	Annually
OVERBURDEN AND WRSAs		
Visual inspection for stability and cover stability	Annually	Every 5 years
Collection ponds and ditches	Monthly	Monthly

7.1.1 Open Pit

The stability of the open pit walls will be assessed quarterly during active and post-closure until the pit has filled. Access to the pit will be restricted, however additional measures may be required if areas of instability are observed. The water level in the pit will also need to be monitored quarterly.

7.1.2 Tailings Management Facility

The TMF will be monitored annually after closure operations are complete. Monitoring will include visual inspections of the overall facility including the reclaimed surface/cover, water level and pond slopes, spillways, tailings surface, and seepage collection system.

Dam Safety Inspections and Reviews will be carried out for the TMF in accordance with the CDA guidelines (CDA 2013). It is expected that Dam Safety Inspections will be required as part of the annual monitoring requirements and Dam Safety Reviews will be required every five years, however the required frequencies will ultimately be based on the Hazard Classification of each dam as defined in the guidelines.

Dam safety inspections will include a visual inspection of the tailings embankments for signs of sloughing, piping, erosion, sliding, water control structures (e.g., ditches, spillways), beaver and rodent activity,

vegetative cover, review of instrumentation, and review of the Operations, Maintenance and Surveillance manual.

Dam safety reviews will consist of a review of the current legislation related to the dam, a risk assessment, failure assessment, hazard classification, hydrotechnical, geotechnical, and operational assessment of the facility.

7.1.3 Overburden and Mine Rock Storage Areas

The MRSAs are to be monitored for signs of physical instability (slope stability, erosion and vegetation cover) on an annual basis. Inspections will include a walkover of the cover material on top of the MRSAs to identify potential drainage issues (e.g., silt accumulation in channels, excessive settlement causing pooling, erosion gullies, and spillway scour), ground cover established by vegetation, and visual inspection of the slopes for signs of movement/sloughing. Inspections will be completed annually during active rehabilitation and subsequently reduced to every five years until stable conditions have been confirmed.

7.1.4 Other Infrastructure

Surface water trenches and ditching will be inspected annually until permanent closure for signs of erosion and wildlife activity. Beaver activity is expected.

Demolition of buildings and burying of foundations will be removed during the initial stages of closure. While in place, an annual inspection of all buildings will be completed.

7.2 WATER CHEMISTRY MONITORING

Water chemistry monitoring for Project discharges, and surface water and groundwater receiving bodies will be completed in accordance with applicable regulatory requirements and approvals, including but not limited to the Closure Plan and Manitoba Water Quality Guidelines. A detailed monitoring program will be developed for the Project once the conditions of these regulatory approvals are finalized. The details of this monitoring program for all phases of the Project will be described in the Closure Plan, including sampling locations, methods, frequencies, and reporting procedures.

For the purposes of this Conceptual Closure Plan, the following subsections provide an overview of the general surface water and groundwater monitoring programs for closure based on anticipated monitoring requirements. The program will be amended based on actual site conditions observed through operation.

7.2.1 Surface Water Monitoring

A closure surface water monitoring program will be implemented to confirm compliance with regulatory approvals and to confirm performance of the final rehabilitation measures. The monitoring program will incorporate water quality, water level and channel velocity during ice free periods. Monitoring will occur for the following sources:

- Pit lake water

- TMF sediment pond
- Receiving waterbodies and watercourses, both upstream and downstream of discharge flows, to identify effects of discharge flows on the environment and confirm compliance with regulatory approvals, including selected monitoring stations in the Keewatin River at the MacLellan site, and Gordon and Farley Lakes at the Gordon site.

7.2.2 Groundwater Monitoring

The objective of the groundwater monitoring program will be to document the recovery in groundwater levels as the open pit fills and to confirm compliance with regulatory approvals. The groundwater monitoring program will incorporate water level and quality monitoring at select locations around the Project site.

Monitoring piezometers and drive-point wells will be installed at the following locations prior to closure, and monitoring will continue after operations have ceased:

- Around the open pit.
- In the vicinity of Gordon and Farley Lakes at the Gordon site, and the Keewatin River at the MacLellan site.
- Monitoring wells upgradient and downgradient of the TMF, MRSAs, and other material stockpiles.

Groundwater quality samples from monitoring wells will be monitored annually until permanent closure; however, the locations and frequency may be reduced based on monitoring results with approval from the Mines Branch. Groundwater quality samples will be analyzed for general chemistry and select dissolved metals.

7.2.3 Water Quality Parameters

Water quality will be monitored with respect to both regulatory approval (compliance) limits and trigger concentrations, which indicate when contingency measures may be required.

Contaminants of Concern (CoCs) will be identified as water monitoring progresses during operations. Water quality monitoring (both surface water and groundwater monitoring) will include, at a minimum, the species in the federal Metal and Diamond Mining Effluent Regulations SOR/2002-222 (MDMER) and the CoCs identified during routine monitoring.

7.3 AQUATIC AND TERRESTRIAL MONITORING

Environmental management, and monitoring plans will be prepared and implemented under the Environmental Management and Monitoring Program (EMMP) to address environmental protection and follow-up requirements for the Project. The plans will include monitoring programs to assess the effectiveness of the mitigation measures related to revegetation and the establishment of wildlife/fish habitat.

8.0 EXPECTED SITE CONDITIONS AT CLOSURE

The following subsections describe the expected site conditions at the time of Permanent Closure.

8.1 LAND USE

The specified closure activities aim to promote the re-establishment of vegetation and animal habitats on site. The site will remain open to the public after final closure, and recreational activities such as hunting, trapping and snowmobiling will be permitted. Access roads from the provincial highway PR391 will remain, however the site will otherwise be left to revegetate to promote a natural appearance. The boulder fence around the pit crest will remain indefinitely.

The Indigenous community engagement process will continue throughout the life of the project, and concerns with respect to the long-term appearance of the sites will be addressed to the extent possible.

8.2 TOPOGRAPHY AND SURFACE DRAINAGE

A summary of the topography of the site and drainage paths at site relinquishment is as follows:

- Surface drainage at the Gordon site is typically towards the Gordon and Farley lakes, and this will also be the case at final closure.
- The area around the overburden stockpile, ore stockpiles and the western side of the pit at the MacLellan site will be graded for surface drainage to the pit. The area around the plant area and the southern part of the pit will be graded towards the south.
- Drainage trenches will be backfilled to allow unabated local runoff.

8.3 GROUNDWATER FLOW

The open pits will be the main sink for groundwater at both the MacLellan and Gordon sites.

9.0 ANTICIPATED CLOSURE COSTS

The costs associated with the proposed closure activities outlined in the preceding Sections have been estimated. Construction quantities have been estimated by Stantec and unit rates have been provided by Ausenco Engineering Canada Inc. Some broadly applicable assumptions in the cost estimates include:

- Outside contractors will be engaged. Significant costs savings will be achievable if the mine fleet is used.
- Unit rates are representative of 2020 figures, and do not include relevant taxes. Increase in cost due to inflation and other market effects have not been considered.
- Progressive rehabilitation, including vegetative plot studies, are assumed to be included with operational costs and therefore not included.
- The cost of handling boulders for rip-rap is also included within operational costs.
- Closure costs will be incurred during the Active Closure phase.

Construction of a cover on the MacLellan TMF is the main cost associated with this project. A detailed estimate for the expected closure costs in provided in Appendix C, and the following Table provides a summary.

Table 9-1 Anticipated Closure Costs

Item	Anticipated Closure Cost – Gordon Site	Anticipated Closure Cost – MacLellan Site
Open Pit	$360,000	$1,030,000
Equipment	N/A – most equipment will be relocated to MacLellan	$500,000
Petroleum / Waste Product	$250,000	$270,000
Infrastructure – Plant Site	$470,000	$2,430,000
Roads	$730,000	$830,000
Mine Rock Storage Area	$2,000,000	$15,600,000
Tailings Management Facility	N/A	$5,340,000
Overburden, Ore Stockpile, Magazine	$200,000	$540,000
Sumps	$360,000	$410,000
Ongoing monitoring and engineering (assumed 10% of total cost)	$437,000	$2,700,000
Total	$4,800,000	$29,650,000

10.0 ENGAGEMENT ON THE CONCEPTUAL CLOSURE PLAN

Engagement has been ongoing prior to and throughout the EA process, and will continue with government agencies, local Indigenous communities, and stakeholders through the life of the Project. Alamos will continue to engage with potentially affected Indigenous communities to hear issues or concerns, and to learn about Indigenous health conditions, socio-economic conditions, and physical and cultural heritage, so as to incorporate pertinent information into planning for closure, as appropriate.

A number of commitments to mitigate adverse Project effects to Indigenous peoples were outlined in Chapter 19. Specific commitments were made related to community development, implementation of environmental management and monitoring plans, and avoidance of land and routes currently used for traditional purposes.

Chapter 3 of the EIS (Engagement) provides more detail on the engagement process covering open houses, site visits, targeted meetings, newsletters, questionnaires, presentations, and capacity funding for technical reviews and community-based studies, among other areas.

11.0 REFERENCES

11.1 LITERATURE CITED

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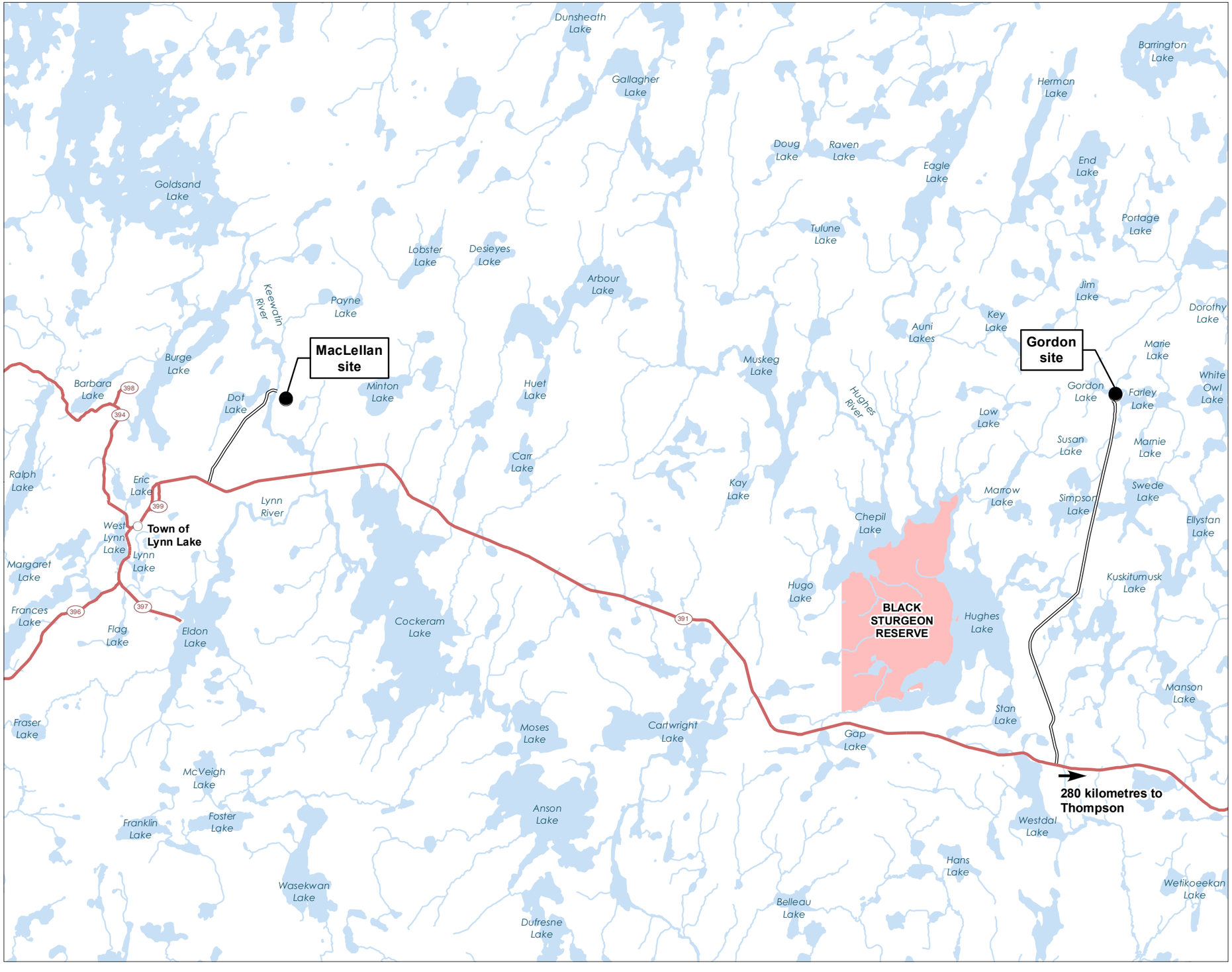
Appendix A MAPS



Stantec

Alamos Gold Inc.

Landbase

- Existing Access Road
- Highway
- Watercourse
- Waterbody
- First Nation Reserve

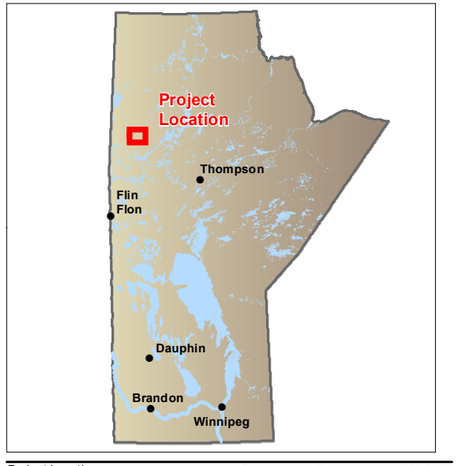
N

0 2.5 5 Kilometres

(At original document size of 11x17)
1:150,000

Notes

1. Coordinate System: NAD 1983 UTM Zone 14N
2. Base Data Sources: Government of Manitoba and Government of Canada



Project Location
Lynn Lake, Manitoba

Prepared by ACampigotto on 2020-04-02
Technical Review by ASomers on 2020-04-02
Senior GIS Review by GKroupa on 2020-04-02

Client/Project 111473008

ALAMOS GOLD INC.
Lynn Lake Gold Project

Map No.

1

Title

General Project Area

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Stantec

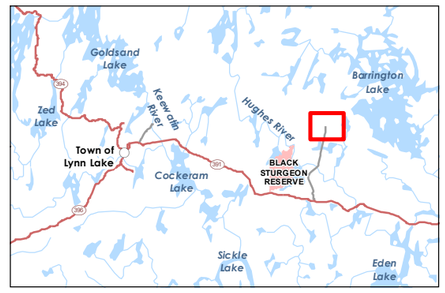
Alamos Gold Inc.

Historical Mine Infrastructure

Existing Infrastructure Associated with Historical Mine

Landbase

Existing Access



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Notes

1. Coordinate System: NAD 1983 UTM Zone 14N
2. Base Data Sources: Government of Manitoba and Government of Canada.
3. Imagery: SPOT-7 imagery, BlackBridge Gemoatics Corp. July 2015.

Project Location
Lynn Lake, Manitoba

Prepared by ACampigotto on 2019-10-24
Technical Review by ASomers on 2019-10-24
Senior GIS Review by GKroupa on 2019-12-11

Client/Project
ALAMOS GOLD INC.
Lynn Lake Gold Project

111473008

Map No.
2a

Title
Historical Mine Operational Area
Gordon site

G:\...GIS Project Folder\111473008 LLGP EA Figures\Ch2 Project Description\For Review\Map2-5 PD_GordonHistoricsMine 20191211.mxd Revised: 2019-12-11 By: JHiebert

Stantec

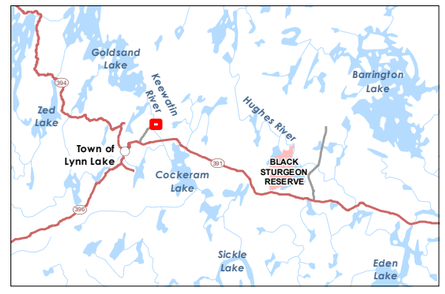
Alamos Gold Inc.

Historical Mine Infrastructure

Existing Infrastructure Associated with Historical Mine

Landbase

Existing Access Road



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(At original document size of 11x17)
1:5,000

Notes

1. Coordinate System: NAD 1983 UTM Zone 14N
2. Base Data Sources: Government of Manitoba and Government of Canada.
3. Imagery: SPOT-7 imagery, BlackBridge Gemoatics Corp. July 2015.

Project Location
Lynn Lake, Manitoba

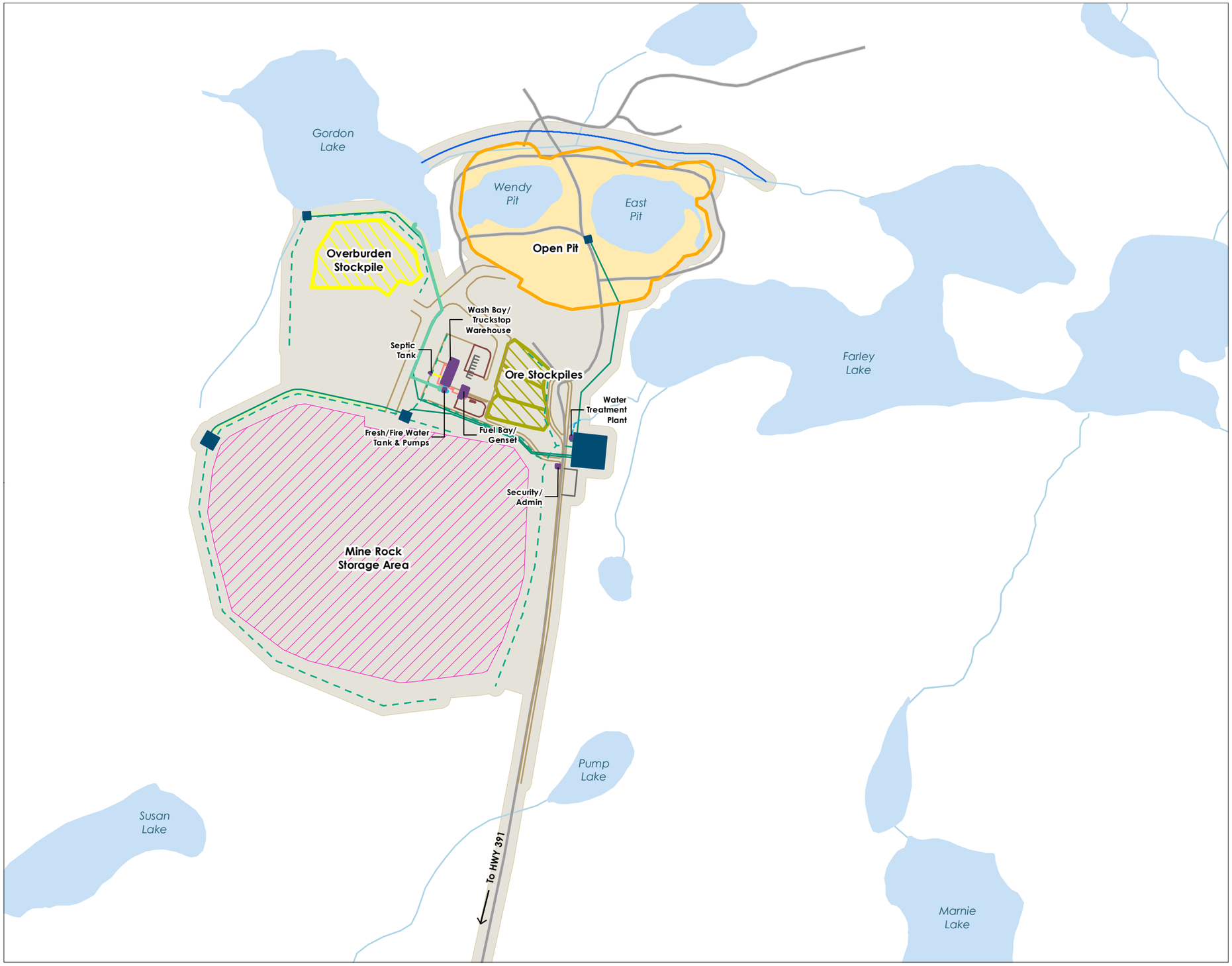
Prepared by ACampigotto on 2019-10-24
Technical Review by ASomers on 2019-10-24
Senior GIS Review by GKroupa on 2019-12-11

Client/Project
ALAMOS GOLD INC.
Lynn Lake Gold Project

111473008

Map No.
2b

Title
Historical Mine Operational Area
MacLellan Site



Stantec

Alamos Gold Inc.

Project Infrastructure

- Proposed Open Pit
- Potential Ore Stockpile
- Potential Mine Rock Storage Area
- Potential Overburden Stockpile
- Project Development Area
- Buildings
- Pond

Site Access

- Proposed Site Access Road
- Drainage Road

Other Infrastructure

- Construction Temporary Facility
- Parking
- Diversion Channel
- Fresh Water Pipe
- Sewer
- Potable Water
- Drainage Ditch - Clean water
- Drainage Ditch - Potentially Contaminated
- Drainage Pipe
- Fire Water

Landbase

- Existing Access Road
- Watercourse
- Waterbody

N

0 250 500 Metres

(At original document size of 11x17)
1:12,000

Notes

1. Coordinate System: NAD 1983 UTM Zone 14N
2. Base Data Sources: Government of Manitoba and Government of Canada.
3. Project Infrastructure features provided by QPit and Ausenco.

Project Location
Lynn Lake, Manitoba

Prepared by ACampigotto on 2020-04-02
Technical Review by MSteinepreis on 2020-04-02

Client/Project
ALAMOS GOLD INC.
Lynn Lake Gold Project

111473008

Map No.
3a

Title
Gordon Site Features During Operations

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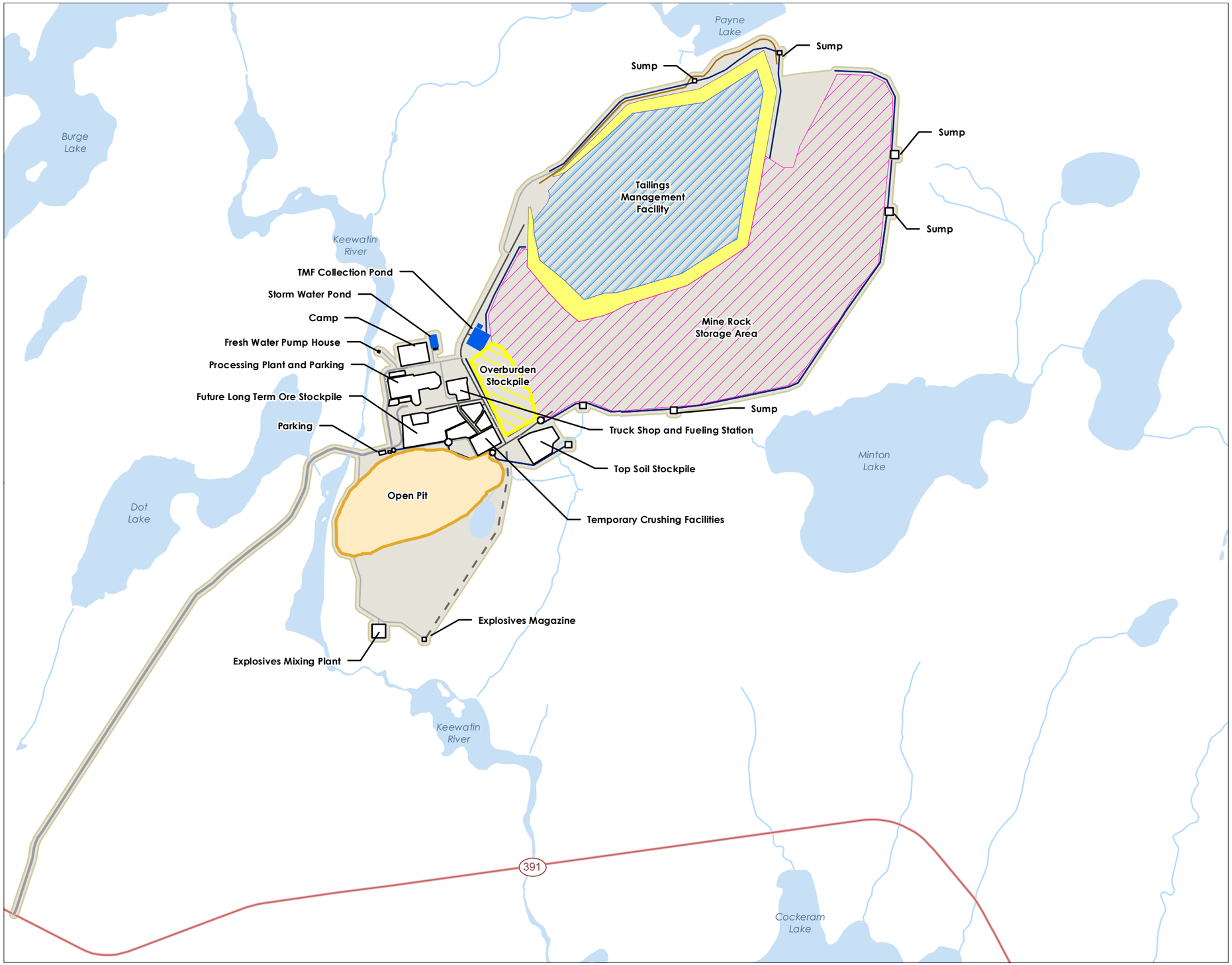

Stantec

Alamos Gold Inc.

Project Infrastructure

- Project Development Area
- Proposed Open Pit
- Proposed Mine Rock Stockpile
- Proposed Overburden Stockpile
- Proposed Tailings Management Facility
- Proposed Tailings Management Facility Pond
- Other Proposed Ponds
- Other Proposed Areas
- Drainage Ditch
- Access Road
- Haul Road
- Inplant Road
- Toe Road
- Future Access

Landbase

- Highway
- Existing Access Road
- Watercourse
- Waterbody

N

0 0.5 1 Kilometres

(At original document size of 11x17)
1:30,000

Notes

1. Coordinate System: NAD 1983 UTM Zone 14N
2. Base Data Sources: Government of Manitoba and Government of Canada.
3. Project Infrastructure features provided by QPit and Ausenco.

Project Location
Lynn Lake, Manitoba

Prepared by ACampigotto on 2020-04-02
Technical Review by MSteinepreis on 2020-04-02

Client/Project
ALAMOS GOLD INC.
Lynn Lake Gold Project

111473008

Map No.
3b

Title
MacLellan Site Features During Operations

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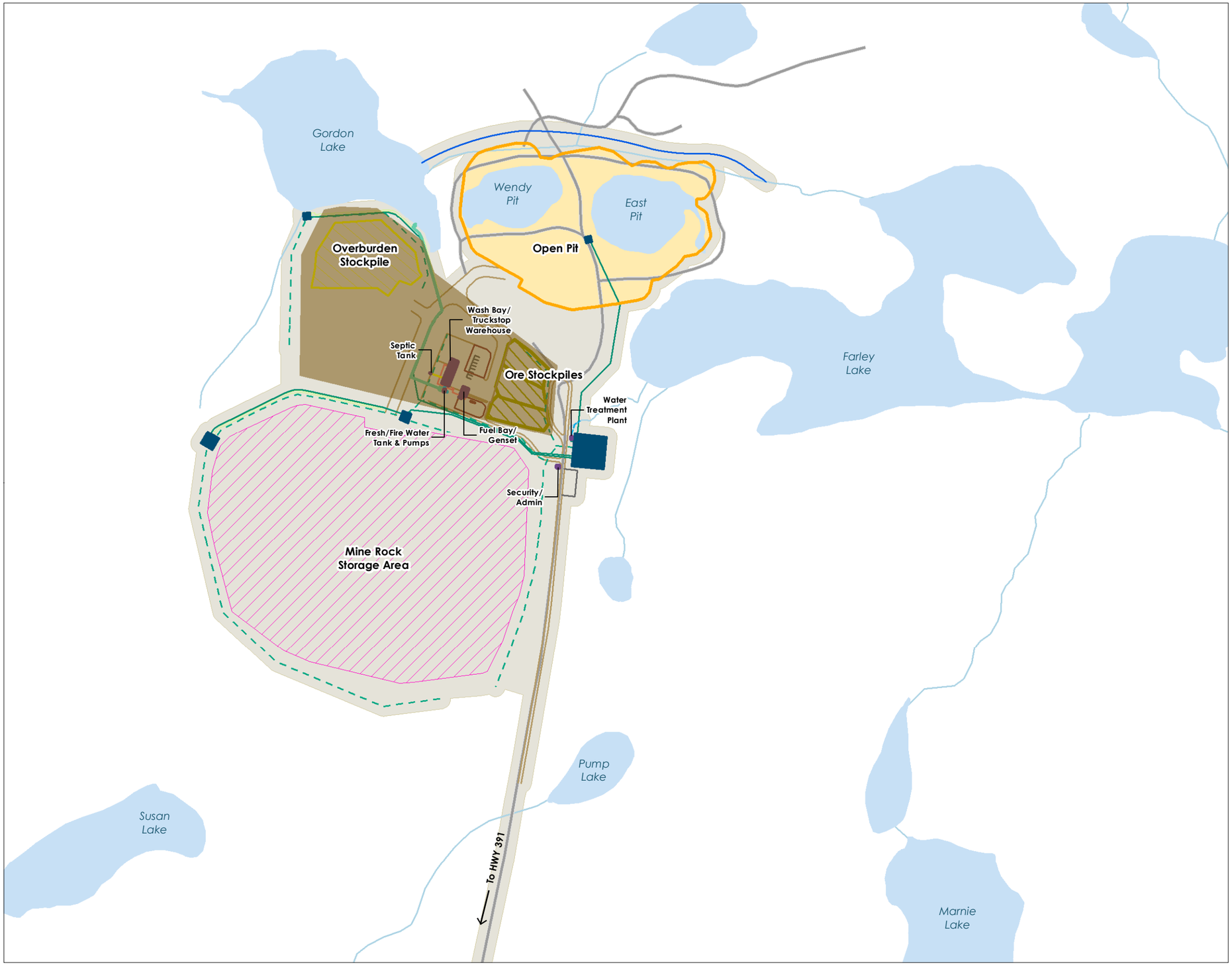


Stantec

Alamos Gold Inc.

Project Infrastructure

- Proposed Open Pit
- Potential Ore Stockpile
- Potential Mine Rock Storage Area
- Potential Overburden Stockpile
- Removed Infrastructure
- Project Development Area
- Buildings
- Pond

Site Access

- Proposed Site Access Road

Landbase

- Existing Access Road
- Watercourse
- Waterbody

- Drainage Road

Other Infrastructure

- Construction Temporary Facility
- Parking
- Diversion Channel
- Fresh Water Pipe
- Sewer
- Potable Water
- Drainage Ditch - Clean water
- Drainage Ditch - Potentially Contaminated
- Drainage Pipe
- Fire Water

N

0 250 500 Metres

(At original document size of 11x17)
1:12,000

Notes

1. Coordinate System: NAD 1983 UTM Zone 14N
2. Base Data Sources: Government of Manitoba and Government of Canada.
3. Project Infrastructure features provided by QPit and Ausenco.

Project Location
Lynn Lake, Manitoba

Prepared by ACampigotto on 2020-04-13
Technical Review by MSteinepreis on 2020-04-13

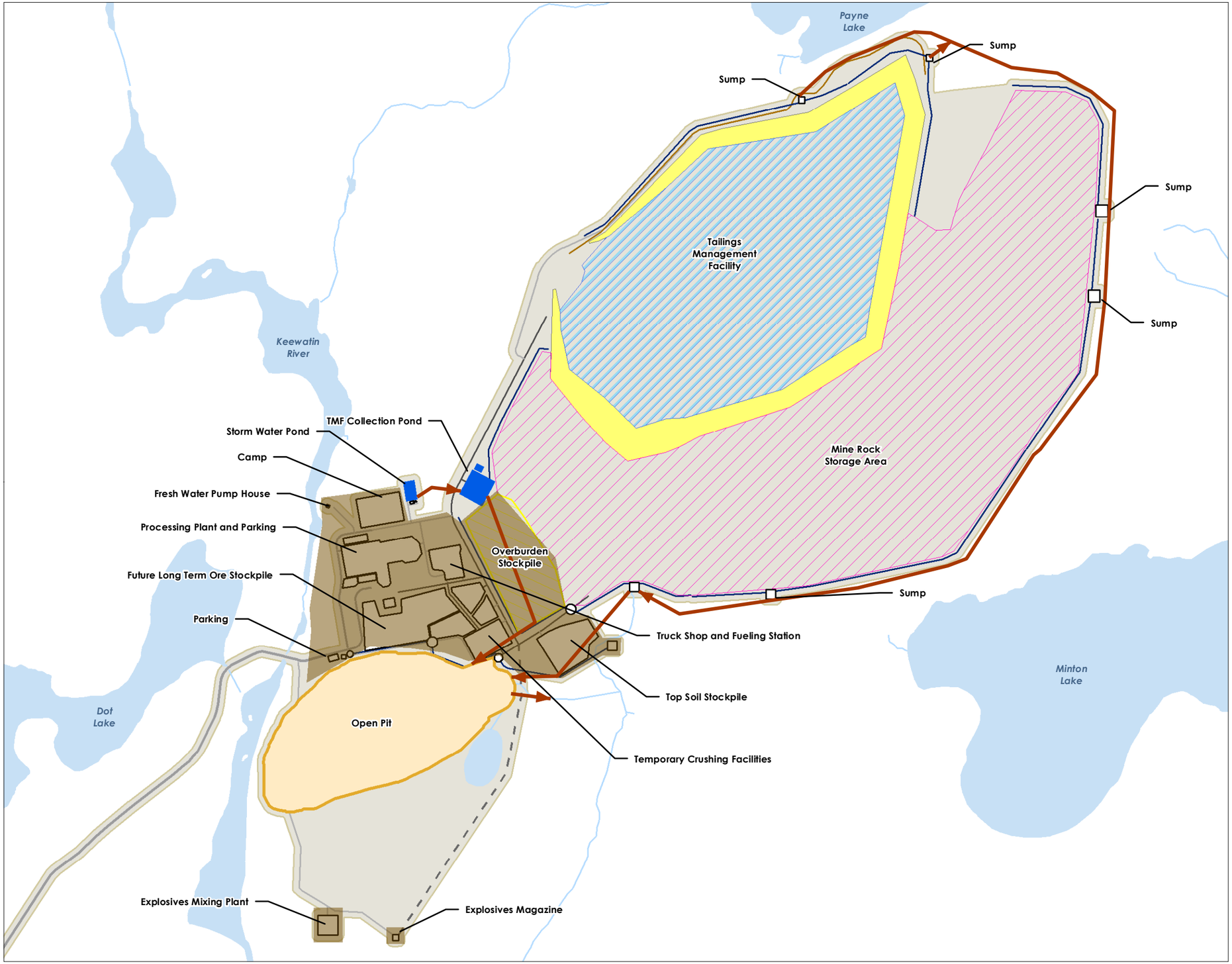
Client/Project
ALAMOS GOLD INC.
Lynn Lake Gold Project

111473008

Map No.
4a

Title
Gordon Site Features at Closure

G:_GIS Project Folder\111473008 LGP EA figures\Closure\Mxd\4b GordonSiteFeatures_Closure_20200519.mxd Revised: 2020-05-19 By: ACampigotto



Stantec

Alamos Gold Inc.

Project Infrastructure

- Project Development Area
- Proposed Open Pit
- Proposed Mine Rock Stockpile
- Proposed Overburden Stockpile
- Proposed Tailings Management Facility
- Proposed Tailings Management Facility Pond
- Other Proposed Ponds
- Other Proposed Areas
- Removed Infrastructure
- Drainage Ditch
- Access Road
- Haul Road
- Inplant Road
- Toe Road
- Future Access Road

Closure Features

- Ditches at Closure

Landbase

- Existing Access Road
- Watercourse
- Waterbody

N

0 250 500 Metres

(At original document size of 11x17)
1:20,000

Notes

1. Coordinate System: NAD 1983 UTM Zone 14N
2. Base Data Sources: Government of Manitoba and Government of Canada.
3. Project Infrastructure features provided by QPit and Ausenco.

Project Location
Lynn Lake, Manitoba

Prepared by ACampigotto on 2020-04-13
Technical Review by MSteinepreis on 2020-04-13

Client/Project
ALAMOS GOLD INC.
Lynn Lake Gold Project

111473008

Map No.
4b

Title
MacLellan Site Features at Closure

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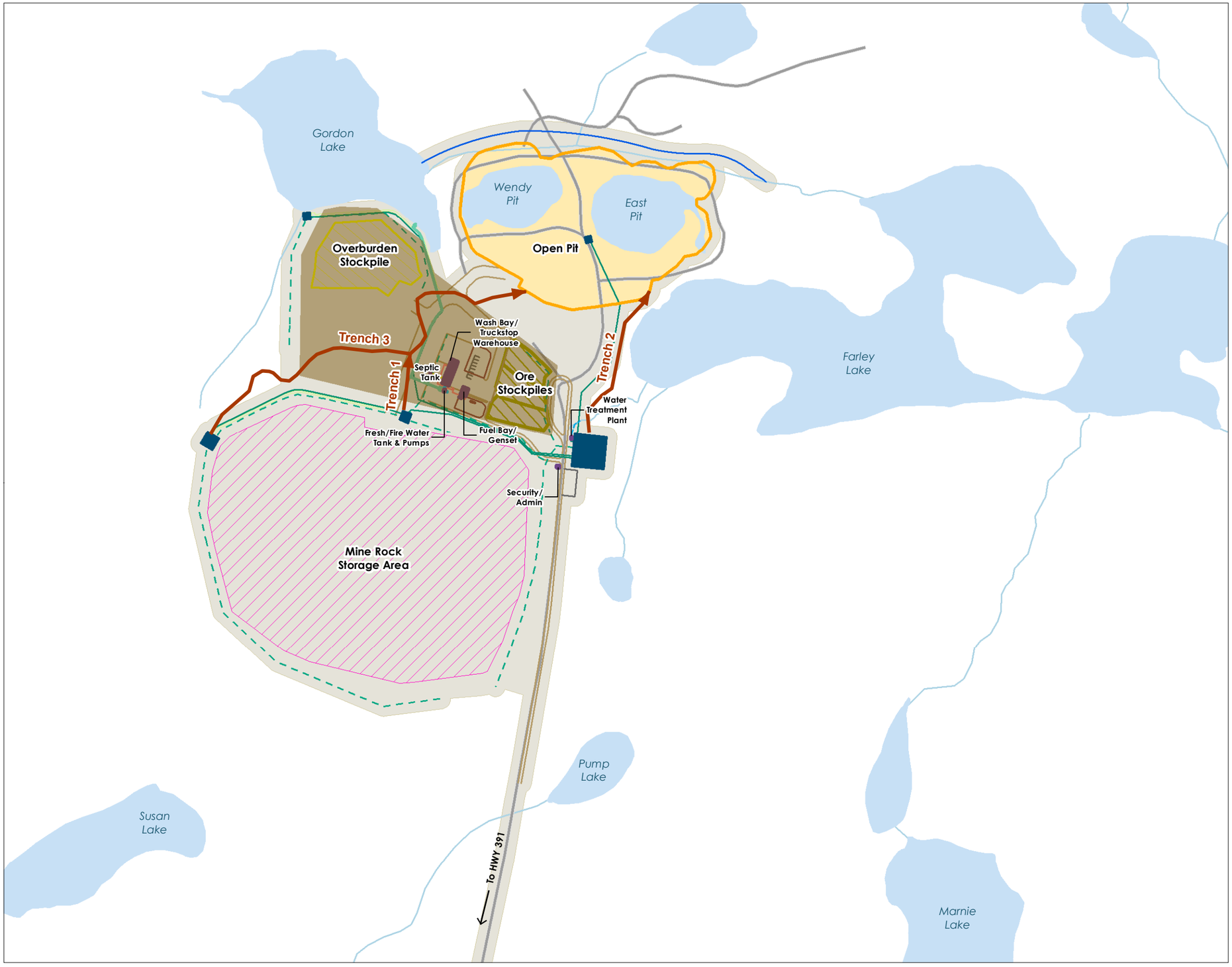
Appendix B FIGURES



Stantec

Project Infrastructure

- Proposed Open Pit
- Potential Ore Stockpile
- Potential Mine Rock Storage Area
- Potential Overburden Stockpile
- Removed Infrastructure
- Project Development Area
- Buildings
- Pond

Site Access

- Proposed Site Access Road

- Drainage Road

Other Infrastructure

- Construction Temporary Facility
- Parking
- Diversion Ditch
- Fresh Water Pipe
- Sewer
- Potable Water
- Drainage Ditch - Clean water
- Drainage Ditch - Potentially Contaminated
- Drainage Pipe
- Fire Water

Closure Features

- Ditches at Closure

Landbase

- Existing Access Road
- Watercourse
- Waterbody

N

0 250 500 Metres

(At original document size of 11x17)
1:12,000

Notes

1. Coordinate System: NAD 1983 UTM Zone 14N
2. Base Data Sources: Government of Manitoba and Government of Canada.
3. Project Infrastructure features provided by QPit and Ausenco.

Project Location
Lynn Lake, Manitoba

Prepared by ACampigotto on 2020-04-14
Technical Review by MSteinepreis on 2020-04-14

Client/Project
ALAMOS GOLD INC.
Lynn Lake Gold Project

111473008

Figure No.
B1

Title
Closure Trench System
Gordon Site

G:_GIS Project Folder\111473008 LGP EA Figures\Closure\Figure B1 Gordon ClosureTrenchSite 20200414.mxd Revised: 2020-04-14 By: ACampigotto

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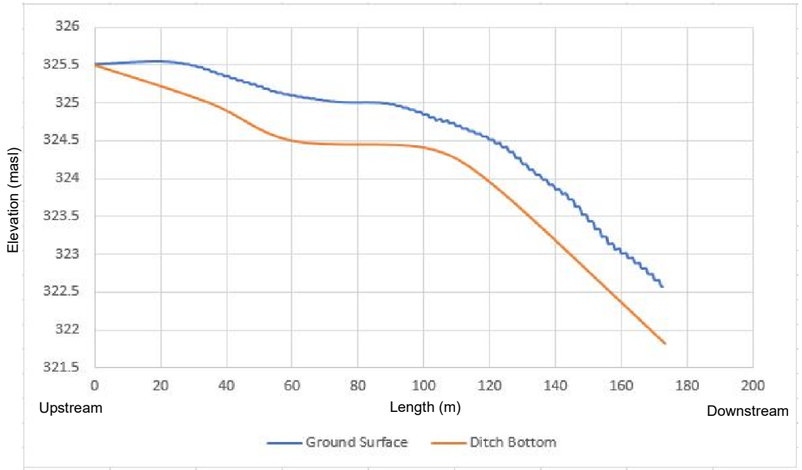

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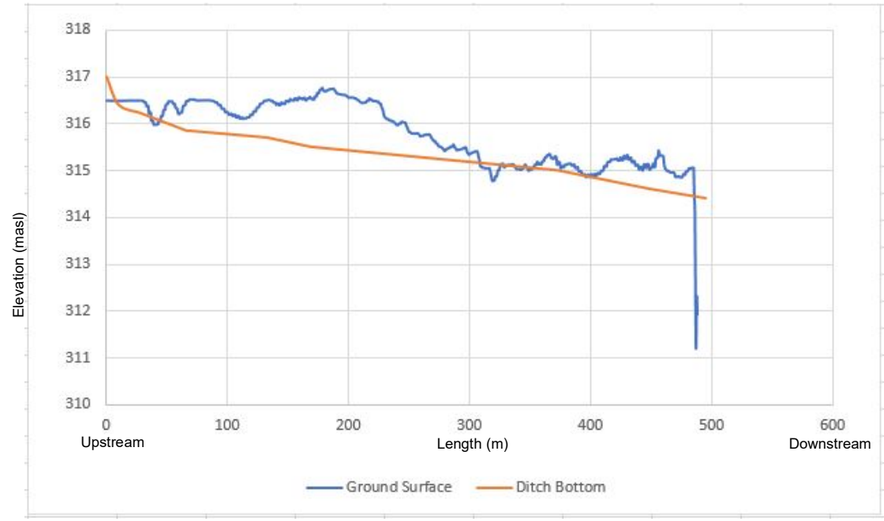

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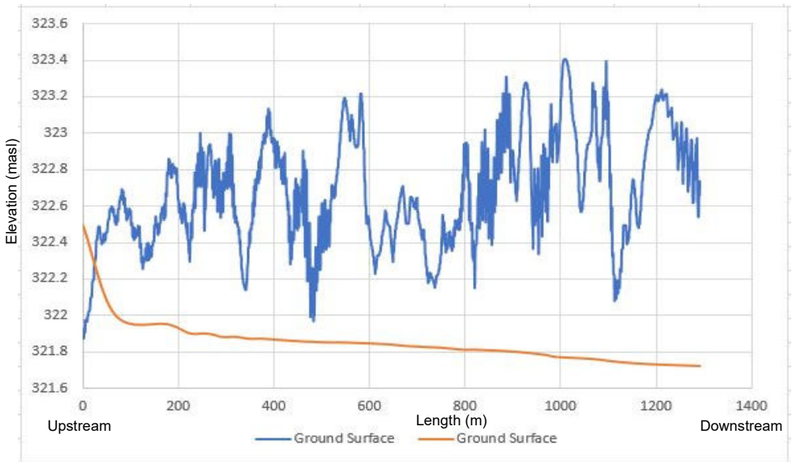

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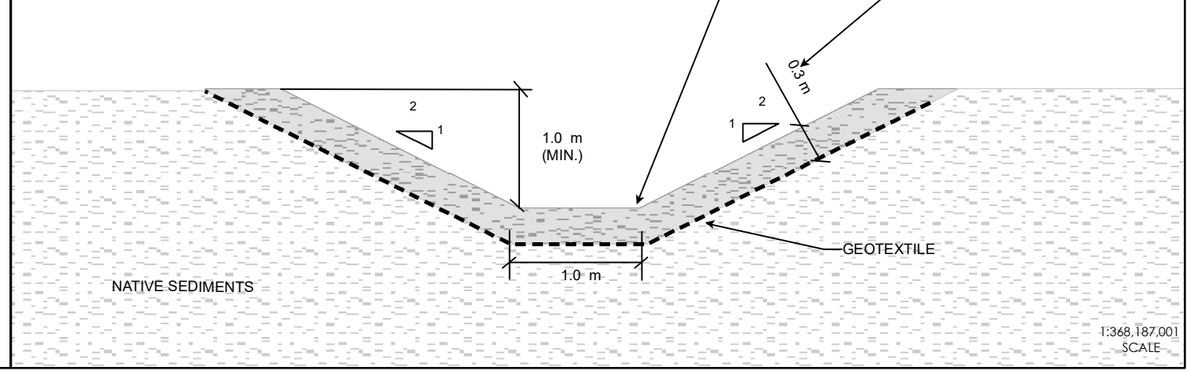

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SCALE

Stantec

Project Location
Lynn Lake
Manitoba

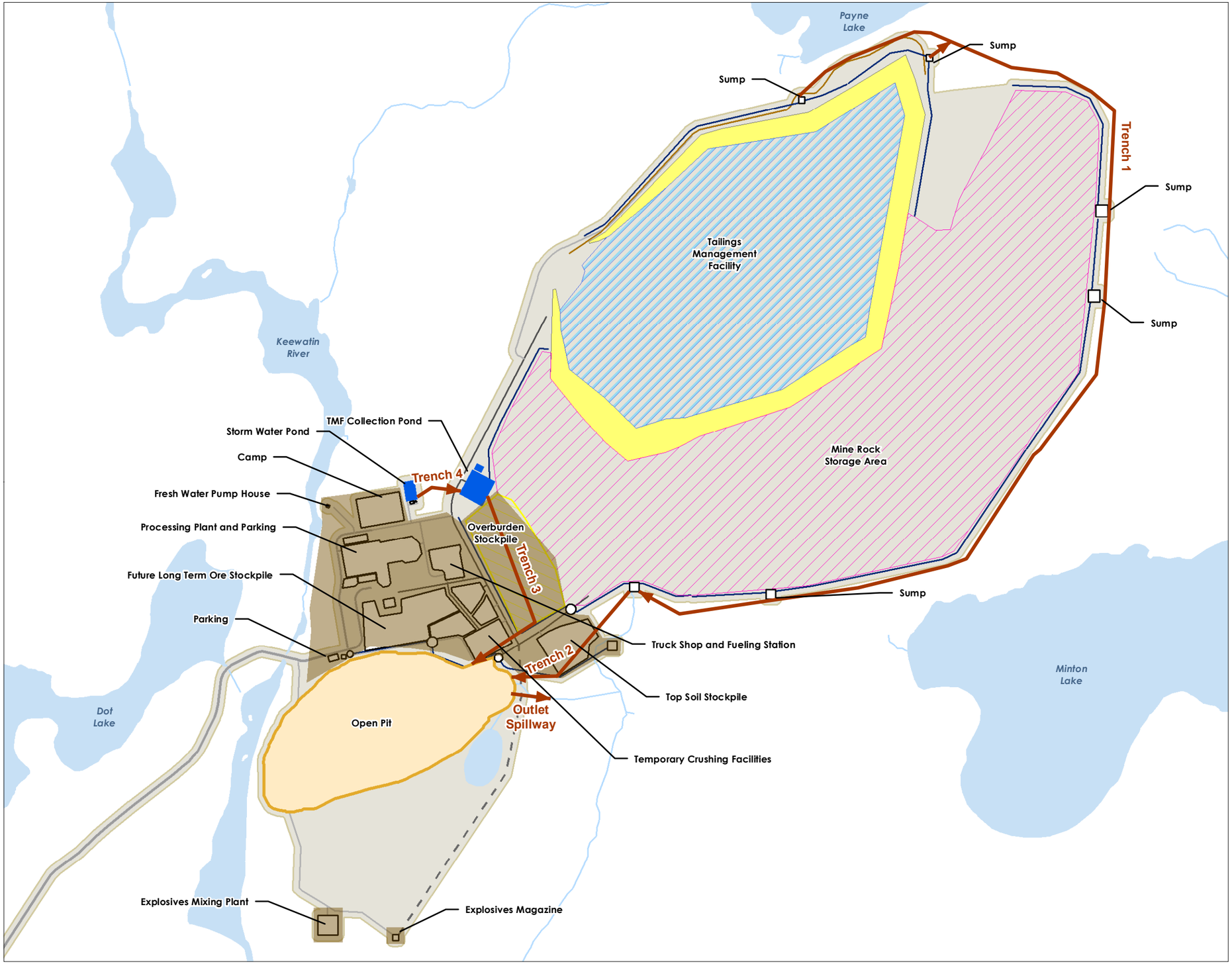
111473008 REVA
Prepared by DH on 2020-04-14
Technical Review by ABC on yyyy-mm-dd
Independent Review by ABC on yyyy-mm-dd

Client/Project
ALAMOS GOLD INC.
LYNN LAKE GOLD PROJECT

Figure No.
B2

Title
Closure Drainage Trenches Profile View Gordon Site

C:\Users\dharvey\Documents\Alamos\111473008_B2_GordonTrenchProfiles_20200414.mxd Revised: 2020-04-14 By: dharvey



Stantec

Project Infrastructure

- Project Development Area
- Proposed Open Pit
- Proposed Mine Rock Stockpile
- Proposed Overburden Stockpile
- Proposed Tailings Management Facility
- Proposed Tailings Management Facility Pond
- Other Proposed Ponds
- Other Proposed Areas
- Removed Infrastructure
- Drainage Ditch
- Access Road
- Haul Road
- Inplant Road
- Toe Road
- Future Access Road

Closure Features

- Ditches at Closure

Landbase

- Existing Access Road
- Watercourse
- Waterbody

N

0 250 500 Metres

(At original document size of 11x17)
1:20,000

Notes

1. Coordinate System: NAD 1983 UTM Zone 14N
2. Base Data Sources: Government of Manitoba and Government of Canada.
3. Project Infrastructure features provided by QPit and Ausenco.

Project Location
Lynn Lake, Manitoba

Prepared by ACampigotto on 2020-04-14
Technical Review by MSteinepreis on 2020-04-14

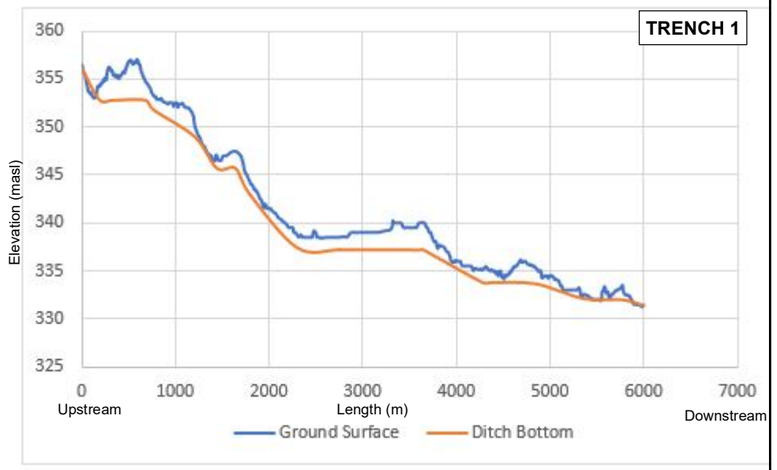
Client/Project
ALAMOS GOLD INC.
Lynn Lake Gold Project

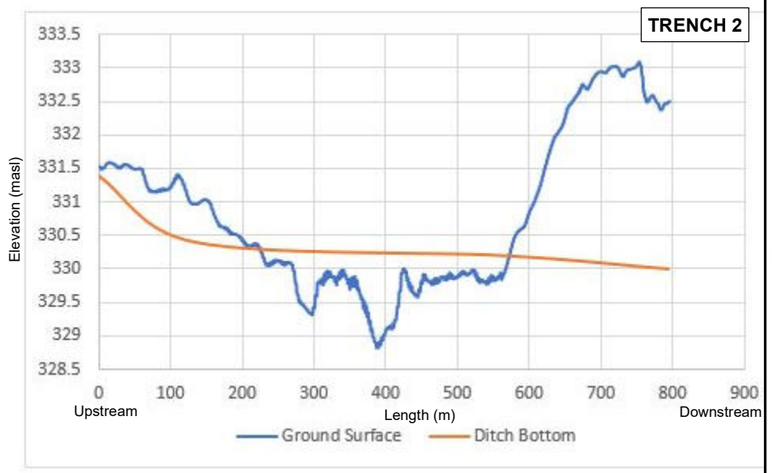
111473008

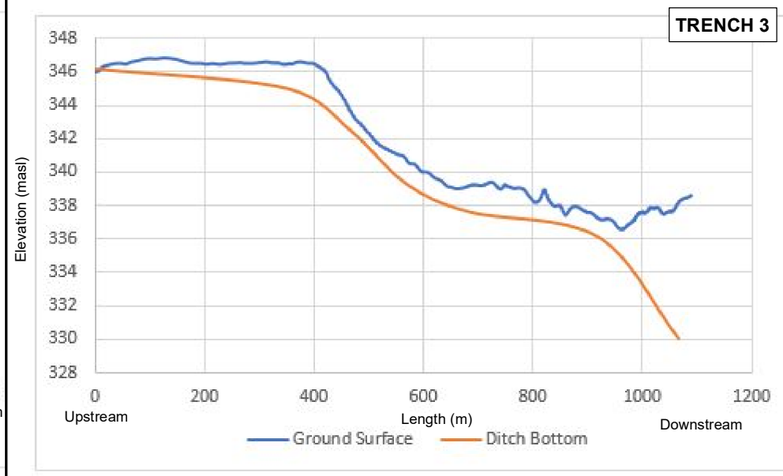
Figure No.
B3

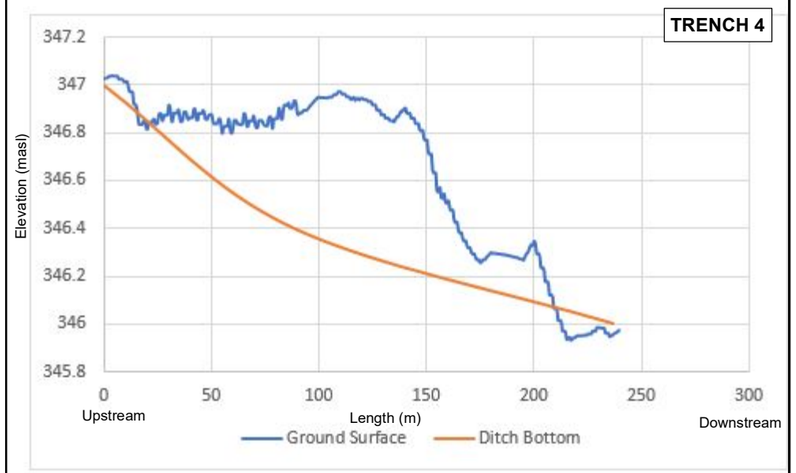
Title
Closure Trench System MacLellan Site

G:_GIS Project Folder\111473008 LLGP EA\Figures\Closure\Figure B3 MacLellan ClosureDrainageTrenches_20200414.mxd Revised 2020-04-14 By: ACampigotto

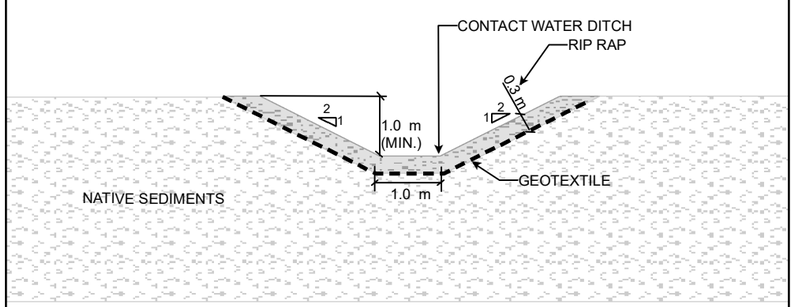








TYPICAL COLLECTION TRENCH



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SCALE

Stantec

Project Location Lynn Lake Manitoba	111473008 REVA Prepared by DH on 2020-04-14 Technical Review by ABC on yyyy-mm-dd Independent Review by ABC on yyyy-mm-dd

Client/Project
ALAMOS GOLD INC.
LYNN LAKE GOLD PROJECT

Figure No.
B4

Title
Closure Drainage Trenches Profile View
MacLellan Site

Appendix C ANTICIPATED CLOSURE COSTS

Log. No.		Gordon Site - Component / Item	Length (m)	Width (m)	Height (m)	Area (m^2)	Vol. (m^3)	Quantity	Unit	Unit Rate	Total Final Reclamation Cost	Significant Assumptions/Comments
101	**Open pit and project disturbance area**											No long term treatment of pit lake is required. Unit rates provided by Ausenco.
	1	Construction of overflow channel to receiver	300	—	—	10	3,000	1	m^3	$7.90	$ 23,700	Assumed length of 300m for overflow channel to Farley lake. 2m base, 1:2 V:H sides.
	2	Place rip-rap in overflow channel	300						m	$0.00	$ -	rip-rap is NAG mine waste. Cost of movement is considered in operating costs for the mine.
	3	Barricade perimeter with rock bunding and signage	4000	—	—	—	—	1	m	$2.80	$ 11,200	Boulders or soil embankment, to prevent vehicular access.
	4	Grade surrounding area to final surface	—	—	—	215,000	—	1	m^2	$1.00	$ 215,000	Assume 50% of the project development area needs to be contoured.
	5	Seeding of impacted surrounding area	—	—	—	215,000	—	1	m^2	$0.50	$ 107,500	Lower end of rates for hydroseeding, assumes that contractor will not need to apply any soil ammendements.
	6	Plant trees	—	—	—	215,000	—	1	m^2	$0.00	$ -	Provincial program likely to be in place to support tree planting.
		Component Total									***$ 357,400***	
102	**Equipment**											
	1	Cleaning, removal and disposal of equipment and machinery in Lynn Lake landfill	—	—	—	—	—	1	LS	$0.00	$ -	Minor equipment requirements at Gordon. Equipment will be relocated to MacLellan at closure.
	2	Remove and disposal of hydrocarbon contaminated machinery / components offsite	—	—	—	—	—	1	LS	$0.00	$ -	
		Component Total									***$ -***	
103	**Petroleum products / waste chemicals**											Rates provided by Ausenco, unless otherwise noted.
	1	Disposal of misc. hydrocarbons / chemicals offsite	—	—	—	—	—	1	LS	$15,000.00	$ 15,000	
	2	Site investigation by consultant around fuel bay and chemical storage area	—	—	—	—	—	1	LS	$80,000.00	$ 80,000	Rate of $200,000 from Ausenco judged to be too high and revised.
	3	Removal, shipping and disposal of hydrocarbon contaminated soil offsite	—	—	—	—	1,800	1	m^3	$85.00	$ 153,000	Assume a 30m x 30m x 2m contaminated zone. Rate of $70 from Ausenco judged to be too low and revised.
	4	Source, haul, place and compact overburden to replace excavated material	—	—	—	—	1,800	1	m^3	$2.80	$ 5,040	Material is from overburden stockpile. Unit rate is from Ausenco and is based on a quote from a contractor for the stockpiling of soil on site. The cost for the reverse process is assumed to be the same.
		Component Total									***$ 253,040***	
104	**Infrastructure plus project disturbance area**											Rates provided by Ausenco, unless otherwise noted.
	1	Demolish building concrete and steel infrastructure; and dispose of in Lynn Lake landfill	—	—	—	—	—	1	LS	$50,000.00	$ 50,000	Assume 1/10 of the cost of MacLellan demolition costs.
	2	Break up concrete slabs and dispose of rubble to 0.3m below final grade	—	—	—	12,500	—	1	m^2	$19.73	$ 246,635	Assume plant project disturbance area is 25% covered in concrete.
	3	Cover broken slabs with overburden to final grade	—	—	—	—	3,750	1	m^3	$2.80	$ 10,500	From overburden stockpile.
	4	Scarify plant site areas	—	—	—	45,000	—	1	m^2	$1.00	$ 45,000	Assume 50% of project development area needs to be contoured. The rate is based on a quote obtained by Ausenco for earthworks to depths less than 30 cm.
	5	Cover impacted area with 0.3m of overburden	—	—	—	—	13,500	1	m^3	$2.80	$ 37,800	From overburden stockpile.
	6	Grade to final surface	—	—	—	45,000	—	1	m^2	$1.00	$ 45,000	
	7	Seed impacted areas	—	—	—	45,000	—	1	m^2	$0.50	$ 22,500	
	8	Plant trees	—	—	—	45,000	—	1	m^2	$0.00	$ -	Provincial program likely to be in place to support tree planting.
	9	Decommission, bury clean water pipelines	1000	—	—	—	—	1	m	$10.00	$ 10,000	
		Component Total									***$ 467,435***	
105	**Roads plus project disturbance area**											Rates provided by Ausenco.
	1	Remove pipe culverts and dispose	—	—	—	—	—	1	LS	$14,750.00	$ 14,750	Assume 1/4 of the cost for MacLellan.
	2	Remove box culverts and dispose	—	—	—	—	—	1	LS	$17,250.00	$ 17,250	Assume 1/4 of the cost for MacLellan.
	3	Intra site roads: scarify exposed surface	15000	20	—	300,000	—	1	m^2	$1.00	$ 300,000	15km of internal site roads. 20m buffer assumed for scarifying intra-site roads. Costs for regrading of the roads are included within the greater site areas.
	4	Intra site roads: cover with 0.3 m overburden	—	—	—		90,000	1	m^3	$2.80	$ 252,000	
	5	Intrasite roads: seed surface	—	—	—	300,000	—	1	m^2	$0.50	$ 150,000	
	6	Plant trees				300,000	—	1	m^2	$0.00	$ -	
	7	Site access roads: scarify surface	15000	20		300,000	—	1	m^2	$0.00	$ -	Assumed site access roads will remain for public access.
	8	Site access roads: cover with 0.3 m overburden	—	—	—		90,000	1	m^2	$0.00	$ -	
	9	Site access roads: seed surface	—	—	—	300,000	—	1	m^2	$0.00	$ -	
	10	Plant trees	—	—	—	300,000	—	1	m^2	$0.00	$ -	
		Component Total									***$ 734,000***	

Log. No.		Gordon Site - Component / Item	Length (m)	Width (m)	Height (m)	Area (m^2)	Vol. (m^3)	Quantity	Unit	Unit Rate	Total Final Reclamation Cost	Significant Assumptions/Comments
106	**Mine Rock Stockpiles plus project disturbance area**											
	1	Grade slopes	—	—	—	93,000	—	1	m^3	$1.00	$ 93,000	
	2	Cover waste rock pile crest and slopes with 0.5 m of overburden	—	—	—	—	310,000	1	m^3	$4.20	$ 1,302,000	
	3	Seed waste rock pile crest	—	—	—	620,000		1	m^2	$0.50	$ 310,000	Assumed 23% of project development area will be PAG and has to be covered.
	4	Contour disturbed area downstream of toe	—	—	—	185,000	—	1	m^2	$1.00	$ 185,000	Assumed 50% of project development area needs to be contoured.
	5	Seed disturbed area downstream of toe	—	—	—	185,000	—	1	m^2	$0.50	$ 92,500	
	6	Construct drainage channel from WRSA seepage collection to receivers	200	—	—	10	2,000	1	m^3	$7.90	$ 15,800	Utilise natural creek to Gordon Lake.
	7	Place rip-rap in drainage channel	200	—	—	—	—	1	m	$0.00	$ -	
		Component Total									***$ 1,998,300***	
107	**Overburden Stockpile plus project disturbance area**											
	1	Contouring of remaining material to final grade as required	—	—	—	77,500	—	1	m^2	$1.00	$ 77,500	All overburden will be used for rehabilitation in other areas. Assumed 25% of area needs to be contoured.
	2	Seed impacted area	—	—	—	77,500	—	1	m^2	$0.50	$ 38,750	
	3	Plant trees	—	—	—	77,500	—	1	m^2	$0.00	$ -	Provincial program to support tree planting.
		Component Total									***$ 116,250***	
108	**Lowgrade Ore Stockpile plus project disturbance area**											Rates provided by Ausenco, unless otherwise noted.
	1	Contouring of disturbed area to final grade as required	—	—	—	35,000	—	1	m^2	$1.00	$ 35,000	Assumed 50% of project development area needs to be contoured.
	2	Cover impacted area with 0.3m of overburden	—	—	—	—	10,500	1	m^3	$2.80	$ 29,400	
	3	Seed impacted area	—	—	—	35,000	—	1	m^2	$0.50	$ 17,500	
	4	Plant trees	—	—	—	35,000	—	1	m^2	$0.00	$ -	Provincial program likely to be in place to support tree planting.
		Component Total									***$ 81,900***	
109	**Site Sump / Drainage Collection Ponds**											Rates provided by Ausenco, unless otherwise noted.
	1	Remove engineering controls for water management ponds (breach embankment, dispose of liner)	—	—	—	—	—	1	LS	$200,000.00	$ 200,000	
	2	Dredge base of ponds	—	—	—	10,000	—	1	m^2	$10.00	$ 100,000	Main pond is 100x100m.
	3	Recontour ponds and surrounding area	—	—	—	10,000	—	1	m^2	$1.00	$ 10,000	
	4	Dredge drainage channels	5000	—	—	—	—	1	m	$10.00	$ 50,000	Clear out muck.
		Component Total									***$ 360,000***	
										Subtotal	***$ 4,368,325***	
201	**Engineering and Project Management (10%)**										***$ 436,833***	
										TOTAL (CDN rounded)	***$ 4,805,200***	

Log. No.		MacLellan Site - Component / Item	Length (m)	Width (m)	Height (m)	Area (m^2)	Vol. (m^3)	Quantity	Unit	Unit Rate	Total Final Reclamation Cost	Significant Assumptions/Comments
101	**Open pit and project disturbance area**											No long term treatment of pit lake is required. Unit rates provided by Ausenco.
	1	Construction of overflow channel to receiver	150	—	—	12	1,800	1	m^3	$7.90	$ 14,220	Assumed length of 300m for overflow channel to Keewatin River. 5m base, 1:2 V:H sides.
	2	Place rip-rap in overflow channel	150	—	—	—	—	1	m	$0.00	$ -	rip-rap is NAG mine waste. Cost of movement is considered in operating costs for the mine.
	3	Barricade perimeter with rock bunding and signage	3,400	—	—	—	—	1	m	$2.80	$ 9,520	Boulders or soil embankment, to prevent vehicular access.
	4	Grade surrounding area to final surface	—	—	—	668,000	—	1	m^2	$1.00	$ 668,000	Includes the disturbance area for the pit and plant area at 133Ha, but does not include the infrastructure itself. Grading assumed to be required for 50% of this area. The rate is based on a quote obtained by Ausenco for earthworks to depths less than 30 cm.
	5	Seeding of impacted surrounding area	—	—	—	668,000	—	1	m^2	$0.50	$ 334,000	Lower end of rates for hydroseeding provided to Ausenco, assumes that contractor will not need to apply any soil ammendements.
	6	Plant trees	—	—	—	668,000	—	1	m^2	$0.00	$ -	Provincial program likely to be in place to support tree planting.
		Component Total									***$ 1,025,740***	
102	**Equipment**											Rates provided by Ausenco.
	1	Cleaning, removal and disposal of equipment and machinery in Lynn Lake landfill	—	—	—	—	—	1	LS	$300,000	$ 300,000	
	2	Remove and disposal of hydrocarbon contaminated machinery / components offsite	—	—	—	—	—	1	LS	$200,000	$ 200,000	Contaminated equipment must be transported to Winnipeg.
		Component Total									***$ 500,000***	
103	**Petroleum products / waste chemicals**											Rates provided by Ausenco, unless otherwise noted.
	1	Disposal of misc. hydrocarbons / chemicals offsite	—	—	—	—	—	1	LS	$15,000	$ 15,000	
	2	Site investigation by consultant around fuel bay and chemical storage area	—	—	—	—	—	1	LS	$100,000	$ 100,000	Rate of $200,000 from Ausenco judged to be too high and revised.
	3	Removal, shipping and disposal of hydrocarbon contaminated soil offsite	—	—	—	—	1,800	1	m^3	$85.00	$ 153,000	Assumed a 30m x 30m x 2m contaminated zone. Rate of $70 from Ausenco judged to be too low and revised.
	4	Source, haul, place and compact overburden to replace excavated material	—	—	—	—	1,800	1	m^3	$2.80	$ 5,040	Material is from overburden stockpile. Unit rate is from Ausenco and is based on a quote from a contractor for the stockpiling of soil on site. The cost for the reverse process is assumed to be the same.
		Component Total									***$ 273,040***	
104	**Infrastructure - Plant, Camp and Ore Stockpile**											Rates provided by Ausenco, unless otherwise noted
	1	Demolish building concrete and steel infrastructure; and dispose of in Lynn Lake landfill	—	—	—	—	—	1	LS	$500,000	$ 500,000	Assumed rate is based on a quote obtained by Ausenco for demolition of the existing (2017) structures of $275k.
	2	Break up concrete slabs and dispose of rubble to 0.3m below final grade	—	—	—	48,500	—	1	m^2	$19.73	$ 956,944	Includes area of plant and camp. Assume 50% of this area is covered in concrete.
	3	Cover broken slabs with overburden to final grade	—	—	—	—	14,550	1	m^3	$2.80	$ 40,740	Material from overburden stockpile
	4	Scarify plant site areas	—	—	—	195,000	—	1	m^2	$1.00	$ 195,000	Assumed the entire footprint of the structures and the ore stockpile needs to be rehabilitated. The rate is based on a quote obtained by Ausenco for earthworks to depths less than 30 cm
	5	Cover impacted area with 0.3m of overburden	—	—	—	—	58,500	1	m^3	$2.80	$ 163,800	Material from overburden stockpile
	6	Contour to final surface	—	—	—	195,000	—	1	m^2	$1.00	$ 195,000	Area of former structures only, distrubance area included with the Pit
	7	Seed impacted areas	—	—	—	195,000	—	1	m^2	$0.50	$ 97,500	
	8	Plant trees	—	—	—	195,000	—	1	m^2	$0.00	$ -	Provincial program likely to be in place to support tree planting
	9	Decommission, bury clean water pipelines from Keewatin River	2000	—	—	—	—	1	m	$10.00	$ 20,000	Pipeline length to be confirmed
	10	Decommission sewage system	—	—	—	—	—	1	LS	$200,000	$ 200,000	
	11	Decommission and bury dirty water pipelines	3000	—	—	—	—	1	m	$10.00	$ 30,000	Pipeline length to be confirmed
	12	Decommission and bury tailings delivery pipelines	3000	—	—	—	—	1	m	$10.00	$ 30,000	Pipeline length to be confirmed
		Component Total									***$ 2,428,984***	
105	**Roads plus project disturbance area**											Rates provided by Ausenco
	1	Remove pipe culverts and dispose	—	—	—	—	—	1	LS	$59,000	$ 59,000	
	2	Remove box culverts and dispose	—	—	—	—	—	1	LS	$69,000	$ 69,000	Cost increase over pipe culverts as construction equipment required
	3	Intra site roads: scarify exposed surface	15000	20	—	300,000	—	1	m^2	$1.00	$ 300,000	Perimeter of site is 15 km, length of intra site roads assumed to be the same. Likely within ±5km. 20m buffer assumed for scarifying intra-site roads. Costs for regrading of the roads are included within the greater site areas.
	4	Intra site roads: cover with 0.3 m overburden	—	—	—		90,000	1	m^3	$2.80	$ 252,000	
	5	Intrasite roads: seed surface	—	—	—	300,000	—	1	m^2	$0.50	$ 150,000	
	6	Plant trees				300,000	—	1	m^2	$0.00	$ -	
	7	Site access roads: scarify surface	—	—	—	—	—	1	m^2	$0.00	$ -	Assumed site access roads will remain for public access
	8	Site access roads: cover with 0.3 m overburden	—	—	—	—	—	1	m^2	$0.00	$ -	
	9	Site access roads: seed surface	—	—	—	—	—	1	m^2	$0.00	$ -	
	10	Plant trees	—	—	—	—	—	1	m^2	$0.00	$ -	
		Component Total									***$ 830,000***	

Log. No.		MacLellan Site - Component / Item	Length (m)	Width (m)	Height (m)	Area (m^2)	Vol. (m^3)	Quantity	Unit	Unit Rate	Total Final Reclamation Cost	Significant Assumptions/Comments
106	**Mine Rock Stockpiles plus project disturbance area**											Rates provided by Ausenco, unless otherwise noted
	1	Grade slopes of MRSA	—	—	—	495,000		1	m^3	$1.00	$ 495,000	Regrade slopes to provide an even surface for cover placement
	2	Cover waste rock pile crest and slopes with 0.5 m of overburden	—	—	—	—	1,707,500	1	m^3	$6.14	$ 10,480,635	0.5 m cover of material from the overburden stockpile on the crest and slopes. Unit rate based on a quote Ausenco received for a superceded mine plan. The rate was adjusted for the shorter haul distance
	2	Seed waste rock pile slopes and crest	—	—	—	3,415,000		1	m^2	$0.50	$ 1,707,500	
	3	Contour disturbed area downstream of toe	—	—	—	541,500	—	1	m^2	$1.00	$ 541,500	Assumed 25% of TSF project disturbance area needs to be contoured.
	4	Seed disturbed area downstream of toe	—	—	—	541,500	—	1	m^2	$0.50	$ 270,750	
	5	Excavate drainage channel from WRSA seepage collection to pit	7150	—	—	10	71,500	1	m^3	$7.90	$ 564,850	
	6	Place rip-rap in drainage channel	7150	—	—	—	—	1	m	$0.00	$ -	
	7	Place geofabric in drainage channels	44330	—	—	—	—	1	m^2	$10.00	$ 443,300	
	7	Place pipe in trenches	7150					1	m	$69.50	$ 496,925	Pipe will be required where the trenches go below the water table. Assume tailings and reclaim pipe is suitable. Cost is maximum installation for pipe in Ausenco-provided costing
	8	Backfill around pipe	7150			10	71,500	1	m^3	$8.70	$ 622,050	
		Component Total									***$ 15,622,510***	
107	**Tailings management area**											Rates provided by Ausenco, unless otherwise noted
	1	Cover TMF with 0.5 m of overburden	—	—	—	—	—	1	LS	$5,339,445	$ 5,339,445	Cover assumed for 75% of tailings surface. Cost includes seeding. Unit rate based on a quote Ausenco received for a superceded mine plan. The rate was adjusted for the shorter haul distance
	2	Excavation of drainage trenches to pit	0	—	—		—	1	m^3	$7.90	$ -	Included in mine rock disturbance area
	3	Placement of rip rap in channel	0	—	—	—	—	1	m	$0.00	$ -	Included in mine rock disturbance area
	4	Place pipe in trenches	0	—	—	—	—	1	m	$69.50	$ -	
	5	Backfill around pipe	—	—	—	10		1	m^3	$8.70	$ -	
	6	Contour disturbed area downstream of toe	—	—	—	0	—	1	m^2	$1.00	$ -	
	7	Seed disturbed area downstream of toe	—	—	—	0	—	1	m^2	$0.50	$ -	
	8	Plant trees	—	—	—	0	—	1	m^2	$0.00	$ -	Provincial program likely to be in place to support tree planting.
		Component Total									***$ 5,339,445***	
108	**Overburden and Ore Stockpile**											Rates provided by Ausenco, unless otherwise noted.
	1	Contouring of remaining OB material to final grade as required	—	—	—	41,500	—	1	m^2	$1.00	$ 41,500	All overburden will be used for rehabilitation in other areas. Assumed 25% of area needs to be contoured.
	2	Contouring of Ore stockpile				9,800	—	1	m^2	$1.00	$ 9,800	All ore will be removed. Assume 100% of this area needs to be contoured
	3	Seed impacted area	—	—	—	51,300	—	1	m^2	$0.50	$ 25,650	
	4	Plant trees	—	—	—	51,300	—	1	m^2	$0.00	$ -	Provincial program to support tree planting.
		Component Total									***$ 76,950***	
109	**Borrow Areas plus project disturbance area**											Rates provided by Ausenco, unless otherwise noted.
	1	Contour area to final grade	—	—	—	48,000	—	1	m^2	$1.00	$ 48,000	
	2	Seed impacted area	—	—	—	48,000	—	1	m^2	$0.50	$ 24,000	
	3	Plant trees	—	—	—	48,000	—	1	m^2	$0.00	$ -	Provincial program likely to be in place to support tree planting.
		Component Total									***$ 72,000***	
110	**Explosives Mixing Plant and Magazine disturbance area**											Rates provided by Ausenco, unless otherwise noted.
	1	Contouring of disturbed area to final grade as required	—	—	—	168,500	—	1	m^2	$1.00	$ 168,500	Assumed 50% of area needs to be contoured.
	2	Cover impacted area with 0.3m of overburden	—	—	—	—	50,550	1	m^3	$2.80	$ 141,540	
	3	Seed impacted area	—	—	—	168,500	—	1	m^2	$0.50	$ 84,250	
	4	Plant trees	—	—	—	168,500	—	1	m^2	$0.00	$ -	Provincial program likely to be in place to support tree planting.
		Component Total									***$ 394,290***	
111	**Site Sump / Drainage Collection Ponds**											Rates provided by Ausenco, unless otherwise noted.
	1	Remove engineering controls for water management ponds (breach embankment, dispose of liner)	—	—	—	—	—	1	LS	$200,000	$ 200,000	
	2	Dredge base of ponds	—	—	—	10,000	—	1	m^2	$10.00	$ 100,000	Main pond is 100x100m.
	3	Recontour ponds and surrounding area	—	—	—	10,000	—	1	m^2	$1.00	$ 10,000	
	4	Dredge drainage channels	10100	—	—	—	—	1	m	$10.00	$ 101,000	Clear out muck.
		Component Total									***$ 411,000***	
										Subtotal	***$ 26,973,958***	
201	**Engineering and Project Management (10%)**										***$ 2,697,396***	
										TOTAL (CDN rounded)	***$ 29,671,400***	

ALAMOS GOLD INC.

Lynn Lake Gold Project Environmental Impact Statement Chapter 24 – Benefits of the Project

Stantec

Prepared by:

Stantec Consulting Ltd.

May 25, 2020

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LIST OF TABLES

Acronyms and Abbreviations

Alamos	Alamos Gold Inc.
EIS	Environmental Impact Statement
GDP	gross domestic product
PDA	Project Development Area
ROW	right-of-way
TMF	tailings management facility

24.0 BENEFITS OF THE PROJECT

During the development of this Project, Alamos Gold Inc. (Alamos) explored opportunities to provide economic and social benefits. Alamos's commitment to sustainability includes the commitment to development of a Project that contributes to the long-term health and viability of the natural environment and supports economic diversity and vibrant local communities (Alamos 2019). This chapter describes the predicted economic and social benefits of the Project.

As required by the federal Final Environmental Impact Statement (EIS) Guidelines (Appendix 4A), this chapter also indicates potential cultural, social and/or economic impacts or benefits to each Indigenous group identified, and a summary of the changes that have been made to the Project since it was originally proposed. In the latter case, the Project has been refined to consider various environmental and engineering constraints and opportunities, and in response to information and comments received from Indigenous communities, the public, stakeholders, and regulators.

24.1 ECONOMIC AND SOCIAL BENEFITS

As is detailed in Chapter 13, the Project will have a range of positive effects associated with increased direct, indirect and induced employment, business growth, and tax and royalty contributions to governments. Secondary positive effects are also anticipated through Project contributions to Gross Domestic Product (GDP). These benefits will occur over the short-term during construction and medium-term during operation. Specifically, an economic analysis based on spending estimates (PwC 2020) concludes that the positive effects of the Project will include:

- Employment
  - The Project will create 11,030 person-years of employment in Manitoba from construction to decommissioning/closure. During this time, the Project will result in the equivalent of 6,652 person-years of employment in the Northern Region of Manitoba and approximately 400 people being directly employed on an annual basis (PwC 2020).
- Provincial and federal economic activity
  - The Project will result in an increase in GDP of $965.0 million for Manitoba, and $663.8 million for Manitoba's Northern Region, from construction to decommissioning/closure (PwC 2020). The Project's GDP contribution outside of Manitoba was not estimated.
- Expenditure on labour, goods and services
  - It is estimated that, over the life of the Project, there will be $493.1 million in capital and $1.9 billion in operational spending in Manitoba (PwC 2020). An estimate of the regional expenditures is not currently available, but the total expenditure on labour in Manitoba's Northern Region is expected to be approximately $546.4 million over the construction to decommissioning/closure phase (PwC 2020).

- Government revenues
  - Estimated total revenues for the Government of Canada over the life of the Project will amount to $160.8 million.
  - The Project will generate an estimated $155.3 million in revenues for the Province of Manitoba over the same period, including an estimated $10.8 million third-party royalty in the first two years of production from the Gordon site.
  - Total local taxes are estimated to be $34.4 million (PwC 2020). Based on its experience elsewhere, Alamos expects to pay property taxes, or grants-in-lieu, to the Town of Lynn Lake while the MacLellan site is operating. However, the amount to be paid has yet to be negotiated between the Town and Alamos.

Alamos supports economic diversity and vibrant local communities and is committed to establishing local collaborations that will contribute to achieving economic and social development goals identified by stakeholders, address local aspirations and concerns, and provide benefits. Alamos will also continue to share information and undertake open and transparent Indigenous, community, and stakeholder engagement activities throughout the life of the Project and has sought to promote local benefits by working with these groups (Chapter 3). Initiatives that will help provide employment, training, and business opportunities include:

- Employment
  - Alamos will locally post job qualifications in advance and identify available training programs and providers for local and Indigenous residents to help them obtain the necessary skills to qualify for potential Project-related Indigenous and local employment.
  - Alamos will work with local communities to develop training programs oriented to Project operational needs.
- Business
  - Alamos will locally post Project purchasing requirements so that local, regional and Indigenous-owned businesses can position themselves to effectively compete to supply goods and services needed for Project construction and operation.
  - Alamos will continue to work with local, regional and Indigenous-owned businesses to enhance their potential for successfully bidding on Project goods and services contracts.

As is indicated in Chapter 14, there will also be beneficial effects on local community wellbeing as a result of Project-related employment and income, and associated changes to individual and household disposable incomes. For example, this will result in increased time and reduced financial barriers to engage in subsistence and family-related activities and healthy eating.

Chapter 19 concludes that the effects to the socio-economic conditions of Indigenous people will primarily be experienced by the Marcel Colomb First Nation. As described in Chapter 3, Marcel Colomb First Nation

expressed interest in economic opportunities related to the Project. Marcel Colomb First Nation expressed concern about its lack of capacity to benefit from the Project, and the potential lack of training, which could have effects on the Project-related opportunities available to the community. Marcel Colomb First Nation also expressed a need for Project contractors to take cultural sensitivity training and the need for a Community Liaison to mentor Marcel Colomb First Nation trainees and employees. Peter Ballantyne Cree Nation, Manitoba Metis Federation, O-Pipon-Na-Piwin Cree Nation, Nisichawayasihk Cree Nation, Hatchet Lake First Nation, Barren Lands First Nation, Sayisi Dene First Nation and Northlands Denesuline First Nation also primarily expressed interest in employment and business opportunities, and in being involved in training, supplier development and other benefits planning initiatives. Chapter 19 concludes that while the Project will have some adverse effects on Indigenous people – for example, the removal of portions of Registered Traplines, increased highway traffic, and noise disturbance at two cabins – the effects will also be positive, as a result of increased local spending by Project workers and increased employment of Indigenous people.

24.2 PROJECT DESIGN CHANGES

This section provides a summary of the changes that have been made to the Project since it was originally proposed. The design and configurations presented in the EIS have evolved over time and will continue to advance in concert with detailed engineering and permitting requirements. The design has been refined to address various environmental and engineering constraints and opportunities, and in response to information and comments received from Indigenous communities, the public, stakeholders, and regulators. For example, during preliminary Project planning, the size and configuration of the tailings management facility (TMF) at the MacLellan site was adjusted to avoid fish-bearing watercourses.

A summary table of key refinements made to the Project design is provided in Table 24-1, including the resultant reduction in environmental effects and the benefits to the economy, Indigenous and local communities, and stakeholders.

Table 24-1 Summary of Project Changes

Change to Project	Additional Information	Benefits to Environment, Economy, and Communities
Surface Drainage		
Modification to Diversion Channel	The footprint and design of the diversion channel at the Gordon site has been optimized. The channel includes fish habitat features to offset the loss of the existing channel.	Engineered design for optimized water movement, with a longer channel and fish habitat features.
Ore Milling and Process Plant Location		
Optimization of Processing Plant Location at MacLellan	The ore milling and processing plant location at the MacLellan site was selected to increase efficiency and reduce environmental effects.	Smaller footprint resulting in decreased habitat alteration and avoided the need for upstream watershed diversion. The site selected was also closer to the mill and ore stockpile. In addition, no watercourse crossings are required for the mine road from the open pit to the processing plant.
Tailings Management Facility		
Refinement of Tailings Management Facility Location	The size and configuration of the TMF at the MacLellan site was adjusted to avoid fish-bearing watercourses.	Avoided or reduced the potential for adverse environmental effects related to potential deposition of mine tailings into fish bearing watercourses or waterbodies.
Modification to TMF Development	The Project Development Area (PDA), including the TMF, was also sited and configured to avoid encroaching on Payne Lake and Minton Lake.	Avoided or reduced the potential for adverse environmental effects on fish and fish habitat.
TMF Discharge (Operation Phase)	Seepage water associated with the TMF will be collected and pumped back to the TMF. Reclaim water from the TMF, underground/open pit dewatering water, and/or contact water from the water management facility will be used to meet ore milling and processing demand requirements.	Reduced risk of adverse environmental effects to surface water, groundwater, and fish and fish habitat.
Ore, Overburden and Mine Rock Stockpiles/Storage Areas		
Overburden Storage Location	The overburden stockpile location was optimized to be situated within the mine rock storage area. The location north of the open pit allows for lower stockpile heights.	Area condensed within the overall footprint of the Project. The location has optimal hauling distance, for greater efficiency and reduced environmental effects.
Water Management Concept/Facilities		
Non-contact water collection system (TMF, settling ponds)	Non-contact water will be diverted to reduce the amount of contact water to manage through use of TMF and settlement pond at the MacLellan site. No further treatment beyond dealing with suspended solids will be required prior to discharge.	Reduced risk for adverse environmental effects on surface water, groundwater, and fish and fish habitat.
Sump Locations	Sump locations were optimized to reduce pumping distances.	Reduced energy consumption and infrastructure complexity.

Table 24-1 Summary of Project Changes

Change to Project	Additional Information	Benefits to Environment, Economy, and Communities
Open Pits		
Open Pit Dewatering	The water in the pits at the Gordon site will be subject to aeration to mix and oxygenate the water prior to dewatering and release to the receiving environment. The volume of pumped water was reduced. Dewatering wells outside the pit (diversion of non-contact water) and an optimized settling pond (for contact water) has reduced in-pit sump requirements.	Reduced the potential for adverse environmental effects on surface water and fish and fish habitat. Reduced energy consumption.
Open Pit Development	New pit development will include the existing pits at the Gordon site and the underground workings at the MacLellan site.	Reuse of previous disturbed footprint.
Historic Mine Infrastructure		
MacLellan Site Property	Existing historical infrastructure will be demolished prior to the construction of new mine infrastructure at the MacLellan site and the new pit development will include the existing shafts at the MacLellan site.	Reuse of previous disturbed footprint.
Work Camp and Other Infrastructure		
Confirmation of the need and location of the work camp for operation	Refinement of the location of the work camp at the MacLellan site.	Reduced the potential for adverse environmental effects on community services and infrastructure (e.g., traffic, worker/local interactions) and alteration of habitat (e.g., off-site clearing for camp development).
Explosives magazine and mixing plant location	Optimization of explosives magazine and mixing plant location at the MacLellan site to be situated away (south) from work camp, water bodies, the open pit and other infrastructure.	The siting of the explosives magazine and mixing plant considered worker safety associated with main mine operations and the environment.
Power Supply and Associated Infrastructure		
Identification of power line supply and generator power source for Project construction and operation	Electrical distribution line confirmed as power supply source with reuse of an existing distribution line right-of-way (ROW) to the MacLellan site.	Reuse of existing distribution line ROW reduces the clearing footprint and reduced loss and/or alteration of habitat. Use of diesel generation to meet total operational needs at MacLellan would have resulted in increased air emissions.

Table 24-1 Summary of Project Changes

Change to Project	Additional Information	Benefits to Environment, Economy, and Communities
Road Infrastructure		
Change in access road requirement	A new access road originally proposed for the MacLellan site was removed from the Project. Existing access roads to the Gordon and MacLellan sites will be reused. No new connection point with PR 391 will be needed.	Reduced the Project environmental footprint at the MacLellan site and the potential for adverse environmental effects on surface water, fish and fish habitat, and community services & infrastructure.
Source: Ausenco Engineering Canada Inc. 2019 (in progress)		

The environmental baseline studies completed in support of the Final EIS Guidelines improved the overall understanding of the existing environment for the Project, including the effects from past historical mining activity. These studies identified environmental constraints during the development of the Project. This has included consideration of the siting and layout of Project infrastructure, and of alternatives to facilitate environmental management and permitting. This process resulted in the following modifications:

- Where possible, the locations of facilities at both the Gordon and MacLellan sites were selected or adjusted to avoid disturbance to sensitive habitat features, such as watercourses and forested areas. Where such disturbance was unavoidable, the size and number of natural features affected were reduced. For example, the PDA at the MacLellan site was condensed to reduce the overall footprint size and the area that would require clearing. An initially proposed new access road to the MacLellan site was removed from the PDA in favor of the reuse of an existing access road ROW. An eagle's nest was avoided by the removal of the requirement for a new access road. The work camp was also located within a compacted PDA at the MacLellan site and not in an area to the west across the Keewatin River.

- Facilities were sited within and not across watershed boundaries to reduce the number of potentially affected waterbodies. The proposed open pit and facilities within the PDA at the Gordon site are now confined to one watershed. Facilities at the MacLellan site, including the proposed open pit and TMF within the PDA are limited to portions of two watersheds. The PDA was also sited and configured to avoid encroaching on both Payne Lake and Minton Lake.

- Ore Milling and Processing Plant Location

  – The process plant location at the MacLellan site was selected to increase efficiency and reduce environmental effects. A smaller footprint resulted in decreased habitat alteration and avoided the need for upstream watershed diversion. The site selected for the plant is close to the ore stockpile and will not require a water crossing between the pit and the processing plant.

- Ore, Overburden and Mine Rock Stockpiles/Storage Areas
  - The overburden stockpile was optimized to be located within the overall footprint of the mine rock storage area at the MacLellan site. The selected location has optimal hauling distance for greater efficiency and reduced environmental effects.
- Water Management Concept/Facilities
  - The Gordon site diversion channel will now be engineered and optimized to take advantage of the natural topography, making it more fish-friendly because the current channel is an unnatural V-shaped design.
  - The new channel will include fish habitat features as an offset for the loss of the existing channel.
  - Non-contact water will be kept separate and diverted from contact water to reduce the amount of the latter needing to be managed. At the Gordon site, water management structures such as diversion ditches and interceptor wells will be constructed to collect, divert, and release non-contact water to the environment. At the MacLellan site, contact water will be stored in the TMF or collected in a settlement pond and will not require treatment beyond solids settling before being discharged to the environment.
- Tailings Management Facility
  - The MacLellan site TMF was adjusted in terms of size and configuration to avoid the deposition of mine tailings into fish bearing watercourses or waterbodies.
  - The current proposed design of the TMF does not overlap spatially with fish-bearing waters.
- Open Pit Development
  - The new open pit developments at the Gordon and MacLellan sites will include the existing open pits (Gordon site) and/or historical shafts (MacLellan site).
  - The existing Gordon site pit lakes will be dewatered during construction. The water in the pits will be aerated to mix the water column and reduce water quality parameter concentrations of concern (e.g., arsenic) prior to its discharge to the environment. Potential releases will be in accordance with applicable provincial regulations with respect to approved water quality parameters.
- Historical Mine Infrastructure
  - Remedial work will be undertaken at the MacLellan site as part of addressing historical mine development at the site.

  - Some of the existing infrastructure will be demolished during Project construction. Some of the demolition activities will be phased, depending on the location of the former infrastructure and its overlap with the footprint of new mine infrastructure.

- Work Camp, Power Supply and Other Infrastructure
  - The location of the work camp at the MacLellan site was confirmed and refined within the PDA reducing potential effects related to traffic and worker/local resident interactions. Placement of the camp to the west of the Keewatin River outside of the PDA was avoided, negating the need for additional habitat alteration.
  - Reuse of an existing distribution line ROW was identified for electrical power supply to the MacLellan site, avoiding the need for diesel generated power supply at the MacLellan site.
  - Existing access roads to the Gordon and MacLellan sites will be refurbished and reused. No new access road connecting from PR 391 will be developed to the MacLellan site.
  - The explosives magazine and mixing plant locations were optimized to be situated south of the work camp, the open pit, and other site infrastructure at the MacLellan site for optimal worker safety in relation to main mine operations.
  - In addition to the Project design changes that have resulted in environmental benefits, the work associated with developing the EIS has resulted in a substantial increase in environmental and socio-economic information throughout the area based on years of field work, literature research and engagement with knowledge holders. This information, which has become available to the public through the EIS process, and reviewed by government authorities, Indigenous communities, and stakeholders, are represented throughout the EIS (Volumes 1 to 3), including technical data reports and analytic and modelling reports contained in Volumes 4 and 5 of the regulatory filing.

24.3 REFERENCES

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ALAMOS GOLD INC.

Lynn Lake Gold Project Environmental Impact Assessment
Chapter 25 - Conclusions

Stantec

Prepared by:

Stantec Consulting Ltd.

May 25, 2020

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Acronyms and Abbreviations

Alamos	Alamos Gold Inc.
EA	environmental assessment
EAP	Environment Act Proposal
EIS	Environmental Impact Statement
VC	valued component

25.0 CONCLUSIONS

This Final Environmental Impact Statement (EIS) documents the results of the environmental assessment (EA) for the Lynn Lake Gold Project (the Project) proposed by Alamos Gold Inc. (Alamos). An environmental assessment of the Project is required under the *Canadian Environmental Assessment Act, 2012* and *The Environment Act* (Manitoba). The Project has been assessed to meet the requirements of both the federal EIS Guidelines and provincial Environment Act Proposal (EAP) Guidelines. Engagement has been ongoing prior to and throughout the EA process, and will continue with agencies, local Indigenous communities, and stakeholders through the life of the Project. As part of the information sharing through the engagement process, Project-related information was provided by Indigenous communities and groups in the form of traditional knowledge and traditional land and resource use studies and other forms of information sharing. Government, Indigenous community and groups, and stakeholder engagement input and Project-related studies have been considered throughout the EA including baseline data collection, mitigation, residual effects assessment, and follow-up and monitoring, where appropriate. Alamos will continue, throughout the life of the mine to incorporate information shared from Indigenous communities and groups wherever appropriate, including changes to outcomes of mitigation and monitoring.

Fourteen valued components (VCs) were identified as relevant and important to the environmental assessment based on regulatory requirements and engagement. They included the atmospheric environment; noise and vibration; groundwater; surface water; fish and fish habitat; vegetation and wetlands; wildlife and wildlife habitat; labour and economy; community services, infrastructure and well-being; land and resource use; heritage resources; current use of lands and resources for traditional purposes; human health; and Indigenous Peoples.

The assessment followed standard EA methods for describing Project interactions with each of the VCs and determining the potential environmental effects associated with the Project for the construction, operation, and decommissioning/closure phases, including areas of federal jurisdiction. It presents mitigation and environmental protection measures to reduce or eliminate adverse effects, characterizes the residual environmental effects that remain after mitigation has been applied, and determines the significance of the effects.

Based on the results of the environmental assessment, including implementing the identified mitigation measures, the Project is not likely to cause significant adverse environmental effects, including cumulative effects and effects from accidents and malfunctions and effects of the environment on the Project. A number of monitoring and reporting commitments have been proposed as part of environmental management, follow-up and monitoring programs to verify the accuracy of the residual effects assessment, determine the effectiveness of mitigation measures, and monitor compliance with regulatory approvals, permits and authorizations.

The Project will have both environmental and socio-economic benefits including:

- Remedial measures to address the removal of historical mine infrastructure at the MacLellan site have been incorporated into the Project, including removal of historical shafts at the MacLellan site and the existing open pits at the Gordon site. The existing Gordon pit lakes will be dewatered during

construction. The water in the pits will be aerated to mix the water column and reduce water quality parameters of concern (e.g., arsenic) prior to its discharge to the environment. Potential releases will be in accordance with applicable provincial regulations with respect to approved water quality parameters.

- The tailings management facility at the MacLellan site has been designed to avoid deposition of mine tailings into fish bearing watercourses or waterbodies. It was also redesigned to avoid encroaching on headwaters of two tributaries to Minton Lake known to be frequented by fish.
- The benefits of constructing and operating the Project for the Northern Manitoba Region and Manitoba include economic development and job creation. The Project will provide Crown royalties and tax revenue for the Town of Lynn Lake, as well as for the provincial and federal governments. These revenues can then be used to support public services, such as health care, education, and infrastructure. Based on an assessment of spending estimates, the Project is expected to have a positive effect on the local economy of Lynn Lake, and economies of the Northern Manitoba Region and the Province of Manitoba.
- Alamos is dedicated to establishing productive local partnerships that contribute to achieving development goals identified by local community stakeholders, to address local priorities and concerns, and to provide benefits to communities. Social benefits are predicted as a result of the Project, including potential local and regional Project-related employment, including training programs oriented to Project operational needs, increased local and regional business revenue, capacity and capabilities, and potential for the supply of goods and services needed for Project construction and operation with local and regional businesses.