APPENDIX 7-A
AIR DISPERSION DETAILED MODEL PLAN
2012 ADDENDUM

Seabridge Gold Inc.

KSM PROJECT
Air Dispersion Detailed Model Plan
2012 Addendum

SEABRIDGE GOLD

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KSM PROJECT

AIR DISPERSION DETAILED MODEL PLAN 2012 ADDENDUM

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SEABRIDGE GOLD

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KSM PROJECT
AIR DISPERSION DETAILED MODEL PLAN 2012 ADDENDUM

Table of Contents

List of Figures

FIGURE **PAGE**

List of Tables

List of Plates

List of Appendices

1. Proponent and Project Description

1.1 PROJECT PROPONENT

Seabridge Gold Inc. (Seabridge) is the proponent for the proposed KSM Project (the Project), a gold, copper, silver, molybdenum mine.

1.2 PROJECT LOCATION

The Project is located in the coastal mountains of northwestern British Columbia. It is approximately 950 km northwest of Vancouver and 65 km northwest of Stewart, within 30 km of the British Columbia-Alaska border (Figure 1.2-1).

1.3 PROJECT OVERVIEW

The Project is located in two geographical areas: the Mine Site and Processing and Tailing Management Area (PTMA), connected by twin 23-km tunnels, the Mitchell-Treaty Twinned Tunnels (Figure 1.3-1). The Mine Site is located south of the closed Eskay Creek Mine, within the Mitchell, McTagg, and Sulphurets Creek valleys. Sulphurets Creek is a main tributary of the Unuk River, which flows to the Pacific Ocean. The PTMA is located in the upper tributaries of Teigen and Treaty creeks. Both creeks are tributaries of the Bell-Irving River, which flows to the Nass River and into the Pacific Ocean. The PTMA is located about 19 km southwest of Bell II on Highway 37.

The Mine Site will be accessed by a new road, the Coulter Creek Access Road, which will be built from km 70 on the Eskay Creek Mine Road. This road will follow Coulter and Sulphurets creeks to the Mine Site. The PTMA will also be accessed by a new road, the Treaty Creek Access Road, the first 3-km segment of which is a forest service road off of Highway 37. The Treaty Creek Access Road will parallel Treaty Creek.

Four deposits will be mined at the KSM Project—Kerr, Sulphurets, Mitchell, and Iron Cap—using a combination of open pit and underground mining methods. Waste rock will be stored in engineered rock storage facilities located in the Mitchell and McTagg valleys at the Mine Site. Ore will be crushed and transported through one of the Mitchell-Treaty Twinned Tunnels to the PTMA. This tunnel will also be used to route the electrical power transmission lines. The second tunnel will be used to transport personnel and bulk materials. The Process Plant will process an average of 130,000 tpd of ore to produce a daily average of 1,200 t of concentrate. Tailing will be pumped to the Tailing Management Facility from the Process Plant. Copper concentrate will be trucked from the PTMA along highways 37 and 37A to the Port of Stewart, which is approximately 170 km away via road.

The mine operating life is estimated at 51.5 years. Approximately 1,800 people will be employed annually during the Operation Phase. Project Construction will take about five years, and the capital cost of the Project is approximately US$5.3 billion.

1.4 MINING AREA

The proposed mining area will be accessed by a new road to be constructed from the current Eskay Creek mine road. The Coulter Creek Access Road will be primarily a single-lane, radio controlled road, constructed for moving large equipment and supplies to the mine site. An existing road leaves Highway 37, south of Bob Quinn, and extends approximately 59 km southwest to the former Eskay Creek Mine. The first 37 km of this road is classified as public road but is subject to controlled and shared access. The remaining 22 km of existing road length is private and subject to a shared agreement. Upgrades to sections of the existing road will be required.

Figure 1.2-1

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KSM Project Location

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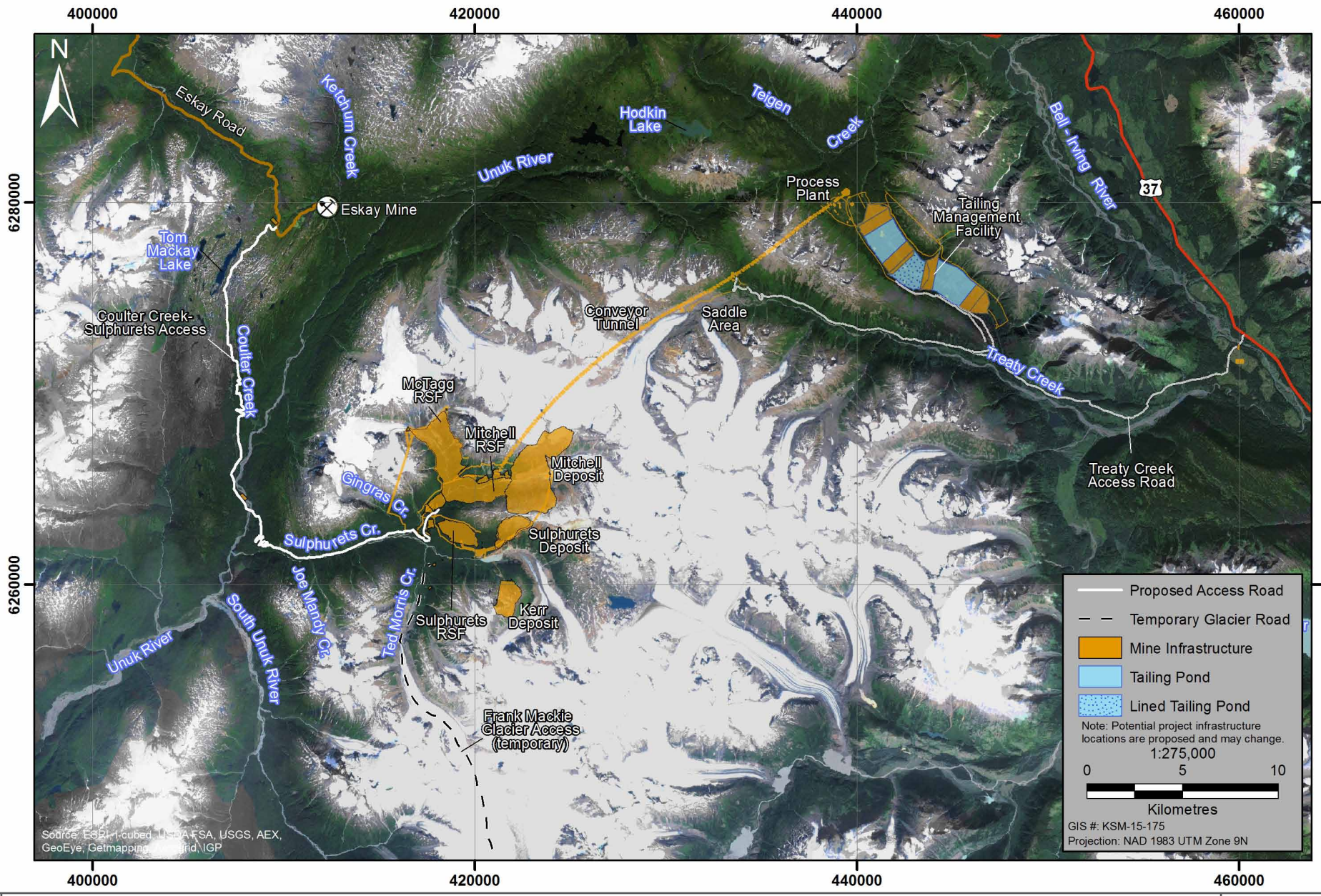

Figure 1.3-1

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KSM Project Layout

Figure 1.3-1

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The new 35-km long Coulter Creek Access Road will commence near the former Eskay Creek Mine and follow the west side of the valley south for approximately 21 km before crossing the Unuk River. It then turns east through a series of switchbacks and follows the north side of the Sulphurets Creek valley to the Mitchell Creek valley and mine site.

The proposed support facilities for the mining area are in the vicinity of the confluence of Sulphurets and Mitchell creeks. They will include accommodation for mine employees and administration and maintenance facilities.

The ore deposits will be mined using conventional drill and blast methods. The Kerr deposit is located on a ridge south of Sulphurets Lake. It is proposed that ore and waste rock be hauled to primary crushers on the east side of the pit. It will then be conveyed to the Mitchell Valley using a rope conveyor, a tunnel conveyor through the Sulphurets-Mitchell Conveyor Tunnel (SMCT), and a second rope conveyor.

The Sulphurets deposit is located on the south side of the ridge north of Sulphurets Lake. It is proposed that waste rock exits the pit via external roads connected to the Sulphurets access road and will be placed on the Mitchell Rock Storage Facility (RSF) and McTagg RSF. It is proposed that ore will be hauled to a pit rim primary crusher on the south slope of Sulphurets Ridge, and then conveyed north through the SMCT into the Mitchell Valley where the coarse ore stockpile is located.

The Mitchell deposit is located on the south side of Mitchell Valley. Pre-stripped waste rock from Mitchell will be used to fill out a road to the Mitchell Ore Processing Complex (OPC). The Primary crushing facility located at the Mitchell mine site will reduce the run-of-mine (ROM) particle size to approximately 80% passing 150 mm by gyratory crushers. Ore from the Sulphurets and Kerr deposits will be crushed at their respective sites as described above, excluding the Sulphurets ore produced during Years 2 to 6, which will be crushed at the Mitchell site. The Iron Cap mineralization will be mined by block caving and be crushed in the underground mine prior to being conveyed.

The Mitchell deposit straddles the Mitchell Creek Valley in an area recently exposed by the recession of the Mitchell Glacier. Mining of the deposit is proposed on both sides of the valley and to a depth of about 600 m below the current valley bottom. Seabridge proposes to construct a diversion tunnel from near the toe of the Mitchell Glacier, southwards towards Sulphurets Lake to divert the flow of Mitchell Creek away from the proposed open pit area. It is proposed that the significant hydraulic head created by this tunnel will be used to drive a hydro-electric plant to generate a portion of the electricity requirements of the Project.

Large volumes of low grade or barren rock will be removed in order to access the ore in each of the deposits. Rock removed to access ore will consist of both potentially acid generating (PAG) and not potentially acid generating (non-PAG) rock. Rock storage areas have been defined in the Mitchell and McTagg Creek valleys and on the south-facing side of the ridge between Sulphurets and Mitchell Creek valleys. Runoff and seepage from the rock storage areas will be collected in a water storage facility contained behind a dam to be located in the lower reaches of Mitchell Creek, and treated prior to discharge to the environment.

A second diversion tunnel will be constructed to direct the flow of McTagg Creek to the Sulphurets Creek Valley, thus avoiding the rock storage areas. The discharge from this tunnel will be available to drive a small hydro-electric plant. Additionally, a run-of-river hydro-electric plant is proposed to harness the hydraulic head of the cascade in the lower reaches of Sulphurets Creek.

Ore from the three deposits will be transported to an ore preparation complex, located on the north side of the Mitchell Creek Valley west of the Mitchell pit. The primary crushing facility at all three deposits will reduce the run-of-mine (ROM) particle size to approximately 80% passing 150 mm by gyratory crushers. Primary crushed ore will be transported to the processing and TMF area by an ore conveyance belt through the Mitchell-Treaty twin tunnel (MTT).

The 23 km Mitchell-Treaty twin tunnel (MTT) system has been designed to connect the Mitchell site to the Processing and TMF site. The crushed ore will be transported through one of the twin tunnels by conveyance. This tunnel will also be used for electrical power transmission and diesel fuel delivery by pipeline. The adjacent tunnel will be used for the transportation of personnel and supplies for mine operating and water management activities.

1.5 PROCESSING AND TAILING MANAGEMENT FACILITY (TMF) AREA

The MTT will terminate on the south side of the valley formed by a north flowing tributary of Teigen Creek (South Teigen Creek) and a south flowing tributary of Treaty Creek (North Treaty Creek), adjacent to the plant site.

The main process and TMF plant will consist of the following facilities:

- secondary crushing by cone crushers;
- tertiary crushing by high pressure roll grinders (HPRGs);
- primary grinding by ball mills;
- copper-gold/molybdenum bulk flotation;
- copper-gold/molybdenum separation depending on molybdenum grade of mill feed;
- copper-gold concentrate and molybdenum concentrate dewatering;
- gold carbon-in-leach (CIL) cyanide leaching of scavenger cleaner tailing and pyrite rougher concentrate;
- gold recovery; and
- cyanide recovery, and then cyanide destruction of washed CIL residue prior to disposal of the residue in the lined pond within the TMF.

The plant will use a conventional crushing/grinding and flotation flowsheet to produce separate copper/gold and molybdenum concentrates, gold doré and tailings. It will process up to 130,000 tonnes per day of ore to produce an average of 882 tonnes per day of copper concentrate and 5 tonnes of molybdenum concentrate. The copper-gold concentrate will be hauled by super-B trucks from KSM to a load out facility at the deep water port of Stewart, BC through highway 37 and highway 37A. Molybdenum concentrate will be transported by trucks, along highway 37 and highway 16 from the KSM site to the port of Prince Rupert. The molybdenum concentrate will be transferred from trucks to containers and then delivered to Fairview Terminals for loading onto oceangoing vessels.

Vehicle access to the processing and TMF area will be by the Treaty Creek Access Road which will consist of a two-lane road constructed to provide permanent access from Highway 37 to the process and TMF area and east portal of the MTT. This road will leave Highway 37 approximately 19 km south of Bell II, cross the Bell-Irving River, and follow the north side of the Treaty Creek valley for approximately 18 km. It will then turn north and follow the west side of the North Treaty Creek/Teigen Creek valley for approximately 12 km to the processing and TMF area, and east portal of the MTT.

The tailings will be pumped through a pipeline to the tailings management facility located in the upper reaches of the Teigen Creek valley, extending southeast over the divide into a tributary of the Treaty Creek drainage. The TMF will be constructed in three cells: the North and South cells for flotation tailings, and a lined cell for CIL tailings. The cells are confined between four dams (North, Splitter, Saddle, and Southeast dams) located within the Teigen-Treaty Creek cross-valley. The area is moderately seismic and the dams are designed to resist earthquake loads. The TMF cells are designed to store the 30-day probable maximum flood with snowmelt. The North and CIL cells will be constructed and operated first; they will store tailings produced in the first 25 years of operation. The North Cell will then be reclaimed while the CIL and South cells are in operation. The North, Splitter, and Saddle earth-fill starter dams will be constructed over a two-year period in advance of the start of milling to form the North and CIL cells and will provide start-up tailings storage for two years.

It is assumed that electricity to power the plant and mine site will be obtained from the provincial electricity grid. A secondary transmission line will be constructed from a switching station, to be located near the point where Highway 37 crosses Glacier Creek. The secondary line will follow the general alignment of the access road, to the plant site, and then pass through the tunnel to the mine site.

In preparation for the Environmental Assessment, environmental baseline studies are being conducted for the KSM Project. These studies include fish and fish habitat, water quality, hydrology, hydrogeology, air quality, wetlands, wildlife, wildlife habitat, land use, aquatic biology, meteorology, terrain hazards, noise, archaeology, terrain and soils, ecosystem and vegetation, country foods and acid rock drainage.

Environmental baseline studies for meteorology began in late September 2007 with the installation of an automated meteorological station in the Sulphurets valley. In early March 2008, a second station was added in the Teigen Creek drainage, and in mid-September 2008 a third and fourth station were installed at the proposed plant site and near the Mitchell deposit, respectively.

2. Purpose and Objectives

Standard air dispersion modelling techniques will be applied to predict the potential air quality effects associated with the KSM mine development and operation, and to determine appropriate mitigation strategies for the various air emission sources.

Air dispersion modelling is commonly used to assess air quality effects of a proposed source with respect to federal and provincial ambient air quality objectives. The dispersion model is a cost effective method to derive an understanding of the interaction of existing and future emission sources with meteorology, topography and existing air quality.

The Air Quality effects assessment will estimate emission rates for the Criteria Air Contaminants (CACs) of concern, and undertake air dispersion modelling to determine ambient air concentrations resulting from proposed Project emissions. The sources included in the air dispersion model will include point and mobile sources, such as vehicle exhaust, and potential effects from blasting and concentrate transport. Predicted ambient air concentrations determined through modelling will be compared to appropriate federal and provincial air quality objectives/standards. Acid deposition of acidic precipitation resulting from release of gases such as NO_X and SO_X will be assessed.

In summary, the air dispersion modelling study will include:

- dispersion of air emissions with emphasis on nitrogen oxide (NO_x as NO_2), sulphuric dioxide (SO_2), carbon monoxide (CO), and suspended particulate matter in different diameters (TSP, PM_{10} and $PM_{2.5}$) on a regional scale;
- deposition and the potential impact of the acidic precipitation resulting from release of gases such as NO_x and SO_x;
- supplemental information for impacts on biological receptors such as vegetation, fish, wildlife and human health; and
- comparison of contaminant concentrations with applicable national and provincial air quality objectives and guidelines.

This Detailed Modelling Plan (DMP) is being submitted to the British Columbia Ministry of Environment (BC MOE) to define the modelling requirements for the Environmental Assessment of KSM Project, to obtain feedback, and to seek approval to proceed with the preparation of the Environmental Assessment report. The DMP has been prepared using the good modelling practice steps described by the Guidelines for Air Quality Dispersion Modelling in British Columbia (BC MOE 2008).

As presented in the Conceptual Model Plan, the proposed preliminary regional study area for the KSM Project air dispersion modelling was 65 × 65 km. In order to cover bigger portion of Highway 37 to determine the effects of access roads and to meet requirements of BC Environmental Assessment Office (BC EAO 2011), the modelling domain has been expanded to cover a 60 × 100 km area. The receptor grid spacing was configured according to *Guidelines for Air Quality Dispersion Modelling in BC* (BC MOE 2008) with modification approved by regulatory consultation (Figure 2-1). The resulting orientation of nested grid receptors provides a reasonable number of receptors (21,477) which will be adequate to assess the effects on ambient air quality. In addition, activities on the access roads will be considered as sources, therefore receptor spacing was reconfigured to accommodate this change. The sensitive receptors were determined by consulting vegetation, fish, wildlife, and human health scientists. Figure 2-1 presents the air dispersion modelling domain and the receptor grids selected for model runs.

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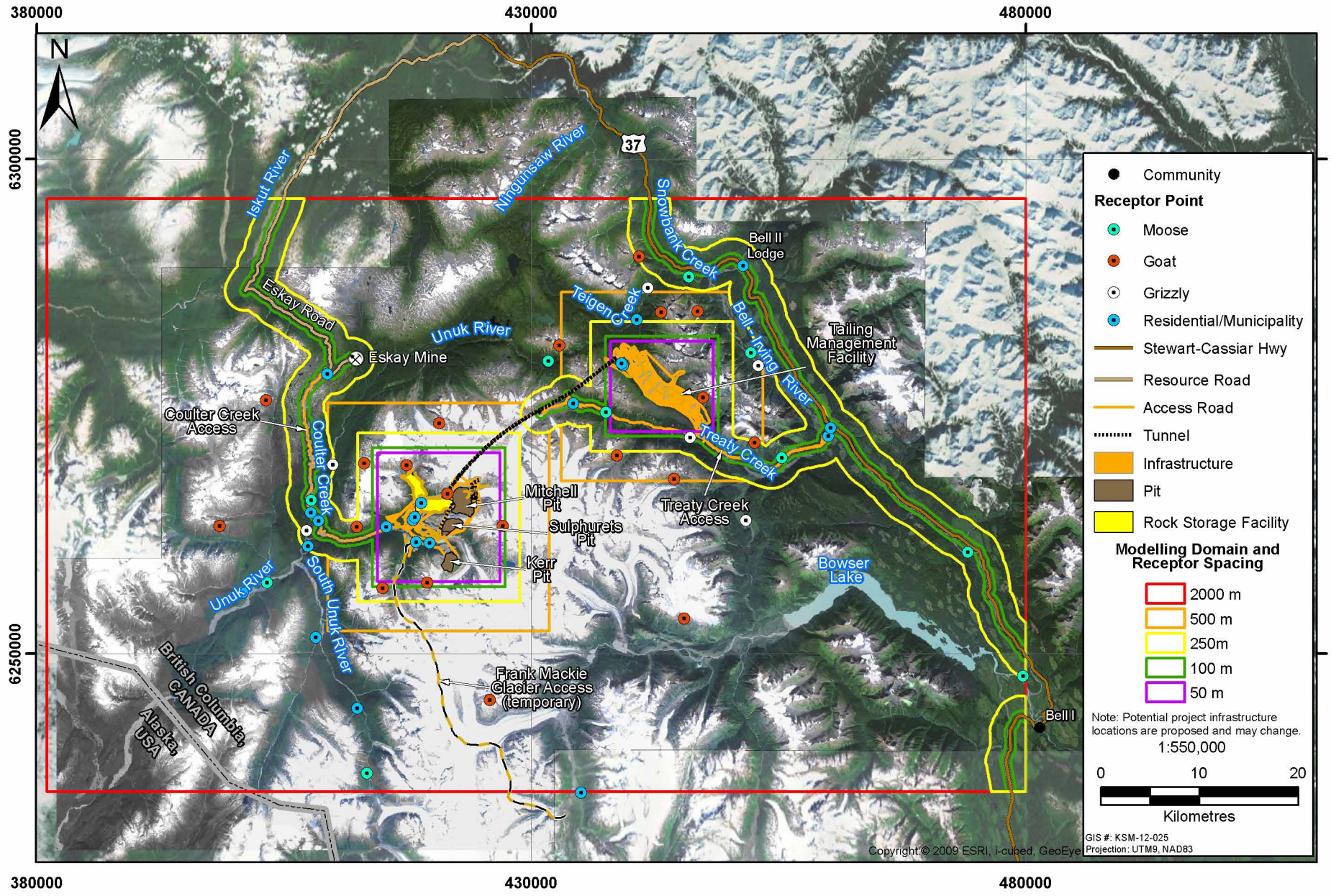

Figure 2-1

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KSM Air Dispersion Modelling Domain and Receptor Spacing

Figure 2-1

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3. Characterize Sources/Contaminants

The KSM project will primarily be based on conventional open pit mining methods. Large haul trucks, shovels and drills will form the basis of the mining equipment. The drilling requirements in the open pit will be dictated by a combination of logistics, wall control and the project blasting schedule. Blasting will be performed on a scheduled basis. Figure 3-1 summarizes the process flow diagram for the KSM Project from the engineering feasibility study (Wardrop 2011).

The air emission sources and characteristics are summarized in Tables 3-1 and 3-2 for the construction and operation phases of the Project, respectively. The primary air quality parameters that will be assessed are TSP, PM_{10} and $PM_{2.5}$, NO_2, SO_2, CO and acid deposition (SO_4^{-2} and NO_3^-). Year -1 and Year 4 are assessed to represent the worst case for construction and operation phases, respectively based on the amount of rock moved, amount of fuel and electric power consumed and amount of explosives used. Detailed explanations are provided in Section 7.

The KSM project air emissions inventory will be generated from manufacturers' specifications when available, AP-42 emission factors (US EPA 1995), NONROAD2008 model Tier 4 emission standards (US EPA 2005) and MOVES2010b (US EPA 2012).

Air emissions from the diesel equipment were based on the horsepower (hp) rating and utilization factor for each piece of equipment and emission factors from the NONROAD2008 model (NONRAOD). US EPA has developed the NONROAD2008 model to provide emissions factors for predicting accurate and reproducible nonroad emissions inventories. NONROAD2008 provides emissions estimates based on fuel-use in a diverse collection of vehicles and equipment, classified categories. The categories consulted for this project were:

- construction and mining equipment, such as graders, backhoes, scrapers, drill rigs, excavators, cranes, off highway trucks, crushers, loaders and dozers;
- industrial equipment, such as fork lifts and sweepers.

The model includes more than 80 basic and 260 specific types of nonroad equipment, and further classifies equipment types by horsepower rating for all regions of the USA. Fuel types include gasoline, diesel, compressed natural gas (CNG), and liquefied petroleum gas (LPG).

NONROAD does not have the ability to predict nonroad emissions for British Columbia. Therefore the model was programmed to predict emissions for the nearest Washington State county to the KSM Project, which was Whatcom County. NONROAD data exists for the State of Alaska; however, the equipment population totals for the State of Alaska are much smaller (about one-tenth) than the equipment population totals for Whatcom County. Thus, Whatcom County was chosen as it is the closest county to the KSM Project with a reasonable equipment population size.

The model was also programmed with the annual average minimum, maximum and average ambient air temperatures measured at the four meteorological stations operational at the KSM site during the baseline studies (i.e., -1.5, 6.1 and 1.7°C, respectively). For the NONROAD estimates it was assumed that the sulphur content of the diesel fuel was 0.0015% (15 mg/kg). This is consistent with the *Sulphur in Diesel Fuel Regulations* – Regular Sulphur Diesel Fuel - Type A fuel that is mainly limited to off-road applications (Environment Canada 2010).

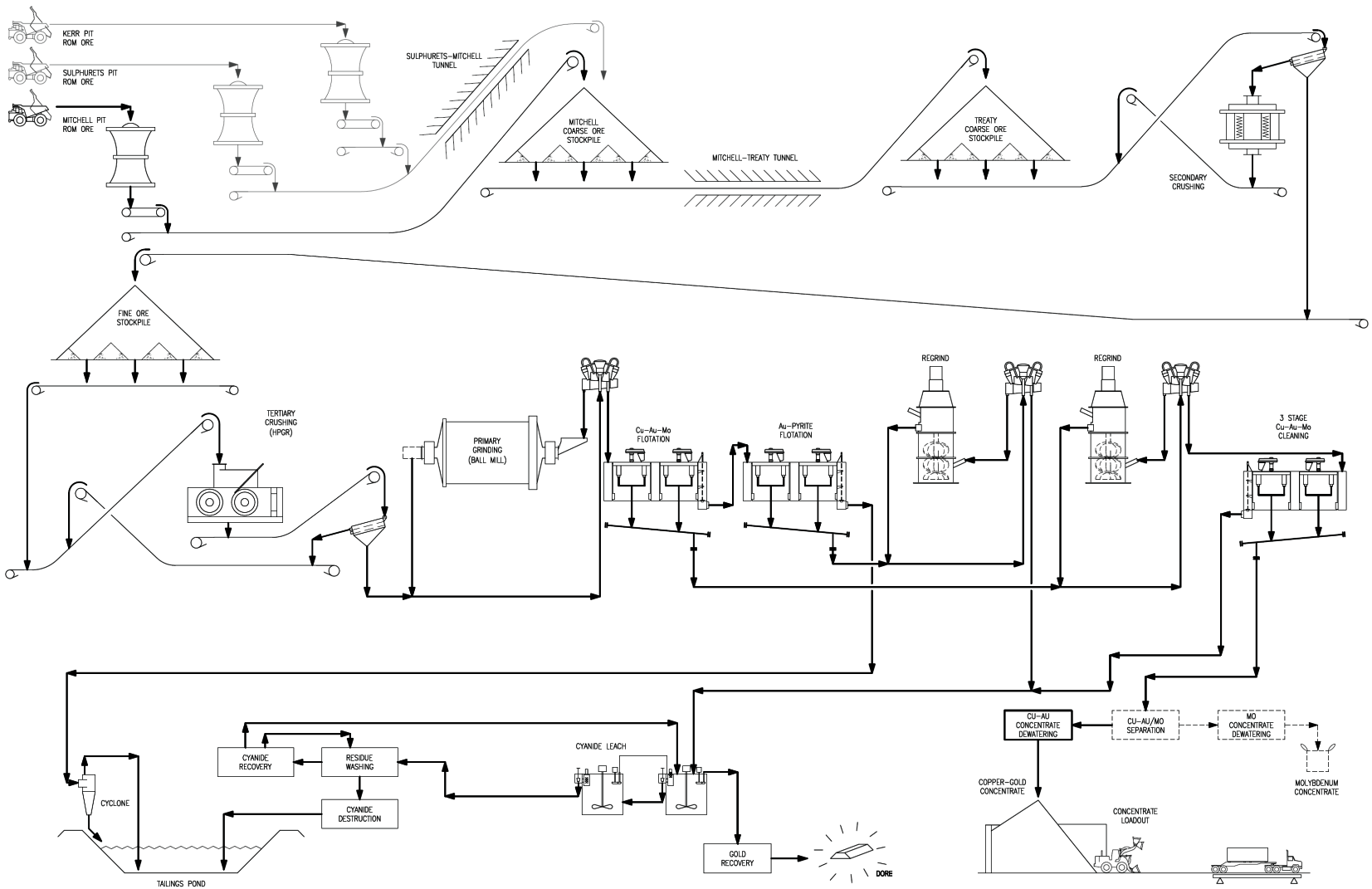

Figure 3-1

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KSM Project Overall Simplified Process Flow Diagram

Figure 3-1

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Table 3-1a. Air Emission Sources and Characteristics during Construction (Year -1)

Stack Description	Prime Power (kW)	Stack Height (m above ground)	Stack Inner Diameter (m)	Volumetric Flow Rate (m3/min)	Exit Velocity (m/s)	Exhaust Temperature (oC)	Emission Rates (g/s)						Reference Emission Factor
							NO_X	SO_2	CO	TSP	PM_{10}	$PM_{2.5}$	
Tunnel Construction Genset - Mine1	1,825	9	0.3556	345.8	58	356.7	7.6610	0.0012	2.0650	0.0902	0.0866	0.0812	Manufactorer's specification adjusted based size
Tunnel Construction Genset - Mine2	1,825	9	0.3556	345.8	58	356.7	7.6610	0.0012	2.0650	0.0902	0.0866	0.0812	Manufactorer's specification adjusted based size
Tunnel Construction Genset - adit	910	9	0.2032	150.1	77	420.5	3.8200	0.0006	1.0300	0.0450	0.0432	0.0405	Manufactorer's specification adjusted based size
Tunnel Construction Genset - saddle1	1,825	9	0.3556	345.8	58	356.7	7.6610	0.0012	2.0650	0.0902	0.0866	0.0812	Manufactorer's specification adjusted based size
Tunnel Construction Genset - saddle2	1,825	9	0.3556	345.8	58	356.7	7.6610	0.0012	2.0650	0.0902	0.0866	0.0812	Manufactorer's specification adjusted based size
Tunnel Construction Genset - Treaty1	1,825	9	0.3556	345.8	58	356.7	7.6610	0.0012	2.0650	0.0902	0.0866	0.0812	Manufactorer's specification adjusted based size
Tunnel Construction Genset - Treaty2	1,825	9	0.3556	345.8	58	356.7	7.6610	0.0012	2.0650	0.0902	0.0866	0.0812	Manufactorer's specification adjusted based size
Camp # 5 800 person Treaty Plant Camp Generator1	400	9	0.2032	91.125	47	470.2	1.6790	0.0003	0.4527	0.0198	0.0190	0.0178	Manufactorer's specification adjusted based size
Camp # 5 800 person Treaty Plant Camp Generator2	400	9	0.2032	91.125	47	470.2	1.6790	0.0003	0.4527	0.0198	0.0190	0.0178	Manufactorer's specification adjusted based size
Camp # 6 120 Person Treaty Saddle Camp Generator	400	9	0.2032	91.125	47	470.2	1.6790	0.0003	0.4527	0.0198	0.0190	0.0178	Manufactorer's specification adjusted based size
Camp # 10 400 Person Treaty Saddle Camp Generator	400	9	0.2032	91.125	47	470.2	1.6790	0.0003	0.4527	0.0198	0.0190	0.0178	Manufactorer's specification adjusted based size
Camp # 5 800 person Treaty Plant Camp incinerator	-	9	0.3556	353	59	1000	0.0356	0.0000	0.0000	0.4274	0.2137	0.1425	EcoWaste Solution emissions adjusted based on camp size
Camp # 6 120 Person Treaty Saddle Camp incinerator	-	9	0.3556	353	59	1000	0.0053	0.0000	0.0000	0.0641	0.0321	0.0214	EcoWaste Solution emissions adjusted based on camp size
Camp # 10 400 Person Treaty Saddle Camp incinerator	-	9	0.3556	353	59	1000	0.0178	0.0000	0.0000	0.2137	0.1068	0.0712	EcoWaste Solution emissions adjusted based on camp size

Table 3-1b. Air Emission Sources and Characteristics during Construction (Year -1)

Activity Area	Equipment	Unit	Horsepower	Operation Hours per Day		Speed (km/hour)	Weight (tonne)	Emission Rates (g/hp-hr)						Reference Emission Factor
				Day (7 a.m. to 10 p.m.)	Night (10 p.m. to 7 a.m.)			NO_X	SO_2	CO	TSP	PM_{10}	$PM_{2.5}$	
Mine Area - Mining, Infrastructure and Mitchell OPC Equipment	P&H 250XPC: Drill	3	850	9.4	5.7	Not required	Not required	5.3576	0.0044	1.3931	0.2321	0.2265	0.2244	NONROAD for tailpipe emissions
	Sandvik D245S	4	475	4.2	2.5	Not required	Not required	3.8949	0.0044	1.1523	0.1857	0.1812	0.1795	NONROAD for tailpipe emissions
	FEL Blast Hole Stemmer CAT 930H	2	149	5.9	3.6	Not required	Not required	1.7344	0.0042	0.7374	0.1815	0.1771	0.1755	NONROAD for tailpipe emissions
	Hydraulic Shovel EX8000	2	3,880	12	7.2	Not required	Not required	3.2539	0.0041	0.9811	0.1329	0.1297	0.1285	NONROAD for tailpipe emissions
	Dozer CAT D10	6	646	8.4	5	Not required	Not required	1.9376	0.0042	1.1513	0.1256	0.1226	0.1215	NONROAD for tailpipe emissions; AP-42 Chapter 11.9 for bulldozing
	Wheel Dozer CAT 834H	1	525	8.4	5	Not required	Not required	2.3981	0.0043	0.9735	0.1459	0.1424	0.1411	NONROAD for tailpipe emissions; AP-42 Chapter 11.9 for bulldozing
	Fuel/Lube Truck CAT 740	1	489	7.1	4.3	Not required	Not required	1.0604	0.0038	0.3723	0.0571	0.0557	0.0552	NONROAD for tailpipe emissions; AP-42 Chapter 13.2.2 for unpaved road dust
	Front End Loader CAT 988	1	555	9.6	5.7	Not required	Not required	2.3981	0.0043	0.9735	0.1459	0.1424	0.1411	NONROAD for tailpipe emissions; AP-42 Chapter 11.9 for bulldozing
	Front End Loader CAT 988H	1	555	4.7	2.8	Not required	Not required	2.3981	0.0043	0.9735	0.1459	0.1424	0.1411	NONROAD for tailpipe emissions; AP-42 Chapter 11.9 for bulldozing
	Excavator - 390kW - CAT 390	2	513	8.8	5.3	Not required	Not required	1.6317	0.0041	0.6610	0.1067	0.1041	0.1031	NONROAD for tailpipe emissions
	Water Pump - 1,400 gal/min - LH8110	3	150	9.5	5.7	Not required	Not required	2.1972	0.0043	0.8899	0.2073	0.2023	0.2004	NONROAD for tailpipe emissions
	Light Plant - 20kW -	4	27	6.3	3.8	Not required	Not required	3.6112	0.0045	0.7957	0.1254	0.1224	0.1213	NONROAD for tailpipe emissions
	Crane - 250t - LTM1250	1	600	2.4	1.4	Not required	Not required	2.5831	0.0043	0.6678	0.1112	0.1085	0.1075	NONROAD for tailpipe emissions
	Excavator - 283kW - CAT 345	4	380	8.3	5	Not required	Not required	1.6317	0.0041	0.6610	0.1067	0.1041	0.1031	NONROAD for tailpipe emissions; AP-42 Chapter 11.9 for bulldozing
	Mobile Screening Plant - Sanvik QA430	1	100	2.7	1.6	Not required	Not required	2.2895	0.0046	1.4019	0.2122	0.2071	0.2052	NONROAD for tailpipe emissions
	Crane - 100t - LTM1100	1	175	4	2.4	Not required	Not required	1.8187	0.0041	0.5026	0.1303	0.1272	0.1260	NONROAD for tailpipe emissions
	FEL - 373kW - CAT988	1	555	6.7	4	Not required	Not required	2.3981	0.0043	0.9735	0.1459	0.1424	0.1411	NONROAD for tailpipe emissions
	Crane - 40t - LTM1040	2	280	3.3	2	Not required	Not required	1.6719	0.0040	0.3707	0.0784	0.0765	0.0758	NONROAD for tailpipe emissions
	Forklift - 30t - Hyster H650HSD	1	230	5.9	3.6	Not required	Not required	1.8265	0.0041	0.6172	0.1249	0.1219	0.1208	NONROAD for tailpipe emissions
	Forklift - 10t - Hyster H210HD	2	155	5.9	3.6	Not required	Not required	1.9949	0.0042	0.8203	0.1962	0.1915	0.1897	NONROAD for tailpipe emissions
	Haul Truck CAT 797F	18	4,000	11.8	7.1	30	688	2.7121	0.0038	0.8347	0.0950	0.0927	0.0918	NONROAD for tailpipe emissions; AP-42 Chapter 13.2.2 for unpaved road dust
	Water Truck 777F	1	1,016	7.1	4.3	12	180	2.7121	0.0038	0.8347	0.0950	0.0927	0.0918	NONROAD for tailpipe emissions; AP-42 Chapter 13.2.2 for unpaved road dust
	Dozer D10T	3	646	8.3	5	5	73	1.9376	0.0042	1.1513	0.1256	0.1226	0.1215	NONROAD for tailpipe emissions; AP-42 Chapter 11.9 for bulldozing
	Grader CAT 24M	2	533	8.3	5	12	73	1.8859	0.0042	0.7642	0.1206	0.1177	0.1166	NONROAD for tailpipe emissions; AP-42 Chapter 11.9 for grading
	Dozer - 433kW - DAT D10T	2	646	8.3	5	5	73	1.9376	0.0042	1.1513	0.1256	0.1226	0.1215	NONROAD for tailpipe emissions; AP-42 Chapter 11.9 for bulldozing
	Tractor/Trailer - 170t - CAT 789	1	1,900	2.5	1.5	30	358	3.7299	0.0042	1.1463	0.1630	0.1591	0.1576	NONROAD for tailpipe emissions; AP-42 Chapter 13.2.2 for unpaved road dust
	Crew Cab Pickup - Chevy Silverado 3500	15	322	5.9	3.6	30	4	1.0604	0.0038	0.3723	0.0571	0.0557	0.0552	NONROAD for tailpipe emissions; AP-42 Chapter 13.2.2 for unpaved road dust
	Ambulance -	1	322	1.2	0.7	30	6	1.0604	0.0038	0.3723	0.0571	0.0557	0.0552	NONROAD for tailpipe emissions; AP-42 Chapter 13.2.2 for unpaved road dust
	Mine Rescue Truck -	1	322	0.6	0.4	30	18	1.0604	0.0038	0.3723	0.0571	0.0557	0.0552	NONROAD for tailpipe emissions; AP-42 Chapter 13.2.2 for unpaved road dust
	47 passenger -	3	280	4	2.4	30	18	0.6333	0.0036	0.1632	0.0218	0.0213	0.0211	NONROAD for tailpipe emissions; AP-42 Chapter 13.2.2 for unpaved road dust
	Maintenance Truck - 1t - Ford F550	3	350	10	6	30	10	1.0604	0.0038	0.3723	0.0571	0.0557	0.0552	NONROAD for tailpipe emissions; AP-42 Chapter 13.2.2 for unpaved road dust
	Fire Truck - T800 Kenworth	1	280	0.7	0.4	30	11	0.6333	0.0036	0.1632	0.0218	0.0213	0.0211	NONROAD for tailpipe emissions; AP-42 Chapter 13.2.2 for unpaved road dust
	Picker Truck - C500 Kenworth	1	380	4	2.4	30	15	1.0604	0.0038	0.3723	0.0571	0.0557	0.0552	NONROAD for tailpipe emissions; AP-42 Chapter 13.2.2 for unpaved road dust
	Scraper - 345kW - CAT 637	3	500	4	2.4	15	100	1.9861	0.0042	0.8046	0.1254	0.1224	0.1213	NONROAD for tailpipe emissions
	Snow Cat - 8 passenger - Tucker 1643RE	3	173	4	2.4	20	6	1.7344	0.0042	0.7374	0.1815	0.1771	0.1755	NONROAD for tailpipe emissions
	Service Truck - T300 Kenworth	2	280	8.9	5.3	30	13	0.6333	0.0036	0.1632	0.0218	0.0213	0.0211	NONROAD for tailpipe emissions; AP-42 Chapter 13.2.2 for unpaved road dust
	Welding Truck - T300 Kenworth	2	280	9.5	5.7	30	13	0.6333	0.0036	0.1632	0.0218	0.0213	0.0211	NONROAD for tailpipe emissions; AP-42 Chapter 13.2.2 for unpaved road dust
	Powerline Truck -	2	280	3.6	2.1	30	13	0.6333	0.0036	0.1632	0.0218	0.0213	0.0211	NONROAD for tailpipe emissions; AP-42 Chapter 13.2.2 for unpaved road dust
	Pick-ups	8	300	6	0.5	30	2.7	0.6333	0.0036	0.1632	0.0213	0.0213	0.0207	NONROAD for tailpipe emissions; AP-42 Chapter 13.2.2 for unpaved road dust
	Pick-ups	6	300	6	1.5	30	2.7	0.6333	0.0036	0.1632	0.0213	0.0213	0.0207	NONROAD for tailpipe emissions; AP-42 Chapter 13.2.2 for unpaved road dust
	Water Truck	1	251	8	-	20	36	0.6333	0.0036	0.1632	0.0213	0.0213	0.0207	NONROAD for tailpipe emissions; AP-42 Chapter 13.2.2 for unpaved road dust
	Flat Decks	2	100	6	2	30	38	0.6747	0.0036	0.2386	0.0402	0.0402	0.0390	NONROAD for tailpipe emissions; AP-42 Chapter 13.2.2 for unpaved road dust
	Man-lift	2	50	5	1	30	7.2	3.5450	0.0044	0.7266	0.1088	0.1088	0.1056	NONROAD for tailpipe emissions
	Sewage Truck	1	188	4	2	30	16	0.6333	0.0036	0.1632	0.0213	0.0213	0.0207	NONROAD for tailpipe emissions; AP-42 Chapter 13.2.2 for unpaved road dust
	Fork Lift	1	62	6	2	10	5.3	3.4713	0.0048	2.0068	0.2300	0.2300	0.2231	NONROAD for tailpipe emissions
	20 ton Crane	1	100	6	1	30	38	2.1908	0.0046	1.3585	0.1996	0.1996	0.1936	NONROAD for tailpipe emissions
	Busses	4	300	3	0.5	30	14.5	0.6333	0.0036	0.1632	0.0213	0.0213	0.0207	NONROAD for tailpipe emissions; AP-42 Chapter 13.2.2 for unpaved road dust

(continued)

Table 3-1b. Air Emission Sources and Characteristics during Construction (Year -1) (continued)

Activity Area	Equipment	Unit	Horsepower	Operation Hours per Day		Speed (km/hour)	Weight (tonne)	Emission Rates (g/hp-hr)						Reference Emission Factor
				Day (7 a.m. to 10 p.m.)	Night (10 p.m. to 7 a.m.)			NO_X	SO_2	CO	TSP	PM_{10}	$PM_{2.5}$	
Mine Area - Mining, Infrastructure and Mitchell OPC Equipment *(cont'd)*	Loaders	2	369	6	1	10	42	2.3981	0.0043	0.9735	0.1424	0.1424	0.1381	NONROAD for tailpipe emissions; AP-42 Chapter 11.9 for bulldozing
	Tracker/Trailer	1	370	6	1	30	60	2.1313	0.0042	0.8629	0.1292	0.1292	0.1253	NONROAD for tailpipe emissions; AP-42 Chapter 13.2.2 for unpaved road dust
	Service Truck	1	100	6	2	30	38	0.6747	0.0036	0.2386	0.0402	0.0402	0.0390	NONROAD for tailpipe emissions; AP-42 Chapter 13.2.2 for unpaved road dust
	Grader	1	193	6	2	10	2	1.2459	0.0039	0.4072	0.0751	0.0751	0.0728	NONROAD for tailpipe emissions; AP-42 Chapter 11.9 for grading
	Pick-ups	6	300	6	1.5	30	27	0.6333	0.0036	0.1632	0.0213	0.0213	0.0207	NONROAD for tailpipe emissions; AP-42 Chapter 13.2.2 for unpaved road dust
	Flat Decks	2	100	6	2	30	38	0.6747	0.0036	0.2386	0.0402	0.0402	0.0390	NONROAD for tailpipe emissions; AP-42 Chapter 13.2.2 for unpaved road dust
	12-ton High Boy	2	50	4	1	10	20	0.6747	0.0036	0.2386	0.0402	0.0402	0.0390	NONROAD for tailpipe emissions
	777 Heavy lift Crane	1	370	4	2	10	23.6	2.5831	0.0043	0.6678	0.1085	0.1085	0.1052	NONROAD for tailpipe emissions
	Man-lifts	4	50	6	1	10	7.2	3.5450	0.0044	0.7266	0.1088	0.1088	0.1056	NONROAD for tailpipe emissions
	Tracker/Trailer	2	370	4	2	30	60	2.1313	0.0042	0.8629	0.1292	0.1292	0.1253	NONROAD for tailpipe emissions; AP-42 Chapter 13.2.2 for unpaved road dust
	Fuel Truck	1	100	6	4	30	38	0.6747	0.0036	0.2386	0.0402	0.0402	0.0390	NONROAD for tailpipe emissions; AP-42 Chapter 13.2.2 for unpaved road dust
	Service Truck	1	100	6	3	30	38	0.6747	0.0036	0.2386	0.0402	0.0402	0.0390	NONROAD for tailpipe emissions; AP-42 Chapter 13.2.2 for unpaved road dust
	Tracker/Trailer	6	370	4	0.67	30	60	2.1313	0.0042	0.8629	0.1292	0.1292	0.1253	NONROAD for tailpipe emissions; AP-42 Chapter 13.2.2 for unpaved road dust
Mine Area - Water Storage Facility	D8-R	2	328	10	0	Not required	Not required	2.1313	0.0042	0.8629	0.1292	0.1292	0.1253	NONROAD for tailpipe emissions
	D10-R	1	613	10	0	Not required	Not required	2.1294	0.0042	1.2395	0.1324	0.1324	0.1284	NONROAD for tailpipe emissions
	315	1	122	10	0	Not required	Not required	1.2013	0.0039	0.5100	0.1179	0.1179	0.1143	NONROAD for tailpipe emissions
	330	1	263	10	0	Not required	Not required	1.0696	0.0038	0.3238	0.0566	0.0566	0.0549	NONROAD for tailpipe emissions
	365	1	404	10	0	Not required	Not required	1.6317	0.0041	0.6610	0.1041	0.1041	0.1010	NONROAD for tailpipe emissions
	375	1	404	10	0	Not required	Not required	1.6317	0.0041	0.6610	0.1041	0.1041	0.1010	NONROAD for tailpipe emissions
	EX1800	1	642	10	0	Not required	Not required	1.6437	0.0041	1.0012	0.1058	0.1058	0.1026	NONROAD for tailpipe emissions
	14-G	1	180	10	0	Not required	Not required	1.2459	0.0039	0.4072	0.0751	0.0751	0.0728	NONROAD for tailpipe emissions; AP-42 Chapter 11.9 for grading
	16-G	1	180	10	0	Not required	Not required	1.2459	0.0039	0.4072	0.0751	0.0751	0.0728	NONROAD for tailpipe emissions; AP-42 Chapter 11.9 for grading
	777-D	3	1,000	10	0	30	100	2.7121	0.0038	0.8347	0.0927	0.0927	0.0900	NONROAD for tailpipe emissions; AP-42 Chapter 13.2.2 for unpaved road dust
	773-Water	1	775	10	0	30	36	1.0624	0.0038	0.5786	0.0558	0.0558	0.0541	NONROAD for tailpipe emissions; AP-42 Chapter 13.2.2 for unpaved road dust
	730-Water	1	775	10	0	30	36	1.0624	0.0038	0.5786	0.0558	0.0558	0.0541	NONROAD for tailpipe emissions; AP-42 Chapter 13.2.2 for unpaved road dust
	740	5	436	10	0	30	2.7	1.0604	0.0038	0.3723	0.0557	0.0557	0.0540	NONROAD for tailpipe emissions; AP-42 Chapter 13.2.2 for unpaved road dust
	583	2	310	10	0	Not required	Not required	3.0035	0.0044	1.2900	0.1829	0.1829	0.1774	NONROAD for tailpipe emissions
	825	1	340	10	0	Not required	Not required	4.6061	0.0054	2.4364	0.3631	0.3631	0.3522	NONROAD for tailpipe emissions
	Drills	2	1,000	10	0	Not required	Not required	5.3576	0.0044	1.3931	0.2265	0.2265	0.2197	NONROAD for tailpipe emissions
	Pumps	5	107	10	0	Not required	Not required	2.1972	0.0043	0.8899	0.2023	0.2023	0.1962	NONROAD for tailpipe emissions
	Light Towers	3	14	10	0	Not required	Not required	4.4575	0.0055	2.4000	0.3532	0.3532	0.3426	NONROAD for tailpipe emissions
	Service	2	100	10	0	30	38	0.6747	0.0036	0.2386	0.0402	0.0402	0.0390	NONROAD for tailpipe emissions; AP-42 Chapter 13.2.2 for unpaved road dust
	Pick-ups	7	300	10	0	30	2.7	0.6333	0.0036	0.1632	0.0213	0.0213	0.0207	NONROAD for tailpipe emissions; AP-42 Chapter 13.2.2 for unpaved road dust
	Bus	1	300	10	0	30	14.5	0.6333	0.0036	0.1632	0.0213	0.0213	0.0207	NONROAD for tailpipe emissions; AP-42 Chapter 13.2.2 for unpaved road dust
TMF Area - Treaty OPC	Pick-ups	6	300	6	1.33	20-30	2.7	0.6333	0.0036	0.1632	0.0213	0.0213	0.0207	NONROAD for tailpipe emissions; AP-42 Chapter 13.2.2 for unpaved road dust
	Pick-ups	6	300	6	1.33	20-30	2.7	0.6333	0.0036	0.1632	0.0213	0.0213	0.0207	NONROAD for tailpipe emissions; AP-42 Chapter 13.2.2 for unpaved road dust
	Water Truck	1	251	8	-	10-20	36	0.6333	0.0036	0.1632	0.0213	0.0213	0.0207	NONROAD for tailpipe emissions; AP-42 Chapter 13.2.2 for unpaved road dust
	Flat Decks	2	100	6	2	20-30	38	0.6747	0.0036	0.2386	0.0402	0.0402	0.0390	NONROAD for tailpipe emissions; AP-42 Chapter 13.2.2 for unpaved road dust
	Man-lift	2	50	6	1	5-10	7.192	3.5450	0.0044	0.7266	0.1088	0.1088	0.1056	NONROAD for tailpipe emissions
	Sewage Truck	1	188	4	2	20-30	16	0.6333	0.0036	0.1632	0.0213	0.0213	0.0207	NONROAD for tailpipe emissions; AP-42 Chapter 13.2.2 for unpaved road dust
	Fork Lift	1	62	6	2	5-10	5.3	3.4713	0.0048	2.0068	0.2300	0.2300	0.2231	NONROAD for tailpipe emissions
	20 ton Crane	1	100	6	1	20-30	38	2.1908	0.0046	1.3585	0.1996	0.1996	0.1936	NONROAD for tailpipe emissions
	Busses	4	300	3	0.5	20-30	14.5	0.6333	0.0036	0.1632	0.0213	0.0213	0.0207	NONROAD for tailpipe emissions; AP-42 Chapter 13.2.2 for unpaved road dust
	Loaders	2	369	6	1	5-10	42	2.3981	0.0043	0.9735	0.1424	0.1424	0.1381	NONROAD for tailpipe emissions; AP-42 Chapter 11.9 for bulldozing
	Tracker/Trailer	1	370	6	1	20-30	60	2.1313	0.0042	0.8629	0.1292	0.1292	0.1253	NONROAD for tailpipe emissions; AP-42 Chapter 13.2.2 for unpaved road dust
	Service Truck	1	100	6	2	20-30	38	0.6747	0.0036	0.2386	0.0402	0.0402	0.0390	NONROAD for tailpipe emissions; AP-42 Chapter 13.2.2 for unpaved road dust
	Grader	1	193	6	2	5-10	19.815	1.2459	0.0039	0.4072	0.0751	0.0751	0.0728	NONROAD for tailpipe emissions; AP-42 Chapter 11.9 for grading

(continued)

Table 3-1b. Air Emission Sources and Characteristics during Construction (Year -1) (completed)

Activity Area	Equipment	Unit	Horsepower	Operation Hours per Day		Speed (km/hour)	Weight (tonne)	Emission Rates (g/hp-hr)						Reference Emission Factor
				Day (7 a.m. to 10 p.m.)	Night (10 p.m. to 7 a.m.)			NO_X	SO_2	CO	TSP	PM_{10}	$PM_{2.5}$	
TMF Area - Treaty OPC *(cont'd)*	Pick-ups	6	300	6	0.67	20-30	2.7	0.6333	0.0036	0.1632	0.0213	0.0213	0.0207	NONROAD for tailpipe emissions; AP-42 Chapter 13.2.2 for unpaved road dust
	Flat Decks	2	100	6	2	20-30	38	0.6747	0.0036	0.2386	0.0402	0.0402	0.0390	NONROAD for tailpipe emissions; AP-42 Chapter 13.2.2 for unpaved road dust
	12-ton High Boy	2	50	4	1	5-10	20	0.6747	0.0036	0.2386	0.0402	0.0402	0.0390	NONROAD for tailpipe emissions
	777 Heavy lift Crane	2	370	4	1	5-10	23.6	2.5831	0.0043	0.6678	0.1085	0.1085	0.1052	NONROAD for tailpipe emissions
	Man-lifts	4	50	5	0.5	5-10	7.192	3.5450	0.0044	0.7266	0.1088	0.1088	0.1056	NONROAD for tailpipe emissions
	Tracker/Trailer	2	370	6	0.5	20-30	60	2.1313	0.0042	0.8629	0.1292	0.1292	0.1253	NONROAD for tailpipe emissions; AP-42 Chapter 13.2.2 for unpaved road dust
	Fuel Truck	1	100	6	2	20-30	38	0.6747	0.0036	0.2386	0.0402	0.0402	0.0390	NONROAD for tailpipe emissions; AP-42 Chapter 13.2.2 for unpaved road dust
	Service Truck	1	100	6	3	20-30	38	0.6747	0.0036	0.2386	0.0402	0.0402	0.0390	NONROAD for tailpipe emissions; AP-42 Chapter 13.2.2 for unpaved road dust
	Tracker/Trailer	6	370	4	1	20-30	60	2.1313	0.0042	0.8629	0.1292	0.1292	0.1253	NONROAD for tailpipe emissions; AP-42 Chapter 13.2.2 for unpaved road dust
TMF Area - Tailing Management Facility	Cat D8-R Dozer	5	328	10	0	30	73	2.1313	0.0042	0.8629	0.1292	0.1292	0.1253	NONROAD for tailpipe emissions
	Cat D10-R Dozer	5	613	10	0	30	73	2.1294	0.0042	1.2395	0.1324	0.1324	0.1284	NONROAD for tailpipe emissions
	Cat 315 Excavator	1	122	10	0	30	19	1.2013	0.0039	0.5100	0.1179	0.1179	0.1143	NONROAD for tailpipe emissions
	Cat 330 Excavator	1	263	10	0	30	40	1.0696	0.0038	0.3238	0.0566	0.0566	0.0549	NONROAD for tailpipe emissions
	Cat 350 Excavator	1	334	10	0	30	70	1.6317	0.0041	0.6610	0.1041	0.1041	0.1010	NONROAD for tailpipe emissions
	Cat 365 Excavator	3	404	10	0	30	70	1.6317	0.0041	0.6610	0.1041	0.1041	0.1010	NONROAD for tailpipe emissions
	Komatsu EX1800	3	642	10	0	30	15	1.6437	0.0041	1.0012	0.1058	0.1058	0.1026	NONROAD for tailpipe emissions
	Cat 980 Loader	1	353	10	0	30	34	2.3981	0.0043	0.9735	0.1424	0.1424	0.1381	NONROAD for tailpipe emissions
	Cat 14 Grader	2	180	10	0	10	18.5	1.2459	0.0039	0.4072	0.0751	0.0751	0.0728	NONROAD for tailpipe emissions; AP-42 Chapter 11.9 for grading
	Cat 16 Grader	3	180	10	0	10	18.5	1.2459	0.0039	0.4072	0.0751	0.0751	0.0728	NONROAD for tailpipe emissions; AP-42 Chapter 11.9 for grading
	Cat 777-D Truck	8	1,000	10	0	30	100	2.7121	0.0038	0.8347	0.0927	0.0927	0.0900	NONROAD for tailpipe emissions; AP-42 Chapter 13.2.2 for unpaved road dust
	Cat 773 Water Truck	3	775	10	0	30	36	1.0624	0.0038	0.5786	0.0558	0.0558	0.0541	NONROAD for tailpipe emissions; AP-42 Chapter 13.2.2 for unpaved road dust
	Cat 730 Water Truck	3	775	10	0	30	36	1.0624	0.0038	0.5786	0.0558	0.0558	0.0541	NONROAD for tailpipe emissions; AP-42 Chapter 13.2.2 for unpaved road dust
	Cat 740 Articulated Truck	8	436	10	0	30	2.7	1.0604	0.0038	0.3723	0.0557	0.0557	0.0540	NONROAD for tailpipe emissions; AP-42 Chapter 13.2.2 for unpaved road dust
	Cat 583 Compactor	2	310	10	0	Not required	Not required	3.0035	0.0044	1.2900	0.1829	0.1829	0.1774	NONROAD for tailpipe emissions
	Cat 825 Compactor	4	340	10	0	Not required	Not required	4.6061	0.0054	2.4364	0.3631	0.3631	0.3522	NONROAD for tailpipe emissions
	Drills	1	1,000	10	0	Not required	Not required	5.3576	0.0044	1.3931	0.2265	0.2265	0.2197	NONROAD for tailpipe emissions
	Pumps	4	107	10	0	Not required	Not required	2.1972	0.0043	0.8899	0.2023	0.2023	0.1962	NONROAD for tailpipe emissions
	Light Towers	5	14	10	0	Not required	Not required	4.4575	0.0055	2.4000	0.3532	0.3532	0.3426	NONROAD for tailpipe emissions
	Service	3	100	10	0	30	38	0.6747	0.0036	0.2386	0.0402	0.0402	0.0390	NONROAD for tailpipe emissions; AP-42 Chapter 13.2.2 for unpaved road dust
	Pick-ups	25	300	10	0	30	2.7	0.6333	0.0036	0.1632	0.0213	0.0213	0.0207	NONROAD for tailpipe emissions; AP-42 Chapter 13.2.2 for unpaved road dust
	Bus	2	300	10	0	30	14.5	0.6333	0.0036	0.1632	0.0213	0.0213	0.0207	NONROAD for tailpipe emissions; AP-42 Chapter 13.2.2 for unpaved road dust
Mitchell-Treaty Tunnel - Equipment per Heading	3.5yd Loader	1	201	3	0	30	42	0.3521	0.0009	0.1193	0.0233	0.0233	0.0226	NONROAD for tailpipe emissions; AP-42 Chapter 11.9 for bulldozing
	30 T Truck	2	400	12	0	30	30	3.7157	0.0132	1.3044	0.1951	0.1951	0.1892	NONROAD for tailpipe emissions; AP-42 Chapter 13.2.2 for unpaved road dust
	6yd Loader	1	295	9	0	30	42	1.5503	0.0039	0.5253	0.1027	0.1027	0.0996	NONROAD for tailpipe emissions; AP-42 Chapter 11.9 for bulldozing
	Bolter	1	149	3	0	Not required	not required	0.3585	0.0007	0.1452	0.0330	0.0330	0.0320	NONROAD for tailpipe emissions; AP-42 Chapter 13.2.2 for unpaved road dust
	Boom Truck	1	201	3	0	30	13	0.1394	0.0008	0.0359	0.0047	0.0047	0.0045	NONROAD for tailpipe emissions; AP-42 Chapter 13.2.2 for unpaved road dust
	Cobra 3 Tractor	1	137	2.25	0	30	60	0.4116	0.0006	0.2401	0.0491	0.0491	0.0476	NONROAD for tailpipe emissions
	Jumbo 2B E/H	1	149	2.25	0	Not required	not required	0.4737	0.0005	0.1341	0.0291	0.0291	0.0282	NONROAD for tailpipe emissions
	Lube / Fuel Truck	1	201	3	0	30	38	0.1394	0.0008	0.0359	0.0047	0.0047	0.0045	NONROAD for tailpipe emissions; AP-42 Chapter 13.2.2 for unpaved road dust
	Scissor Lift	1	137	4.5	0	Not required	not required	0.4489	0.0010	0.1846	0.0431	0.0431	0.0418	NONROAD for tailpipe emissions
	Tractors	5	101	4.5	0	30	60	3.0345	0.0043	1.7703	0.3617	0.3617	0.3508	NONROAD for tailpipe emissions

Table 3-1c. Air Emission Sources and Characteristics during Construction (Year -1)

Sources		Emission Factor						Notes
		NO_X	SO_2	CO	TPS	PM_{10}	$PM_{2.5}$	
Blasting	AP-42 Chapter 11.9 for blasting of overburden	**kg/blast**						Area per blast is 4,190.5 m^2
		-	62	2,095	1,140	593	34	
Drilling	AP-42 Chapter 13.3	**kg/hole**						58 holes per blast
		-	-	-	0.59	0.3	0.09	
Unpaved road dust	AP-42 Chapter 13.2.2	**g/km**						Assume road water to 4% moisture ratio and 87.5% control efficiency
	48' Flat-Deck	-	-	-	0.389	0.109	0.011	
	Vans (Enclosed Trailers)	-	-	-	0.264	0.074	0.007	
	Bus & Passenger Vehicles	-	-	-	0.232	0.065	0.006	
	Bulk Tanker	-	-	-	0.478	0.133	0.013	
	Tanker (45,000 L)	-	-	-	0.389	0.109	0.011	
Paved road dust	Testing Re-entrained Aerosol Kinetic Emissions from Roads (TRAKER) by DRI, adjusted based on weight	**g/km**						Speciation obtained from AP-42 Chapter 13.2.1 Particle Size Multipliers for Paved Road Equation
		-	-	-	0.865	0.166	0.040	
Land clearing	AP-42 C13.1 Alaska (Region 10)	**kg/hectare**						Assume forest fire. PM_{10} and $PM_{2.5}$ speciation obtained from California Environmental Protection Agency (CEIDARS). Source 136: agricultural burning
		-	-	-	305	268	259	
Construction of Buildings at Plant Site	AP-42 C13.2.3	**Mg/hectare/month**						Speciation obtained from AP-42 Appendix B Source #3
		-	-	-	2.69	1.37	0.40	
Bulldozing	AP-42 Chapter 11.9 for bulldozing of overburden	**kg/hour**						Silt content 7.5%; moisture content 9.3%
		-	-	-	1.61	0.31	0.17	
Grading	AP-42 Chapter 11.9 for grading	**kg/km**						Silt content 7.5%
		-	-	-	0.52	0.19	0.02	
Material drop	AP-42 Chapter 13.2.4	**kg/Mg**						Average wind speed 2.08 m/s; moisture content 9.3%
		-	-	-	1.28E-04	6.05E-05	9.17E-06	

The estimates from NONROAD are conservative. The model outputs have built in adjustments for in-use operation versus new engine test results (e.g., deterioration and transient operation). Given the inherent conservative estimations in NONROAD, the emission factors used for the KSM project air emissions inventory provide appropriate representation of a worst-case scenario.

Other emission factors used in the KSM air dispersion modelling assessment are provided in the US EPA's AP-42 document – *Compilation of Air Pollutant Emission Factors, Volume 1 – Stationary Point and Area Sources* – 5th Edition (US EPA 1995). As part of the rigorous assessment of US EPA published emission factors, each AP-42 emission factor is assigned a quality rating from "A" to "F". A quality rating of "A" (excellent) indicates that the factor is developed from source tests which are performed by "a sound or generally sound methodology and a1re reported in enough detail for adequate validation" and data are taken from "many randomly chosen facilities in the industry population" (BC MOE 2008). On the other end of the spectrum, a quality rating of "F" (poor) indicates that the factor is developed from "a generally unacceptable method, but the method may provide an order-of-magnitude value for the source" and "the facilities tested do not represent a random sample of the industry" (BC MOE 2008). Emission factors from explosives detonation (ANFO) came from AP-42 section 13.3 *Explosives Detonation* (quality rating = "D" or below average). Generator emissions were obtained from manufacturer specifications provided by Seabridge. Incinerator emissions were estimated based on information from the Snap Lake Diamond Mine EIS. The camp used a CA-600 incinerator by EcoWaste Solution for camp size of 260 people. The incinerator emissions were scaled using number of employees at the camp as camp waste is typically proportional to the number of employees.

Figure 3-2 summarizes the Project's mined material flow chart. Figure 3-3 shows the locations of various air emissions during construction and Figure 3-4 shows the location of the various air emissions for operations.

Fugitive dust will be modelled separately from the diesel emissions as per the BC MOE guidelines recommend modelling procedure. The rational for this is that there are large uncertainties associated with fugitive dust emission factors from AP-42. Various AP-42 emission factors will be used for the construction and operation scenarios for fugitive dust for unpaved road. For paved road, emission factor for PM_{10} was obtained from a study done to assess alternative technologies for evaluating paved-road dust emissions. The vehicle-based mobile sampling system was assessed to be used as an alternative to traditional paved road silt sampling. This Testing Re-entrained Aerosol Kinetic Emissions from Roads (TRAKER) system was developed by Nevada System of Higher Education's Desert Research Institute (DRI) and testing was performed on different types of paved road. The average emission factor for PM_{10} from the study for freeway was selected for Highway 37.

The crushers are connected to baghouses for which flowrates and particulate outlet concentrations were provided. Blasting, drilling, grading and bulldozing emissions factors were obtained from AP-42 Chapter 11.9 for overburden.

The coarse ore stockpiles at the exit portal of the MTT at the Treaty OPC site will be enclosed and therefore not be a source of fugitive dust emissions from wind erosion. The following stockpiles on the mine site will not be enclosed: overburden stockpiles, a low grade ore stockpile to the west of the Mitchell OPC, a coarse ROM ore storage pile adjacent to the Mitchell OPC, and the McTagg, Mitchell, Temporary Sulphurets, and Sulphurets RSF. The majority of the material storage in the RSF and ROM ore stockpiles are in the larger size fractions, with less than 20% smaller than 5 cm. The overburden stockpiles have a greater potential to be a source of emissions due to wind erosion.

Table 3-2a. Air Emission Sources and Characteristics during Operation (Year 4)

Stack Description	Prime Power (kW)	Stack Height (m above ground)	Stack Inner Diameter (m)	Volumetric Flow Rate (m3/min)	Exit Velocity (m/s)	Exhaust Temperature (oC)	Emission Rates (g/s)						Reference Emission Factor
							NO_X	SO_2	CO	TSP	PM_{10}	$PM_{2.5}$	
Mitchell Primary Crusher baghouse	-	9	1.500	2124	20	Ambient	-	-	-	1.57E-01	1.57E-01	1.24E-01	Manufactorer's specification adjusted
Mitchell Coarse Ore Reclaim baghouse - before MTT	-	9	1.000	1274	27	Ambient	-	-	-	9.40E-02	9.40E-02	7.41E-02	Manufactorer's specification adjusted
Mitchell Coarse Ore Reclaim baghouse - after MTT	-	9	1.500	2124	20	Ambient	-	-	-	1.57E-01	1.57E-01	1.24E-01	Manufactorer's specification adjusted
Cone Crusher Building baghouse 1	-	9	1.500	2832	27	Ambient	-	-	-	2.09E-01	2.09E-01	1.65E-01	Manufactorer's specification adjusted
Cone Crusher Building baghouse 2	-	9	1.500	2832	27	Ambient	-	-	-	2.09E-01	2.09E-01	1.65E-01	Manufactorer's specification adjusted
Fine Ore Stockpile bagthouse	-	9	1.000	1274	27	Ambient	-	-	-	9.40E-02	9.40E-02	7.41E-02	Manufactorer's specification adjusted
HPGR baghouse #1	-	9	1.000	1274	27	Ambient	-	-	-	9.40E-02	9.40E-02	7.41E-02	Manufactorer's specification adjusted
Mitchell Operating Camp generator	400	9	0.203	91	47	470.2	1.68E+00	2.64E-04	4.53E-01	1.98E-02	1.90E-02	1.78E-02	Manufactorer's specification adjusted based size
Treaty Operating Camp generator	400	9	0.203	91	47	470.2	1.68E+00	2.64E-04	4.53E-01	1.98E-02	1.90E-02	1.78E-02	Manufactorer's specification adjusted based size
Mitchell Operating Camp incinerator (350 person)	-	9	0.356	353	59	1000	1.56E-02	0.00E+00	0.00E+00	1.87E-01	9.35E-02	6.23E-02	EcoWaste Solution emissions adjusted based on camp size
Treaty Operating Camp incinerator (250 person)	-	9	0.356	353	59	1000	1.11E-02	0.00E+00	0.00E+00	1.34E-01	6.68E-02	4.45E-02	EcoWaste Solution emissions adjusted based on camp size
Adits (Tunnel 1) exhaust	-	Horizontal stack	3.4	3061	5.6	Ambient	1.18E-01	2.34E-04	4.79E-02	1.32E-01	1.32E-01	4.45E-02	ACGIH standard and tractor emission. Stack parameter calculated based on BC Mode Guideline section 11.6
Adits (Tunnel 2) exhaust	-	Horizontal stack	3.9	2961	4.1	Ambient	1.18E-01	2.34E-04	4.79E-02	1.32E-01	1.32E-01	4.45E-02	ACGIH standard and tractor emission. Stack parameter calculated based on BC Mode Guideline section 11.6

Table 3-2b. Air Emission Sources and Characteristics during Operation (Year 4)

Activity Area	Equipment	Unit	Horsepower	Operation Hours per Day		Speed (km/hour)	Weight (tonne)	Emission Rates (g/hp-hr)						Reference Emission Factor
				Day (7 a.m. to 10 p.m.)	Night (10 p.m. to 7 a.m.)			NO_X	SO_2	CO	TSP	PM_{10}	$PM_{2.5}$	
Mine Area – Mining, Infrastructure and Mitchell OPC Equipment	P&H 250XPC: Drill	3	850	9.4	5.7	Not required	Not required	5.3576	0.0044	1.3931	0.2321	0.2265	0.2244	NONROAD for tailpipe emissions
	Sandvik D245S	4	475	4.2	2.5	Not required	Not required	3.8949	0.0044	1.1523	0.1857	0.1812	0.1795	NONROAD for tailpipe emissions
	FEL Blast Hole Stemmer CAT 930H	2	149	5.9	3.6	Not required	Not required	1.7344	0.0042	0.7374	0.1815	0.1771	0.1755	NONROAD for tailpipe emissions
	Hydraulic Shovel EX8000	2	3,880	12.0	7.2	Not required	Not required	3.2539	0.0041	0.9811	0.1329	0.1297	0.1285	NONROAD for tailpipe emissions
	Dozer CAT D10	6	646	8.4	5.0	Not required	Not required	1.9376	0.0042	1.1513	0.1256	0.1226	0.1215	NONROAD for tailpipe emissions
	Wheel Dozer CAT 834H	3	525	8.4	5.0	Not required	Not required	2.3981	0.0043	0.9735	0.1459	0.1424	0.1411	NONROAD for tailpipe emissions
	Fuel/Lube Truck CAT 740	3	489	7.1	4.3	Not required	Not required	1.0604	0.0038	0.3723	0.0571	0.0557	0.0552	NONROAD for tailpipe emissions
	Front End Loader CAT 988	3	555	9.6	5.7	Not required	Not required	2.3981	0.0043	0.9735	0.1459	0.1424	0.1411	NONROAD for tailpipe emissions
	Front End Loader CAT 988H	2	555	4.7	2.8	Not required	Not required	2.3981	0.0043	0.9735	0.1459	0.1424	0.1411	NONROAD for tailpipe emissions
	Excavator - 390kW - CAT 390	2	513	8.8	5.3	Not required	Not required	1.6317	0.0041	0.661	0.1067	0.1041	0.1031	NONROAD for tailpipe emissions
	Water Pump - 1400 gal/min - LH8110	6	150	9.5	5.7	Not required	Not required	2.1972	0.0043	0.8899	0.2073	0.2023	0.2004	NONROAD for tailpipe emissions
	Light Plant - 20kW -	6	27	6.3	3.8	Not required	Not required	3.6112	0.0045	0.7957	0.1254	0.1224	0.1213	NONROAD for tailpipe emissions
	Crane - 250t - LTM1250	2	600	2.4	1.4	Not required	Not required	2.5831	0.0043	0.6678	0.1112	0.1085	0.1075	NONROAD for tailpipe emissions
	Excavator - 283kW - CAT 345	4	380	8.3	5.0	Not required	Not required	1.6317	0.0041	0.661	0.1067	0.1041	0.1031	NONROAD for tailpipe emissions
	Mobile Screening Plant - Sanvik QA430	1	100	2.7	1.6	Not required	Not required	2.2895	0.0046	1.4019	0.2122	0.2071	0.2052	NONROAD for tailpipe emissions
	Crane - 100t - LTM1100	2	175	4.0	2.4	Not required	Not required	1.8187	0.0041	0.5026	0.1303	0.1272	0.1260	NONROAD for tailpipe emissions
	FEL - 373kW - CAT988	1	555	6.7	4.0	Not required	Not required	2.3981	0.0043	0.9735	0.1459	0.1424	0.1411	NONROAD for tailpipe emissions
	Crane - 40t - LTM1040	2	280	3.3	2.0	Not required	Not required	1.6719	0.004	0.3707	0.0784	0.0765	0.0758	NONROAD for tailpipe emissions
	Forklift - 30t - Hyster H650HSD	1	230	5.9	3.6	Not required	Not required	1.8265	0.0041	0.6172	0.1249	0.1219	0.1208	NONROAD for tailpipe emissions
	Forklift - 10t - Hyster H210HD	2	155	5.9	3.6	Not required	Not required	1.9949	0.0042	0.8203	0.1962	0.1915	0.1897	NONROAD for tailpipe emissions
	Haul Truck CAT 797F	54	4,000	4.3	0.0	30	688	2.7121	0.0038	0.8347	0.0950	0.0927	0.0918	NONROAD for tailpipe emissions; AP-42 Chapter 13.2.2 for unpaved road dust
	Water Truck 777F	2	1,016	7.1	4.3	12	180	2.7121	0.0038	0.8347	0.0950	0.0927	0.0918	NONROAD for tailpipe emissions; AP-42 Chapter 13.2.2 for unpaved road dust
	Dozer D10T	4	646	8.3	5.0	5	73	1.9376	0.0042	1.1513	0.1256	0.1226	0.1215	NONROAD for tailpipe emissions; AP-42 Chapter 13.2.2 for unpaved road dust
	Grader CAT 24M	4	533	8.3	5.0	12	73	1.8859	0.0042	0.7642	0.1206	0.1177	0.1166	NONROAD for tailpipe emissions; AP-42 Chapter 13.2.2 for unpaved road dust
	Dozer - 433kW - DAT D10T	2	646	8.3	5.0	5	73	1.9376	0.0042	1.1513	0.1256	0.1226	0.1215	NONROAD for tailpipe emissions; AP-42 Chapter 13.2.2 for unpaved road dust
	Tractor/Trailer - 170t - CAT 789	1	1,900	2.5	1.5	30	358	3.7299	0.0042	1.1463	0.1630	0.1591	0.1576	NONROAD for tailpipe emissions; AP-42 Chapter 13.2.2 for unpaved road dust
	Crew Cab Pickup - Chevy Silverado 3500	18	322	5.9	3.6	30	4	1.0604	0.0038	0.3723	0.0571	0.0557	0.0552	NONROAD for tailpipe emissions; AP-42 Chapter 13.2.2 for unpaved road dust
	Ambulance -	1	322	1.2	0.7	30	6	1.0604	0.0038	0.3723	0.0571	0.0557	0.0552	NONROAD for tailpipe emissions; AP-42 Chapter 13.2.2 for unpaved road dust
	Mine Rescue Truck -	1	322	0.6	0.4	30	18	1.0604	0.0038	0.3723	0.0571	0.0557	0.0552	NONROAD for tailpipe emissions; AP-42 Chapter 13.2.2 for unpaved road dust
	47 passenger -	4	280	4.0	2.4	30	18	0.6333	0.0036	0.1632	0.0218	0.0213	0.0211	NONROAD for tailpipe emissions; AP-42 Chapter 13.2.2 for unpaved road dust
	Maintenance Truck - 1t - Ford F550	5	350	10.0	6.0	30	10	1.0604	0.0038	0.3723	0.0571	0.0557	0.0552	NONROAD for tailpipe emissions; AP-42 Chapter 13.2.2 for unpaved road dust
	Fire Truck - T800 Kenworth	1	280	0.7	0.4	30	11	0.6333	0.0036	0.1632	0.0218	0.0213	0.0211	NONROAD for tailpipe emissions; AP-42 Chapter 13.2.2 for unpaved road dust
	Picker Truck - C500 Kenworth	2	380	4.0	2.4	30	15	1.0604	0.0038	0.3723	0.0571	0.0557	0.0552	NONROAD for tailpipe emissions; AP-42 Chapter 13.2.2 for unpaved road dust
	Scraper - 345kW - CAT 637	5	500	4.0	2.4	15	100	1.9861	0.0042	0.8046	0.1254	0.1224	0.1213	NONROAD for tailpipe emissions; AP-42 Chapter 13.2.2 for unpaved road dust
	Snow Cat - 8 passenger - Tucker 1643RE	6	173	4.0	2.4	20	6	1.7344	0.0042	0.7374	0.1815	0.1771	0.1755	NONROAD for tailpipe emissions; AP-42 Chapter 13.2.2 for unpaved road dust
	Service Truck - T300 Kenworth	5	280	8.9	5.3	30	13	0.6333	0.0036	0.1632	0.0218	0.0213	0.0211	NONROAD for tailpipe emissions; AP-42 Chapter 13.2.2 for unpaved road dust
	Welding Truck - T300 Kenworth	4	280	9.5	5.7	30	13	0.6333	0.0036	0.1632	0.0218	0.0213	0.0211	NONROAD for tailpipe emissions; AP-42 Chapter 13.2.2 for unpaved road dust
	Powerline Truck -	2	280	3.6	2.1	30	13	0.6333	0.0036	0.1632	0.0218	0.0213	0.0211	NONROAD for tailpipe emissions; AP-42 Chapter 13.2.2 for unpaved road dust
	Backhoe Loader	2	100	5	1	10	10	3.9405	0.0058	4.8946	0.7068	0.7068	0.6856	NONROAD for tailpipe emissions; AP-42 Chapter 13.2.2 for unpaved road dust
	Dump Truck (20 tonne capacity)	2	410	5	1	30	33	1.0604	0.0038	0.3723	0.0557	0.0557	0.0540	NONROAD for tailpipe emissions; AP-42 Chapter 13.2.2 for unpaved road dust
	Bus - 37 Passenger	7	240	1	-	30	14	0.6333	0.0036	0.1632	0.0213	0.0213	0.0207	NONROAD for tailpipe emissions; AP-42 Chapter 13.2.2 for unpaved road dust
	Forklift (1,800 kg capacity)	4	62	4	1	10	5	3.4713	0.0048	2.0068	0.2300	0.2300	0.2231	NONROAD for tailpipe emissions; AP-42 Chapter 13.2.2 for unpaved road dust
	Bobcat	1	92	2	2	10	4	2.0787	0.0046	2.0028	0.2639	0.2639	0.2560	NONROAD for tailpipe emissions; AP-42 Chapter 13.2.2 for unpaved road dust
	Forklift - Large (10,000 kg capacity)	2	164	1	1	10	23	1.9949	0.0042	0.8203	0.1915	0.1915	0.1857	NONROAD for tailpipe emissions; AP-42 Chapter 13.2.2 for unpaved road dust
	Crane - 100T	1	300	2	1	20	160	1.6719	0.0040	0.3707	0.0765	0.0765	0.0742	NONROAD for tailpipe emissions; AP-42 Chapter 13.2.2 for unpaved road dust
	Boom Truck - 20T	1	100	6	3	30	38	0.6747	0.0036	0.2386	0.0402	0.0402	0.0390	NONROAD for tailpipe emissions; AP-42 Chapter 13.2.2 for unpaved road dust
	Loader F/E	2	369	3	1	10	42	2.3981	0.0043	0.9735	0.1424	0.1424	0.1381	NONROAD for tailpipe emissions; AP-42 Chapter 13.2.2 for unpaved road dust
	Passenger Van	2	300	6	2	30	3	0.6333	0.0036	0.1632	0.0213	0.0213	0.0207	NONROAD for tailpipe emissions; AP-42 Chapter 13.2.2 for unpaved road dust

(continued)

Table 3-2b. Air Emission Sources and Characteristics during Operation (Year 4) (completed)

Activity Area	Equipment	Unit	Horsepower	Operation Hours per Day		Speed (km/hour)	Weight (tonne)	Emission Rates (g/hp-hr)						Reference Emission Factor
				Day (7 a.m. to 10 p.m.)	Night (10 p.m. to 7 a.m.)			NO_X	SO_2	CO	TSP	PM_{10}	$PM_{2.5}$	
Mine Area – Mining, Infrastructure and Mitchell OPC Equipment *(cont'd)*	Truck 1/2 tonne	8	300	4.5	1	30	3	0.6333	0.0036	0.1632	0.0213	0.0213	0.0207	NONROAD for tailpipe emissions; AP-42 Chapter 13.2.2 for unpaved road dust
	Snow plow/sanding truck	1	400	6	3	20	4	1.0604	0.0038	0.3723	0.0557	0.0557	0.0540	NONROAD for tailpipe emissions; AP-42 Chapter 13.2.2 for unpaved road dust
	Tool Truck	2	401	4	1	30	5	1.0604	0.0038	0.3723	0.0557	0.0557	0.0540	NONROAD for tailpipe emissions; AP-42 Chapter 13.2.2 for unpaved road dust
	HDPE fusion machine	1	67	1	1	30	3	3.5854	0.0049	2.1632	0.2563	0.2563	0.2486	NONROAD for tailpipe emissions; AP-42 Chapter 13.2.2 for unpaved road dust
	Culvert de-icing machine	2	300	2	1	30	3	2.0264	0.0042	0.6816	0.1334	0.1334	0.1294	NONROAD for tailpipe emissions; AP-42 Chapter 13.2.2 for unpaved road dust
	Water Trucks	2	100	6	1	60	4	0.6747	0.0036	0.2386	0.0402	0.0402	0.0390	NONROAD for tailpipe emissions; AP-42 Chapter 13.2.2 for unpaved road dust
TMF Area - Treaty OPC	Backhoe Loader	4	100	5	1	10	10	3.9405	0.0058	4.8946	0.7068	0.7068	0.6856	NONROAD for tailpipe emissions; AP-42 Chapter 13.2.2 for unpaved road dust
	Dump Truck (20 tonne capacity)	4	410	5	1	30	33	1.0604	0.0038	0.3723	0.0557	0.0557	0.0540	NONROAD for tailpipe emissions; AP-42 Chapter 13.2.2 for unpaved road dust
	Forklift (1,800 kg capacity)	4	62	4	1	10	5	3.4713	0.0048	2.0068	0.2300	0.2300	0.2231	NONROAD for tailpipe emissions; AP-42 Chapter 13.2.2 for unpaved road dust
	Bobcat	3	92	2	2	10	4	2.0787	0.0046	2.0028	0.2639	0.2639	0.2560	NONROAD for tailpipe emissions; AP-42 Chapter 13.2.2 for unpaved road dust
	Forklift - Large (10,000 kg capacity)	4	164	1	1	10	23	1.9949	0.0042	0.8203	0.1915	0.1915	0.1857	NONROAD for tailpipe emissions; AP-42 Chapter 13.2.2 for unpaved road dust
	Crane - 100T	1	300	2	1	20	160	1.6719	0.0040	0.3707	0.0765	0.0765	0.0742	NONROAD for tailpipe emissions; AP-42 Chapter 13.2.2 for unpaved road dust
	Boom Truck - 20T	1	100	6	3	30	38	0.6747	0.0036	0.2386	0.0402	0.0402	0.0390	NONROAD for tailpipe emissions; AP-42 Chapter 13.2.2 for unpaved road dust
	Loader F/E	2	369	3	1	10	42	2.3981	0.0043	0.9735	0.1424	0.1424	0.1381	NONROAD for tailpipe emissions; AP-42 Chapter 13.2.2 for unpaved road dust
	Passenger van	2	300	4	2	30	3	0.6333	0.0036	0.1632	0.0213	0.0213	0.0207	NONROAD for tailpipe emissions; AP-42 Chapter 13.2.2 for unpaved road dust
	Truck 1/2 tonne	10	300	5	2	30	3	0.6333	0.0036	0.1632	0.0213	0.0213	0.0207	NONROAD for tailpipe emissions; AP-42 Chapter 13.2.2 for unpaved road dust
	Snow plow/sanding truck	2	400	6	3	20	4	1.0604	0.0038	0.3723	0.0557	0.0557	0.0540	NONROAD for tailpipe emissions; AP-42 Chapter 13.2.2 for unpaved road dust
	Tool Truck	2	401	4	1	30	5	1.0604	0.0038	0.3723	0.0557	0.0557	0.0540	NONROAD for tailpipe emissions; AP-42 Chapter 13.2.2 for unpaved road dust
	HDPE fusion machine	1	38	1	1	30	3	3.5854	0.0049	2.1632	0.2563	0.2563	0.2486	NONROAD for tailpipe emissions; AP-42 Chapter 13.2.2 for unpaved road dust
	Culvert press washer	2	38	2	1	10	1	2.0264	0.0042	0.6816	0.1334	0.1334	0.1294	NONROAD for tailpipe emissions; AP-42 Chapter 13.2.2 for unpaved road dust
	Water Trucks	1	100	4	1	20	28	0.6747	0.0036	0.2386	0.0402	0.0402	0.0390	NONROAD for tailpipe emissions; AP-42 Chapter 13.2.2 for unpaved road dust
TMF Area – Tailing Management Facility	50 tonne haul trucks	4.5	325	10	0	30	50	1.0604	0.0038	0.3723	0.0557	0.0557	0.0540	NONROAD for tailpipe emissions; AP-42 Chapter 13.2.2 for unpaved road dust
	Front end loader	1	555	10	0	Not required	Not required	2.1313	0.0042	0.8629	0.1292	0.1292	0.1253	NONROAD for tailpipe emissions
	Excavator	1	513	10	0	Not required	Not required	1.6317	0.0041	0.6610	0.1041	0.1041	0.1010	NONROAD for tailpipe emissions
	10 tonne	1.5	114	10	0	Not required	Not required	1.7354	0.0042	0.7376	0.1771	0.1771	0.1718	NONROAD for tailpipe emissions
	D7 tractor	1.5	240	10	0	30	25.00	1.4220	0.0040	0.4787	0.0913	0.0913	0.0886	NONROAD for tailpipe emissions; AP-42 Chapter 13.2.2 for unpaved road dust
	pickup trucks	2	300	2.5	0	30	2.7	0.6333	0.0036	0.1632	0.0213	0.0213	0.0207	NONROAD for tailpipe emissions; AP-42 Chapter 13.2.2 for unpaved road dust
	Water truck	1	775	5	0	30	36	2.7121	0.0038	0.8347	0.0927	0.0927	0.0900	NONROAD for tailpipe emissions; AP-42 Chapter 13.2.2 for unpaved road dust
	fuel/service truck	1	100	5	0	30	38	0.6747	0.0036	0.2386	0.0402	0.0402	0.0390	NONROAD for tailpipe emissions; AP-42 Chapter 13.2.2 for unpaved road dust
	50 tonne haul trucks	4.5	325	10	0	30	50	1.0604	0.0038	0.3723	0.0557	0.0557	0.0540	NONROAD for tailpipe emissions; AP-42 Chapter 13.2.2 for unpaved road dust
	Front end loader	1	555	10	0	Not required	Not required	2.1313	0.0042	0.8629	0.1292	0.1292	0.1253	NONROAD for tailpipe emissions
	Two Excavators	2	513	10	0	Not required	Not required	1.6317	0.0041	0.6610	0.1041	0.1041	0.1010	NONROAD for tailpipe emissions
	10 tonne roller	1.5	114	10	0	Not required	Not required	1.7354	0.0042	0.7376	0.1771	0.1771	0.1718	NONROAD for tailpipe emissions
	D7 tractor	1.5	240	10	0	30	25	1.4220	0.0040	0.4787	0.0913	0.0913	0.0886	NONROAD for tailpipe emissions; AP-42 Chapter 13.2.2 for unpaved road dust
	Pickup trucks	2	300	2.5	0	30	2.7	0.6333	0.0036	0.1632	0.0213	0.0213	0.0207	NONROAD for tailpipe emissions; AP-42 Chapter 13.2.2 for unpaved road dust
	Water truck	1	775	5	0	30	36	2.7121	0.0038	0.8347	0.0927	0.0927	0.0900	NONROAD for tailpipe emissions; AP-42 Chapter 13.2.2 for unpaved road dust
	Fuel/service truck	1	100	5	0	30	38	0.6747	0.0036	0.2386	0.0402	0.0402	0.0390	NONROAD for tailpipe emissions; AP-42 Chapter 13.2.2 for unpaved road dust
	D8 Tractors	2.5	328	15	5	30	73	2.1313	0.0042	0.8629	0.1292	0.1292	0.1253	NONROAD for tailpipe emissions; AP-42 Chapter 13.2.2 for unpaved road dust
	Excavator	1	513	2.5	0	Not required	Not required	1.6317	0.0041	0.6610	0.1041	0.1041	0.1010	NONROAD for tailpipe emissions
	Light plants	4	27	10	0	Not required	Not required	3.6112	0.0045	0.7957	0.1224	0.1224	0.1187	NONROAD for tailpipe emissions
	Pickup truck	1	300	5	0	30	3	0.6333	0.0036	0.1632	0.0213	0.0213	0.0207	NONROAD for tailpipe emissions; AP-42 Chapter 13.2.2 for unpaved road dust
	Road Grader	1	533	5	0	Not required	Not required	3.1480	0.0046	1.4740	0.1500	0.1500	0.1455	NONROAD for tailpipe emissions
	Water truck	1	775	10	0	30	36	2.7121	0.0038	0.8347	0.0927	0.0927	0.0900	NONROAD for tailpipe emissions; AP-42 Chapter 13.2.2 for unpaved road dust
	Road Snow clearing equipment (Snowplow)	1	173	10	0	Not required	Not required	1.7344	0.0042	0.7374	0.1815	0.1771	0.1755	NONROAD for tailpipe emissions
	Diversion snow clearing equipment (D6 dozer)	1	240	10	0	Not required	Not required	1.4220	0.0040	0.4787	0.0913	0.0913	0.0886	NONROAD for tailpipe emissions
	Diversion snow clearing equipment (Snow blower)	1	173	10	0	Not required	Not required	1.7344	0.0042	0.7374	0.1815	0.1771	0.1755	NONROAD for tailpipe emissions

Table 3-2c. Air Emission Sources and Characteristics during Operation (Year 4)

Sources		Emission Factor						Notes
		NO_X	SO_2	CO	TPS	PM_{10}	$PM_{2.5}$	
Blasting	AP-42 Chapter 11.9 for blasting of overburden				**kg/blast**			Area per blast is 10,837.5 m^2
		-	62	2,095	4,742	2,466	142	
Drilling	AP-42 Chapter 13.3				**kg/hole**			150 holes per blast
		-	-	-	0.59	0.3	0.09	
Unpaved road dust	AP-42 Chapter 13.2.2				**g/km**			Assume road water to 4% moisture ratio and 87.5% control efficiency
	48' Flat-Deck	-	-	-	0.389	0.109	0.011	
	Vans (Enclosed Trailers)	-	-	-	0.264	0.074	0.007	
	Bus & Passenger Vehicles	-	-	-	0.232	0.065	0.006	
	Bulk Tanker	-	-	-	0.478	0.133	0.013	
	Tanker (45,000 L)				0.389	0.109	0.011	
	Bulk B-Train				0.431	0.120	0.012	
	Super-BTrain				0.431	0.120	0.012	
	Super-B Trucks	-	-	-	0.431	0.120	0.012	
Paved road dust	Testing Re-entrained Aerosol Kinetic Emissions from Roads (TRAKER) by DRI, adjusted based on weight				**g/km**			Speciation obtained from AP-42 Chapter 13.2.1 Particle Size Multipliers for Paved Road Equation
		-	-	-	0.865	0.166	0.040	
Bulldozing	AP-42 Chapter 11.9 for bulldozing of overburden				**kg/hour**			Silt content 7.5%; moisture content 9.3%
		-	-	-	1.61	0.31	0.17	
Grading	AP-42 Chapter 11.9 for grading				**kg/km**			Silt content 7.5%
		-	-	-	0.52	0.19	0.02	
Material drop	AP-42 Chapter 13.2.4				**kg/Mg**			Average wind speed 2.08 m/s; moisture content 9.3%
		-	-	-	1.28E-04	6.05E-05	9.17E-06	

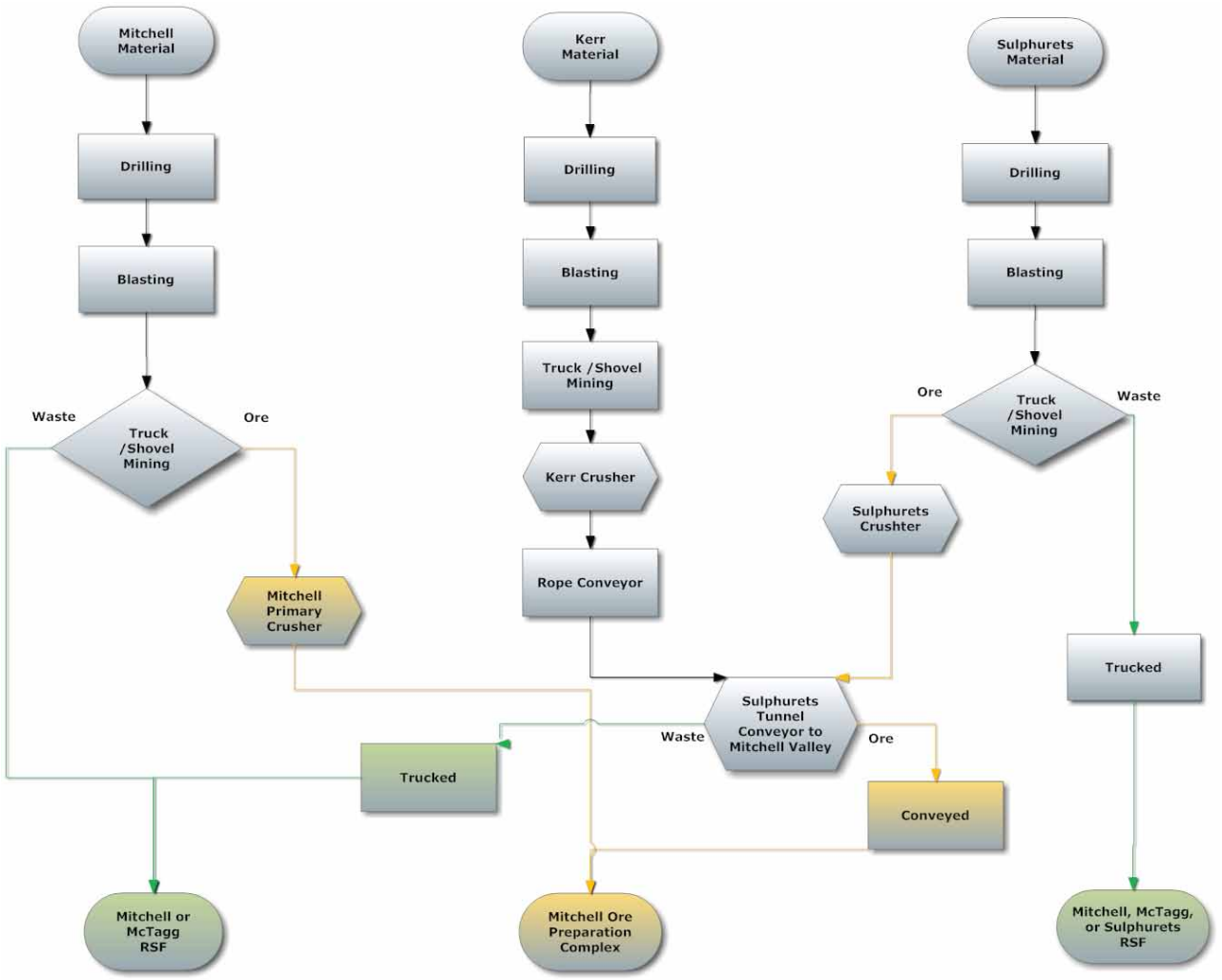

Figure 3-2

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KSM Project Mined Material Flow Chart

Figure 3-2

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PROJECT # 868-022-18 GIS No. KSM-12-075_T January 28, 2013

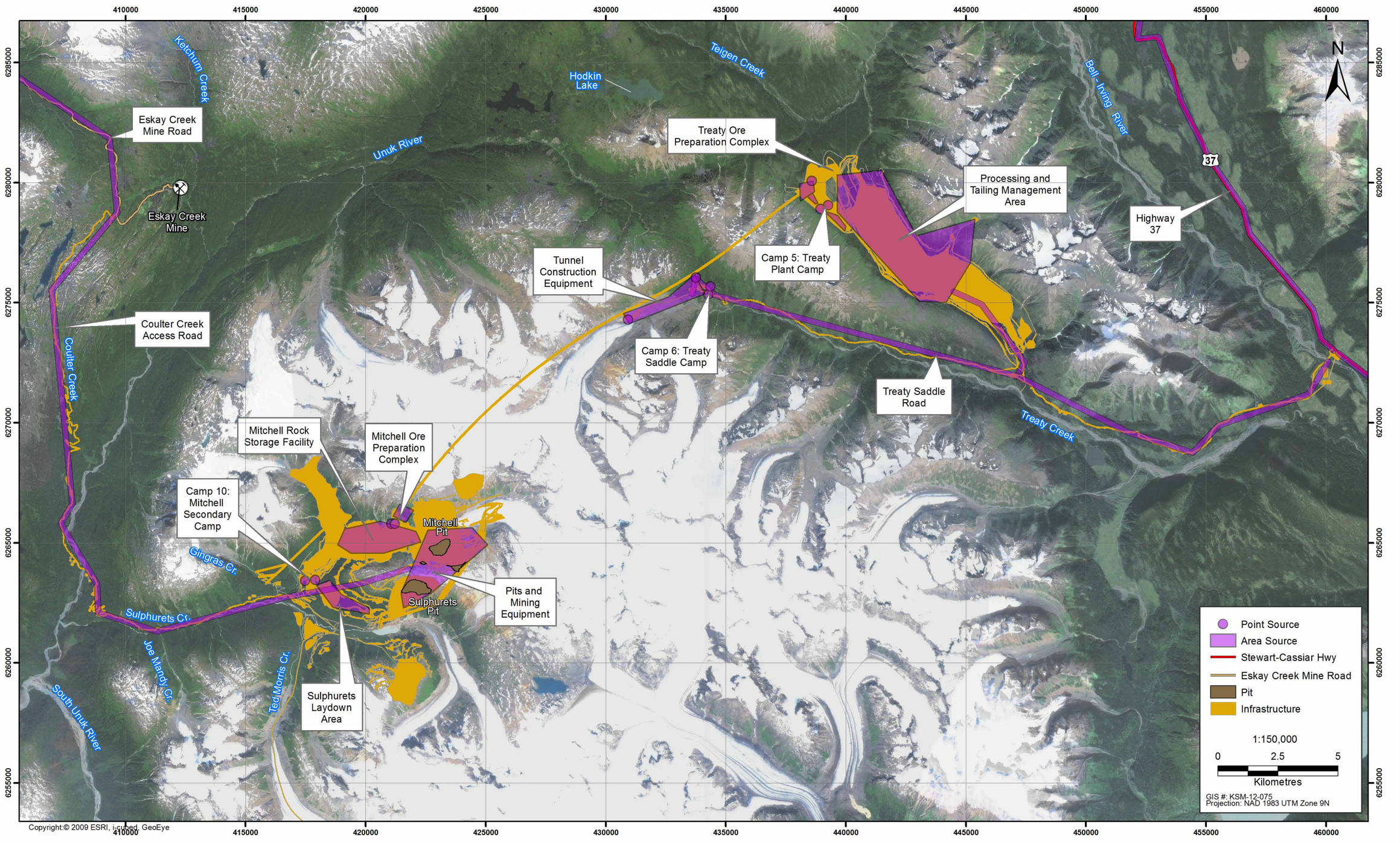

Figure 3-3

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KSM Project Construction Phase Air Emission Sources (Year -1)

PROJECT # 868-022-18 GIS No. KSM-12-076_T January 28, 2013

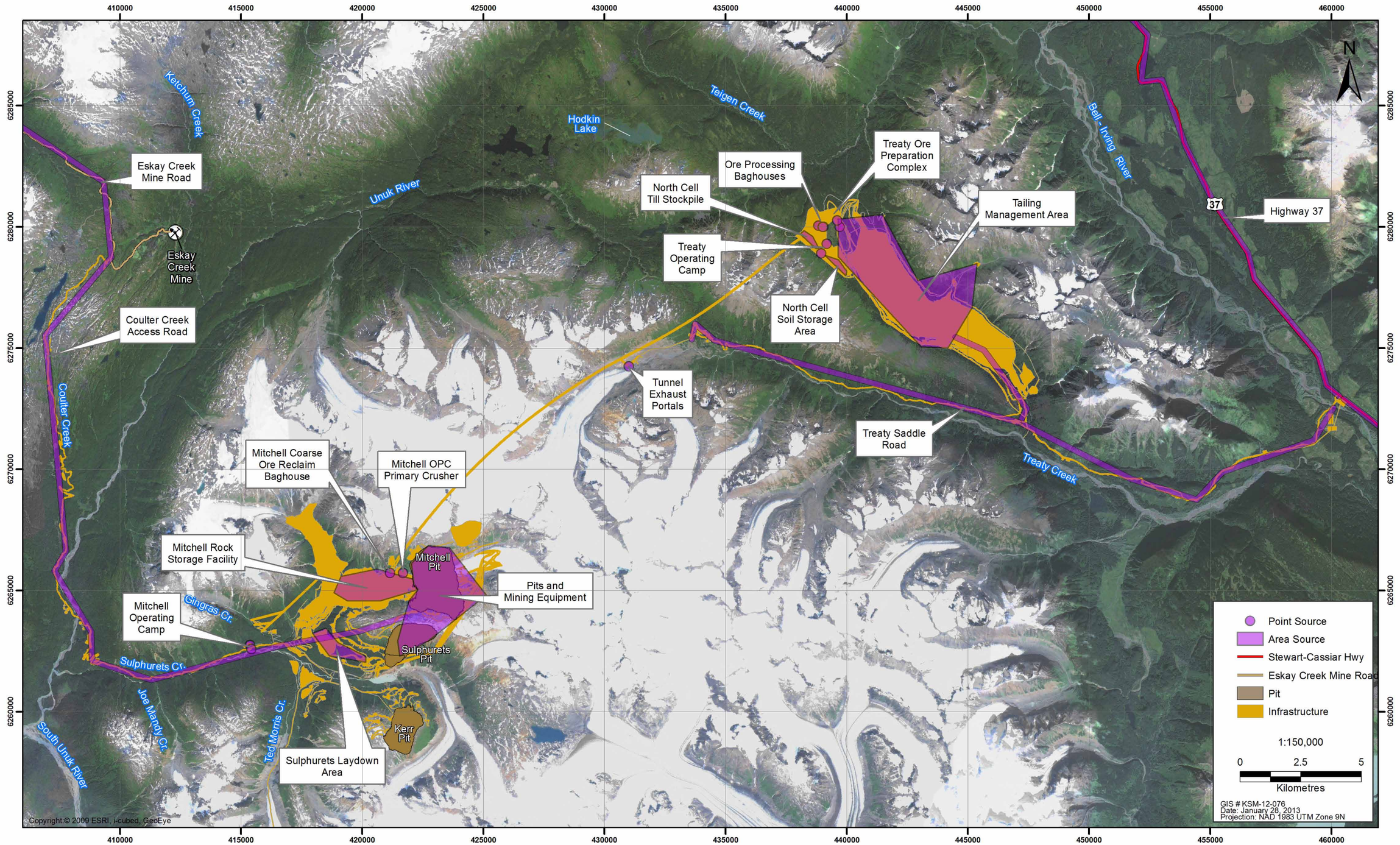

Figure 3-4

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KSM Project Operation Phase
Air Emission Sources (Year 4)

The maximum hourly wind speed in 2009 was 15.9 m/s at the Mitchell meteorological station. Following calculations outlined in the Fastest Mile Method equation 4 in Chapter 13.2.5 of AP-42 (US EPA 2006), the maximum hourly wind speed in 2009 at the Mitchell station has a friction velocity of 0.84 m/s ($u^* = 0.053\ u_{10}^+$ where u^* = friction velocity (m/s) and u_{10}^+ = fastest mile of the reference anemometer for the period between disturbances). Referencing the threshold friction velocity of 1.02 m/s for overburden in Table 13.5.2-2 of AP-42, the wind at the Mitchell station is not fast enough to cause wind erosion.

In order to trigger wind erosion, the measured instantaneous wind speed at 10 m has to be greater than 19.2 m/s (calculated using equation 4 in AP-42 Section 13.5.2-2). Although hourly wind speed was used in assessing wind erosion in the previous paragraph and fast wind gusts may occur at times, given that the average hourly wind speed exceeds 10 m/s only 34 hours in one year, the potential for wind gusts exceeding 19.2 m/s and causing an effect is very limited. Emissions from the material dropped onto the stockpiles will be included using emission factors described in AP-42 Chapter 13.2.4.

Unpaved road dust emission factors were obtained from AP-42 Chapter 13.2.2 assuming watering the road will achieve 4% moisture ratio which will reduce fugitive dust emissions by 87.5%. During construction, a portion of the project area will be cleared. Any salvageable material will be taken from site and only wood debris will be burnt onsite. However, it is difficult to obtain detailed information such as tree debris types, volume/weight, etc. for the open burning. Emission factors for forest fires of the Alaska region, which is the closest region to the Project area, described in AP-42 Chapter 13.1 will be used.

Acid deposition will be modelled using the chemical transformation scheme MESOPUFF-II in CALPUFF using the default parameters for diffusivity, Henry's Law coefficient, and liquid/frozen scavenging coefficients.

4. Physical and Meteorological Setting Characterization

The KSM Project lies in the rugged Coastal Mountains of northwestern British Columbia, with elevations ranging from 238 metres above sea level (masl) in the valley bottom along the proposed access road that connects the proposed Plant Site and the proposed tailings management facility area, to over 2,300 masl at the highest peaks. The property is characterized by steep topography with loose talus resulting from rockslides and slumps. Large portions of the property, particularly at the Kerr deposit, are located on extreme slopes. Therefore, the terrain can be characterized as complex. The dominant land cover in the study area is forest and grass on a mountainous area. The forest in the KSM Project area is defined as a mature subalpine fir/spruce stand with approximately 80% fir and 20% spruce.

To characterize the meteorology in this complex physical setting, a total of four automated meteorological stations were installed and commissioned for the KSM Project as part of the meteorology baseline program. The location of these stations is summarized below and shown in Figure 4-1.

An automated meteorological station was installed in the Teigen Creek valley near the proposed plant site on March 4, 2008 (Plate 4-1). This meteorological station records wind speed and direction, air temperature, relative humidity and solar radiation. Very deep snow at the time of installation required the use of an innovative tripod as an interim arrangement rather than a conventional 10 m tower for mounting the recording instruments. Due to the snow conditions and the design of the tripod, installation of a precipitation gauge and a snow depth gauge at that time was not possible.

The temporary tripod station at Teigen Creek ran on battery power from a deep cycle marine battery, but was converted to solar power when the permanent 10 m tower was installed in early July 2008. Temperature, relative humidity, wind speed and direction, solar radiation and barometric pressure sensors were mounted on the temporary tripod structure. The various sensors were remounted on the 10 m steel tower anchored with bed-rock anchors and guy wires in early July 2008. The wind sensor was mounted at the top of the tower at a height of 10 m. This configuration is consistent with the Environment Canada - Meteorological Services of Canada (EC-MSC) standard sensor height for data to be used for air dispersion modelling (EC-MSC 2004). Wind speed is measured in metres per second (m/s) and wind direction in degrees from true north.

A second automated meteorological station (Sulphurets Creek) was installed on a scaffold frame located on the ridge northwest of Sulphurets Lake in the Sulphurets Creek valley near the proposed open pits in September 2007 to the station collects wind speed and direction, air temperature, relative humidity, solar radiation, rain or snow-water-equivalent (SWE) precipitation (depends on the season) and has a snow pillow for measuring the SWE of the snowpack. The Sulphurets meteorological station is surrounded by trees that bias the wind data. Therefore, wind data from this station will not be used in the creation of the CALMET wind fields. Sulphurets meteorological station experienced malfunctions due to failure of electronic components in 2009. These problems have since have been resolved and as of September 20, 2009 all sensors were functioning properly. The data for the period of September 20 to December 31, 2009 was used a supplemental surface data except for wind.

To address the poor wind data being collected at the Sulphurets Creek station, a wind-only meteorology station (Mitchell Deposit) was installed in the area of the proposed Mitchell pit on September 17, 2008 (Plates 4-2 and 4-3). The siting of this wind-only station complies with standards established by Environment Canada - Meteorological Services of Canada (EC-MSC 2004).

PROJECT # 868-010-06-03 GIS No. KSM-12-026 January 8, 2013

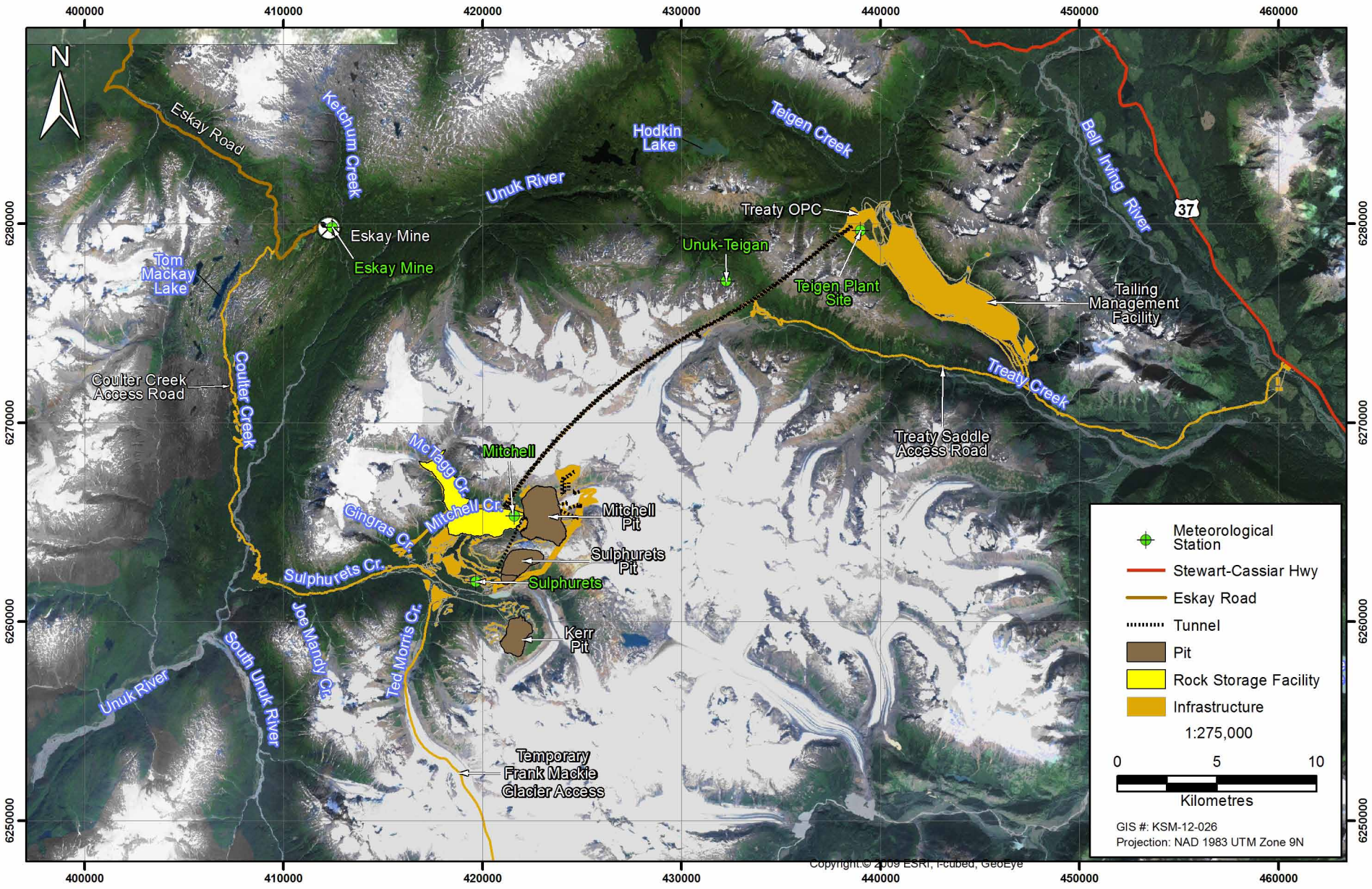

Figure 4-1

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KSM Meteorological Station Locations

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Figure 4-1

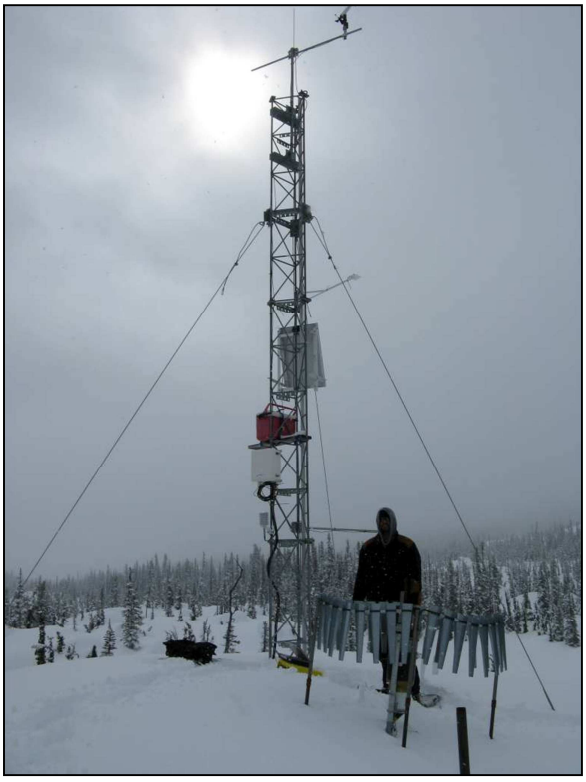

Plate 4-1. Teigen Creek 10 m Meteorological Station (March 2011)

Plate 4-2. Mitchell 10 m Meteorological Station in Summer (August 2012)

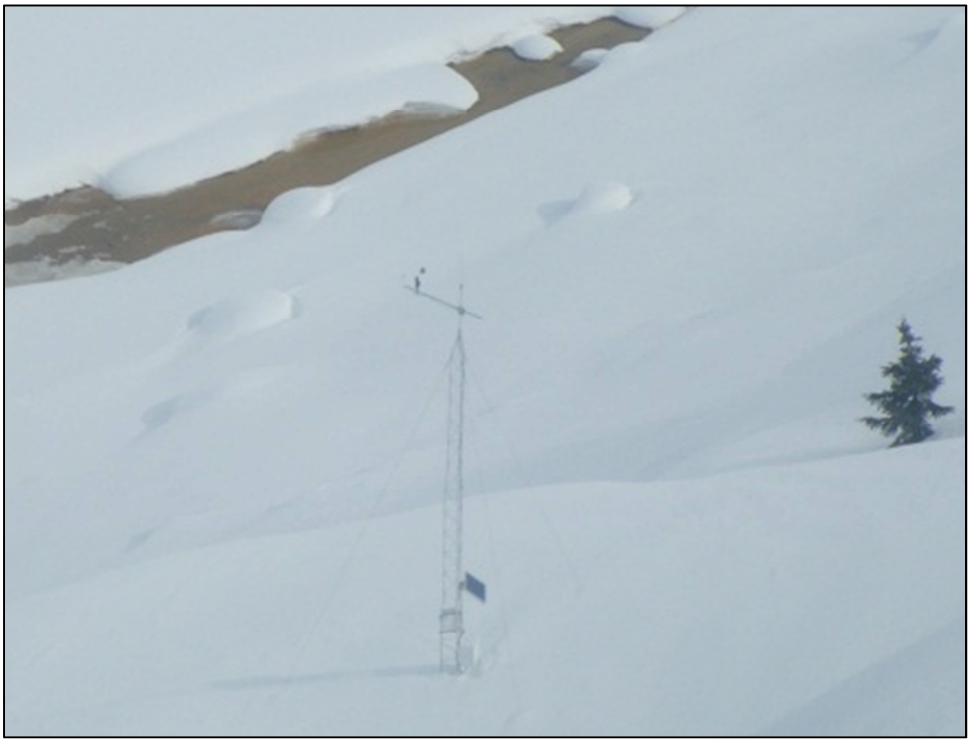

Plate 4-3. Mitchell 10 m Meteorological Station in Winter (March 2012).

The Unuk-Teigen meteorological station was installed on September 18, 2008 in response to a proposed alternative plant site located in a saddle between the middle fork of Teigen Creek and Unuk River (Plate 4-4). This station is essentially identical in design to the tower station installed at Teigen Creek in July 2008. Solar radiation, precipitation and barometric pressure are not measured at this station because they are expected to be similar to Teigen Creek.

Plate 4-4. Unuk-Teigen 10 m Meteorological Station (June 2011).

The MSC guidelines (EC-MSC 2004) were used as a reference for installation and operations of the meteorological stations. Furthermore, meteorological sensors were sent to manufacturers to be maintained/calibrated regularly by following the manufacturer's recommended schedule. The observational data from the three on-site meteorological stations used with MM5 prognostic data to create the CALMET output file. MM5 data is needed to characterize upper air data in the modelling domain. CALMET output files were checked for quality assurance purposes by following recommendations in BC Guidelines section 10.2.1 (BC MOE 2008). A CALMET resolution of 0.5 km was used.

Figures 4-2 to 4-4 summarize the 2009 wind roses from the KSM meteorological stations that were used to generate the CALMET output files with MM5 data (surface wind velocity data collected by a wind sensor 10 m above ground level). As expected the predominant wind directions coincided with the axis of the valleys.

BC baseline thematic mapping files and the National Geospatial-Intelligence Agency (NGA) 3 arc second digital elevation model were used to generate the GEO.DAT file. The generated file compared well with the other maps of the area (Figure 4-5). This comparison confirmed that the digital model used for the CALMET modeling was representative of the actual conditions.

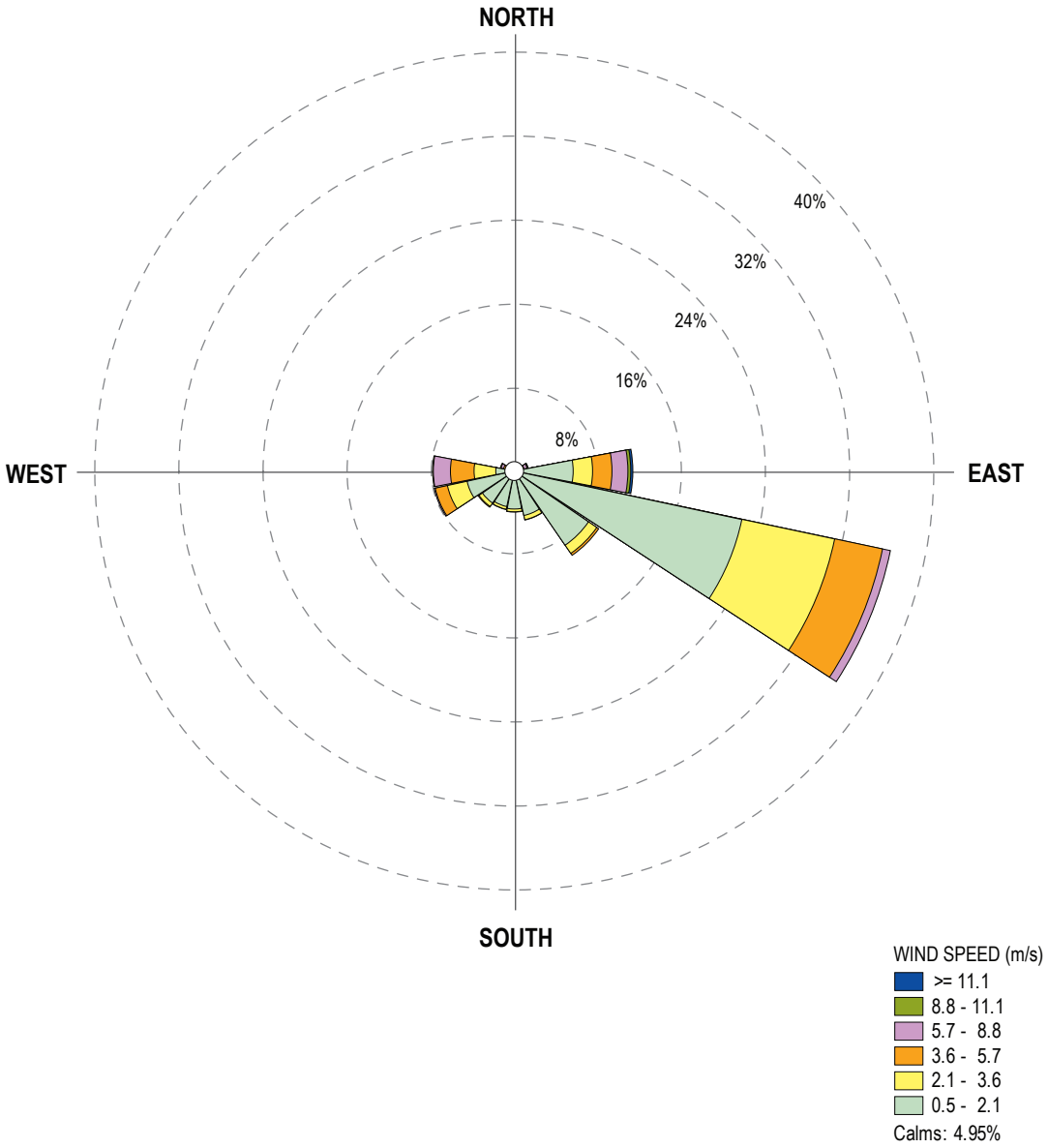

Figure 4-2

Mitchell Deposit Wind Rose 2009

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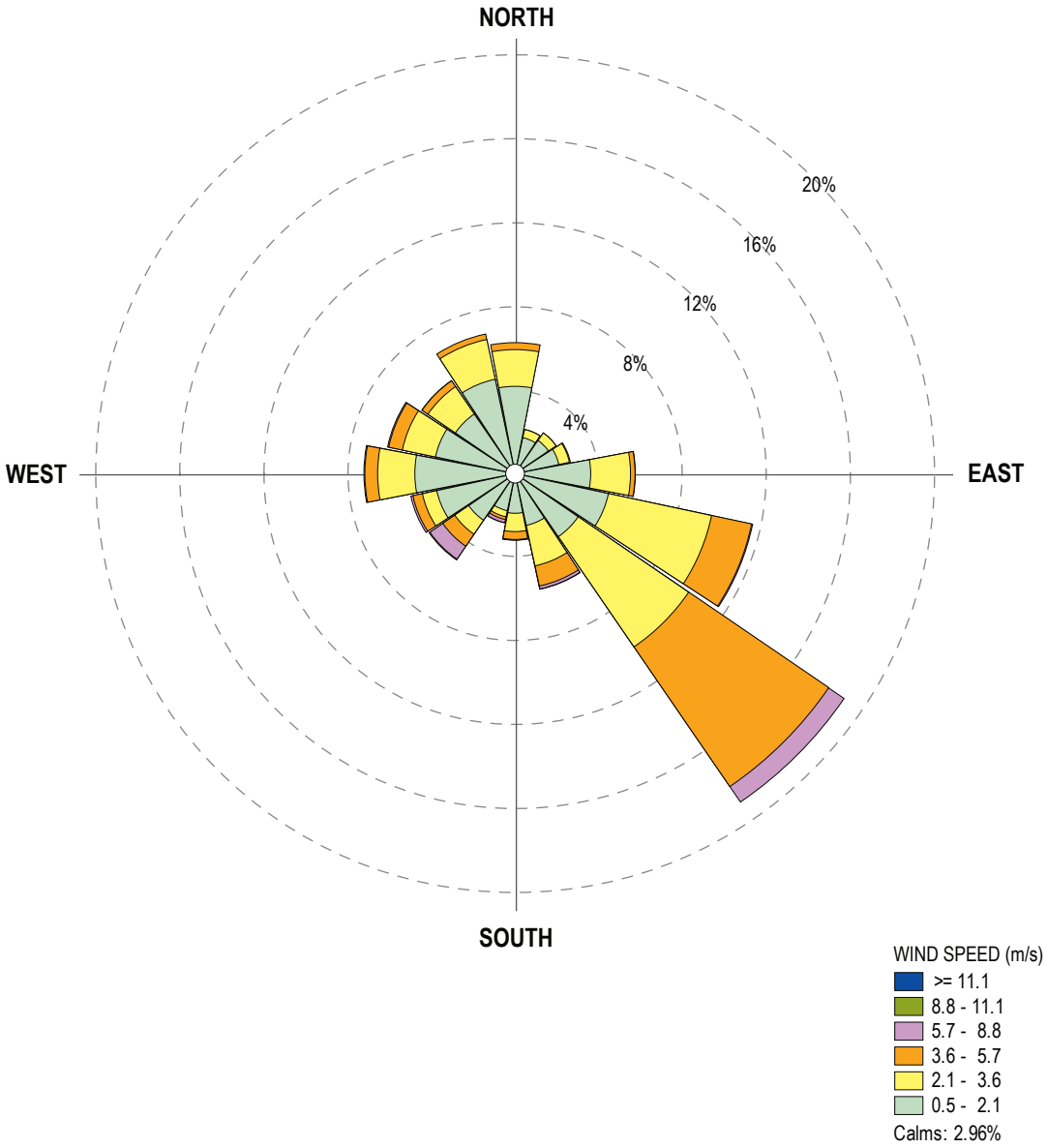

Figure 4-3

Teigen Creek Wind Rose 2009

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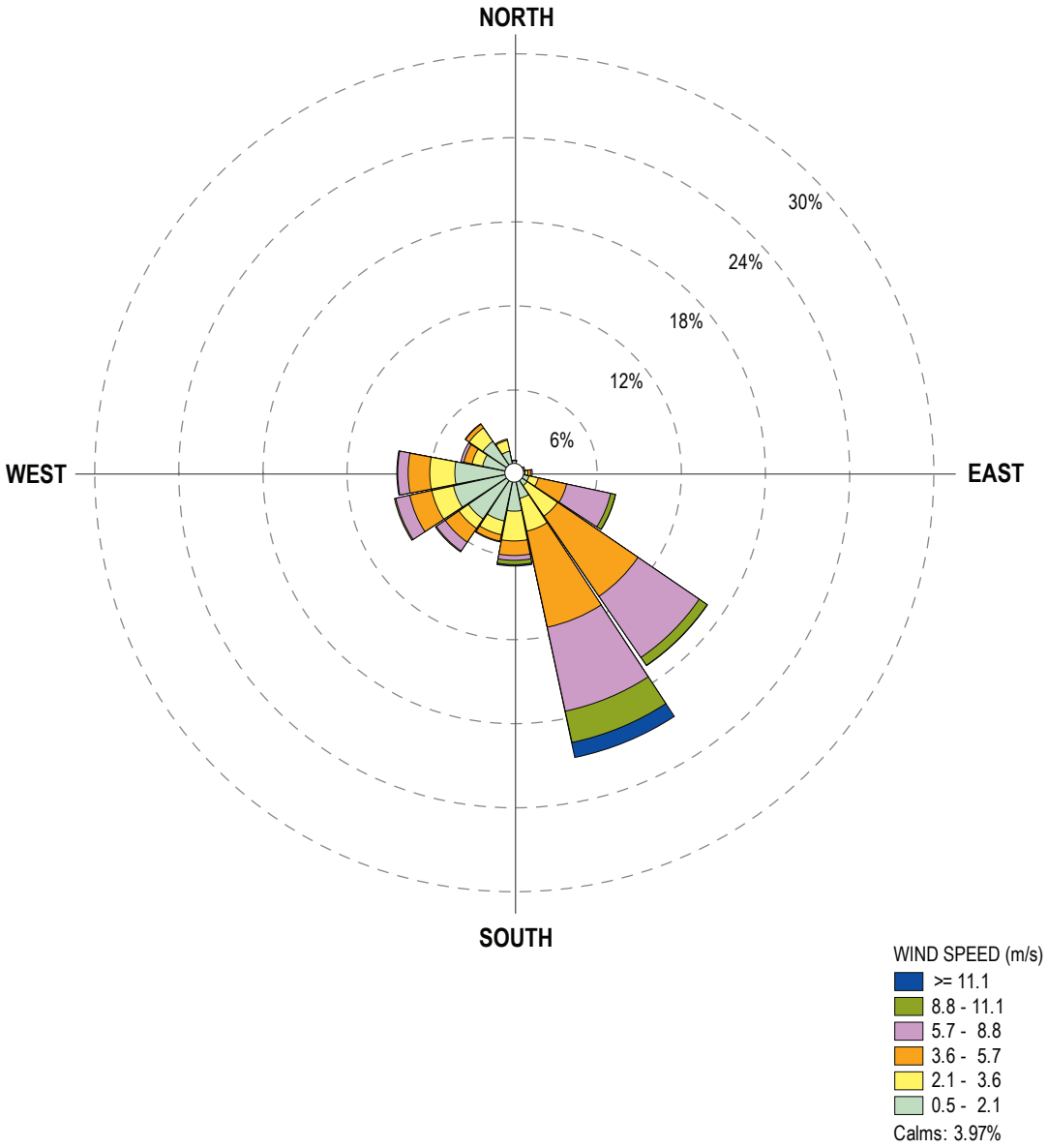

Figure 4-4

Unuk Teigen Wind Rose 2009

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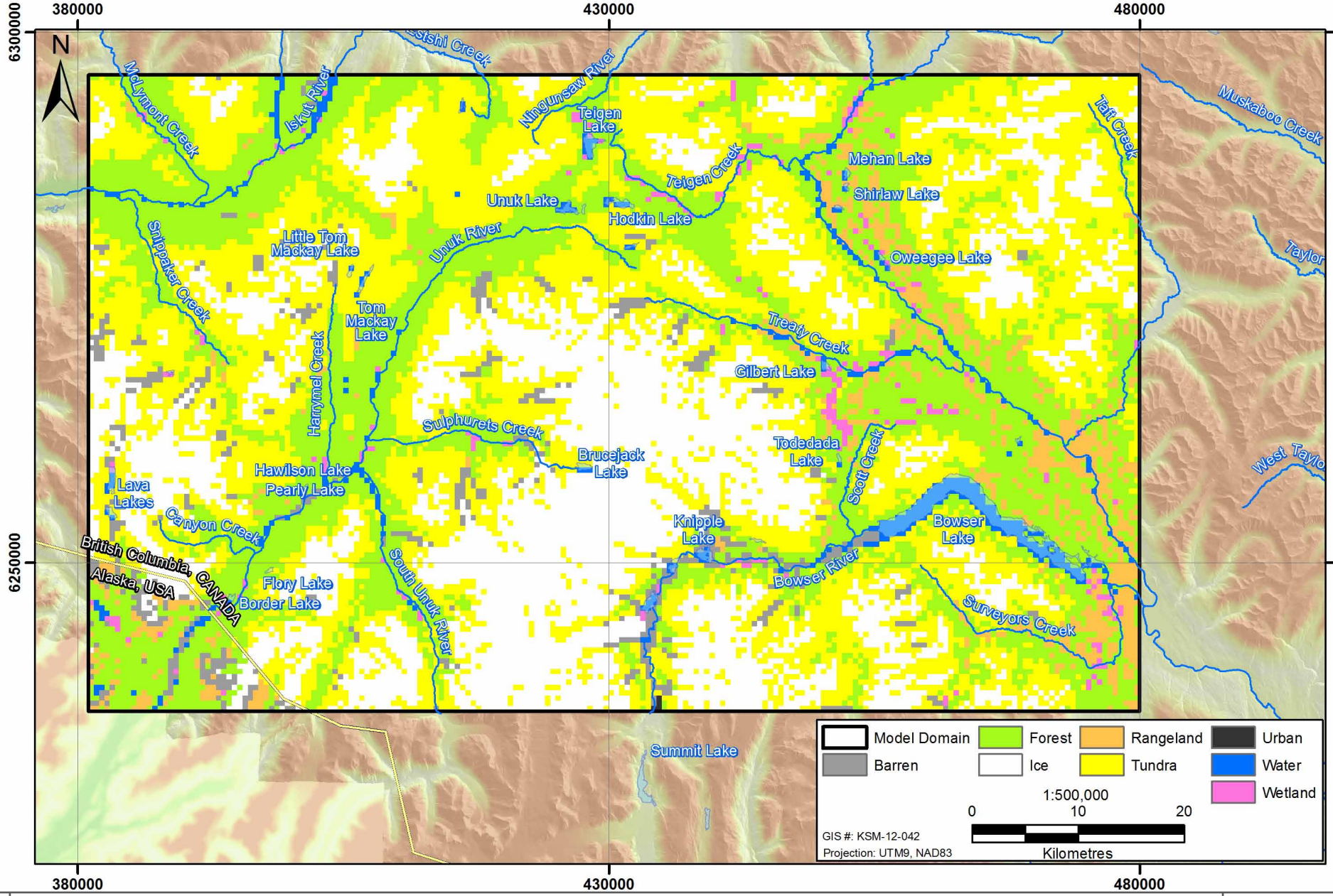

Figure 4-5

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Thematic Present Land Use Map for Air Dispersion Modelling Domain

Figure 4-5

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The Pasquill Gifford stability class data were examined from CALMET output file at the Teigen OPC location for QA/QC purposes (Figures 4-6 and 4-7). Since there is no observational stability class determination, the CALMET program utilized MM5 dataset for stability classes. Figure 4-6 shows that during the early morning hours (midnight to 5 a.m.), the atmosphere was predominantly slightly stable and moderately stable. For the next 5 hours (6 a.m. to 10 a.m.) there is a transition from neutral stability to slightly or moderately unstable. For the next 7 hours (11 a.m to 5 p.m.) the stability was predominantly slightly or moderately unstable. The stability gradually trends towards slightly or moderately stable for the remaining 7 hours (6 p.m. to midnight). Figure 4-7 summarizes the distribution of PG stability classes for 2009. The moderately stable PG stability class was the most common (32%) and the least common was extremely stable (3%).

Figures 4-8 to 4-31 summarize the hourly wind fields for the most stable and unstable days. The most unstable day and the most stable day were determined by reviewing the 2009 hourly stability classes. January 18 and June 30, 2009 were chosen for the wind field assessments for the most stable and unstable days, respectively. The wind fields for each grid are presented in these figures for the surface, 2nd and 3rd layers. Generally, the predominant wind directions and wind speeds were determined by topography. Surface wind directions were aligned with the valley axis. In addition, the winds in the 2nd and 3rd layers had similar direction and were usually consistent with the surface layer.

The hourly air temperatures for all CALMET layers were plotted for the grid where the main plant will be built. The output data was compared with the station normals of Bob Quinn AGS station and Unuk River Eskay Creek station which are operated by Environment Canada - Meteorological Services of Canada (EC-MSC) (Figure 4-32). The figure confirms that there was reasonable agreement between the CALMET air temperature outputs and the regional EC-MSC climate normal data from Bob Quinn AGS and Unuk River Eskay Creek stations which are 58.7 km and 19.4 km away from KSM Project, respectively.

Figure 4-32 includes the air temperatures from all 12 CALMET layers. As expected the air temperatures from the upper layers were cooler than the lower layers.

Further analysis was performed on the air temperature data within the Project area. Figure 4-33 compares the surface air temperature at the Teigen Creek meteorological station with the CALMET surface layer temperature output. The CALMET output temperature was extracted from the grid where Teigen surface meteorological station exists. The results indicate a good agreement between the measured and modelled (CALMET) air temperatures near the ground surface.

The mixing height data from the CALMET output files were reviewed to determine the diurnal and annual trends and to determine if they were reasonable given the meteorological setting for the KSM project. The hourly mixing heights in 2009 are summarized in Figure 4-34 and the diurnal mixing heights are summarized in Figure 4-35. CALMET obtained mixing height data from the MM5 data because there was no observational data. In general, the mixing heights were higher during the summer months compared with the winter months. The median mixing heights were higher between 12 p.m. and 7 p.m.. The minimum mixing heights were always higher between 1 p.m. and 4 p.m.

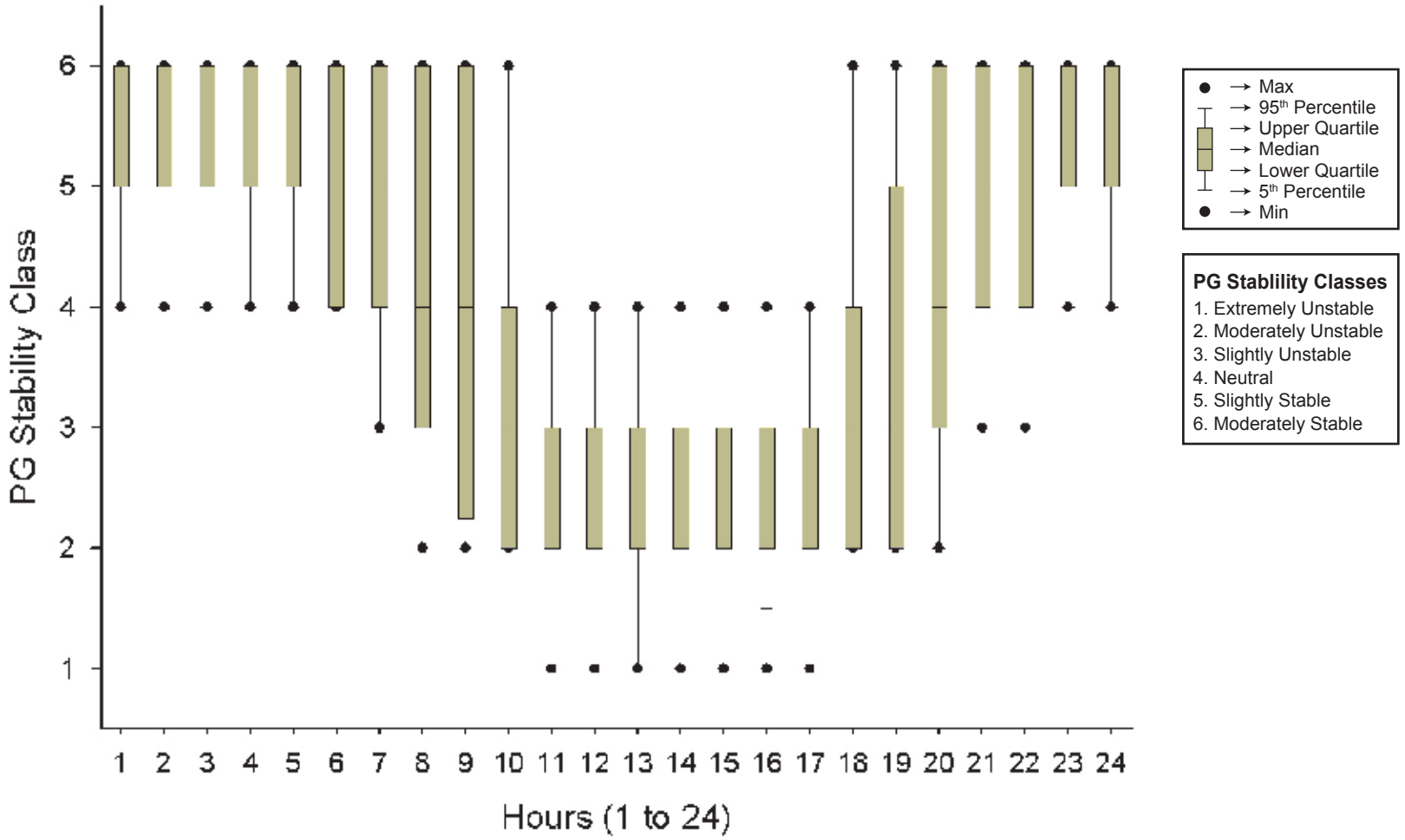

Figure 4-6

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Diurnal Pasquill-Gifford Stability Classes in 2009

Figure 4-6

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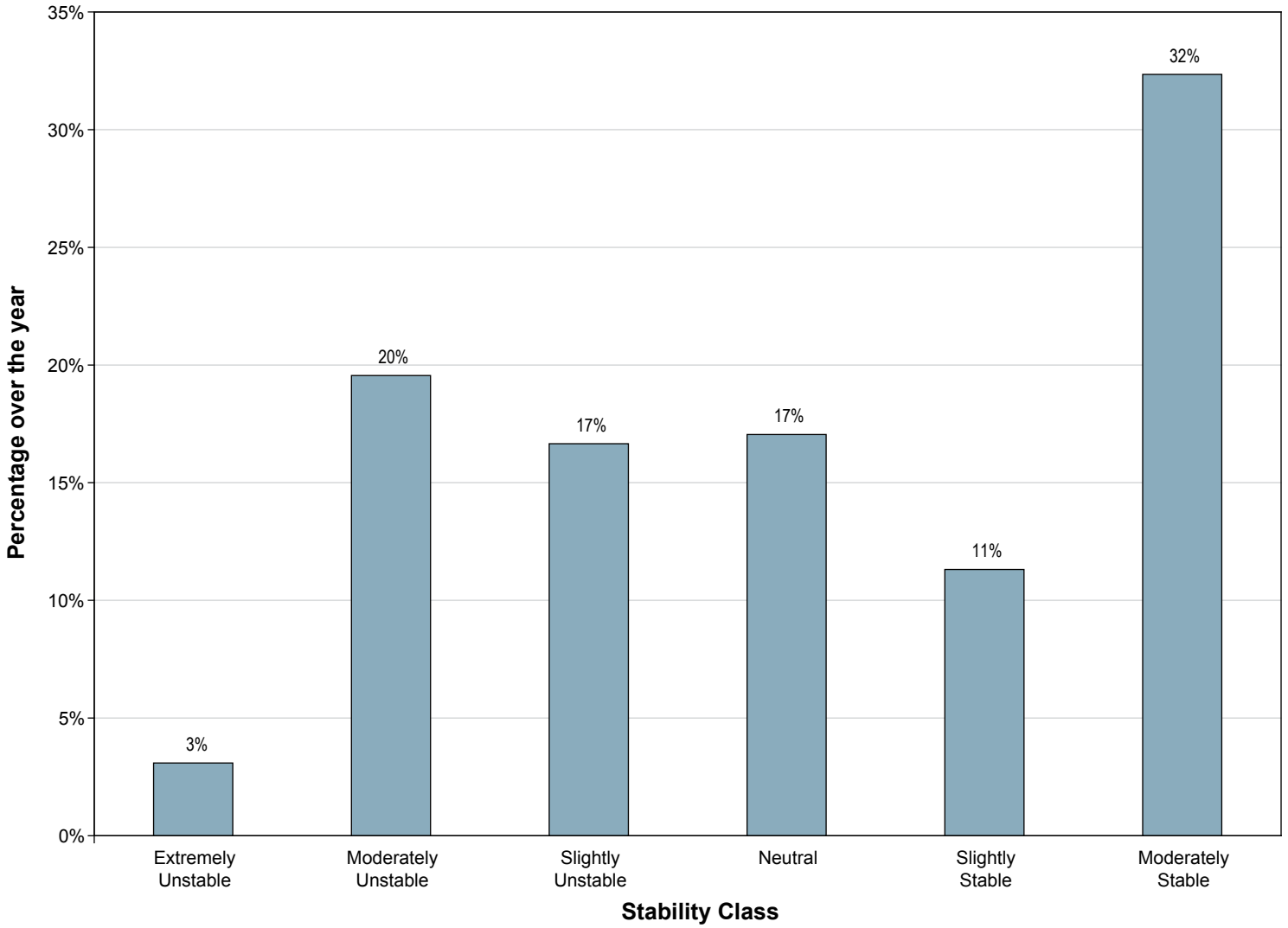

Figure 4-7

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Pasquill-Gifford Stability Class in 2009

Figure 4-7

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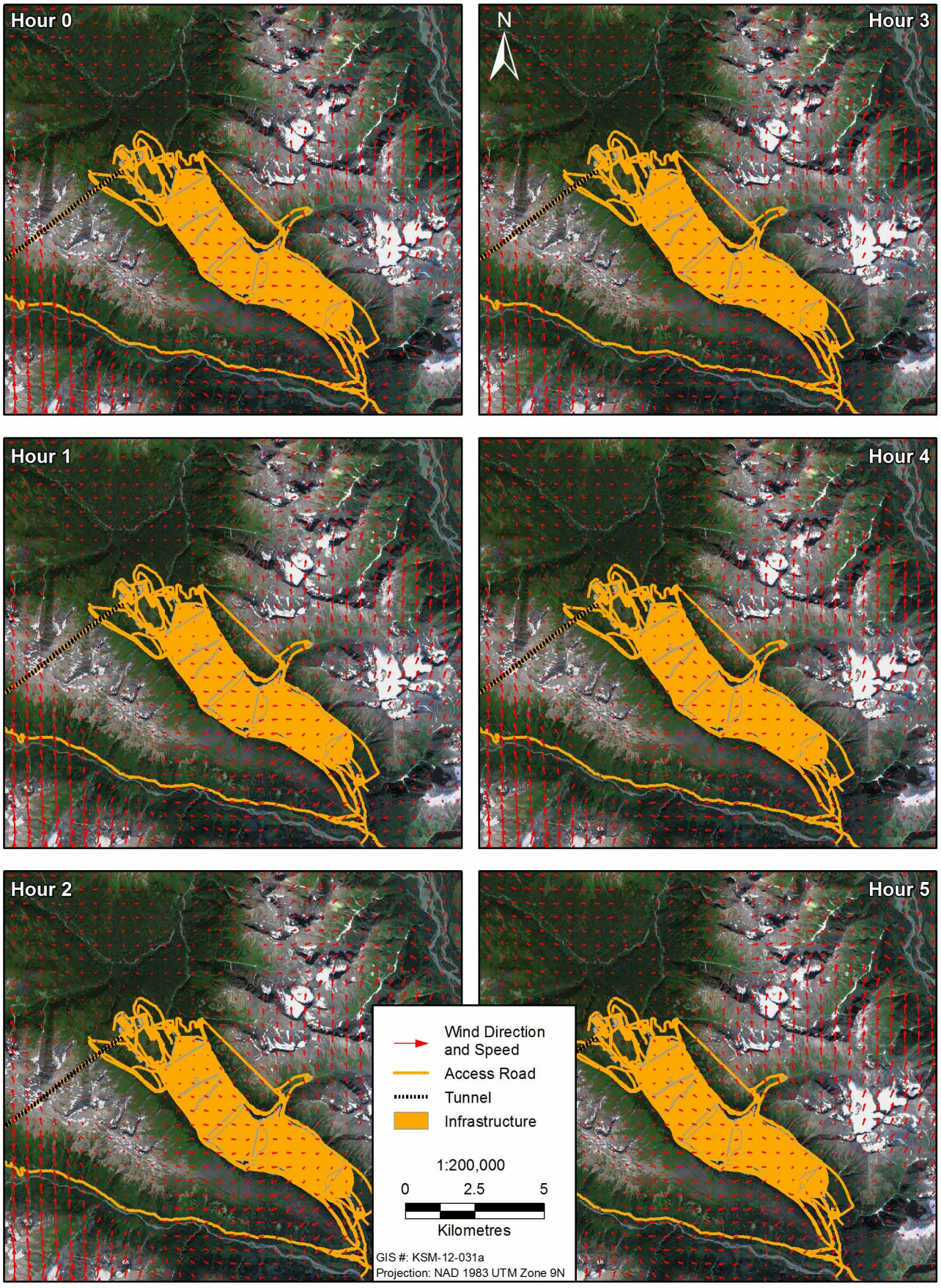

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KSM Project: 0 to 18 m (Layer 1) Wind Speed and Direction, January 18, 2009 - Hours 0 to 5

Figure 4-8

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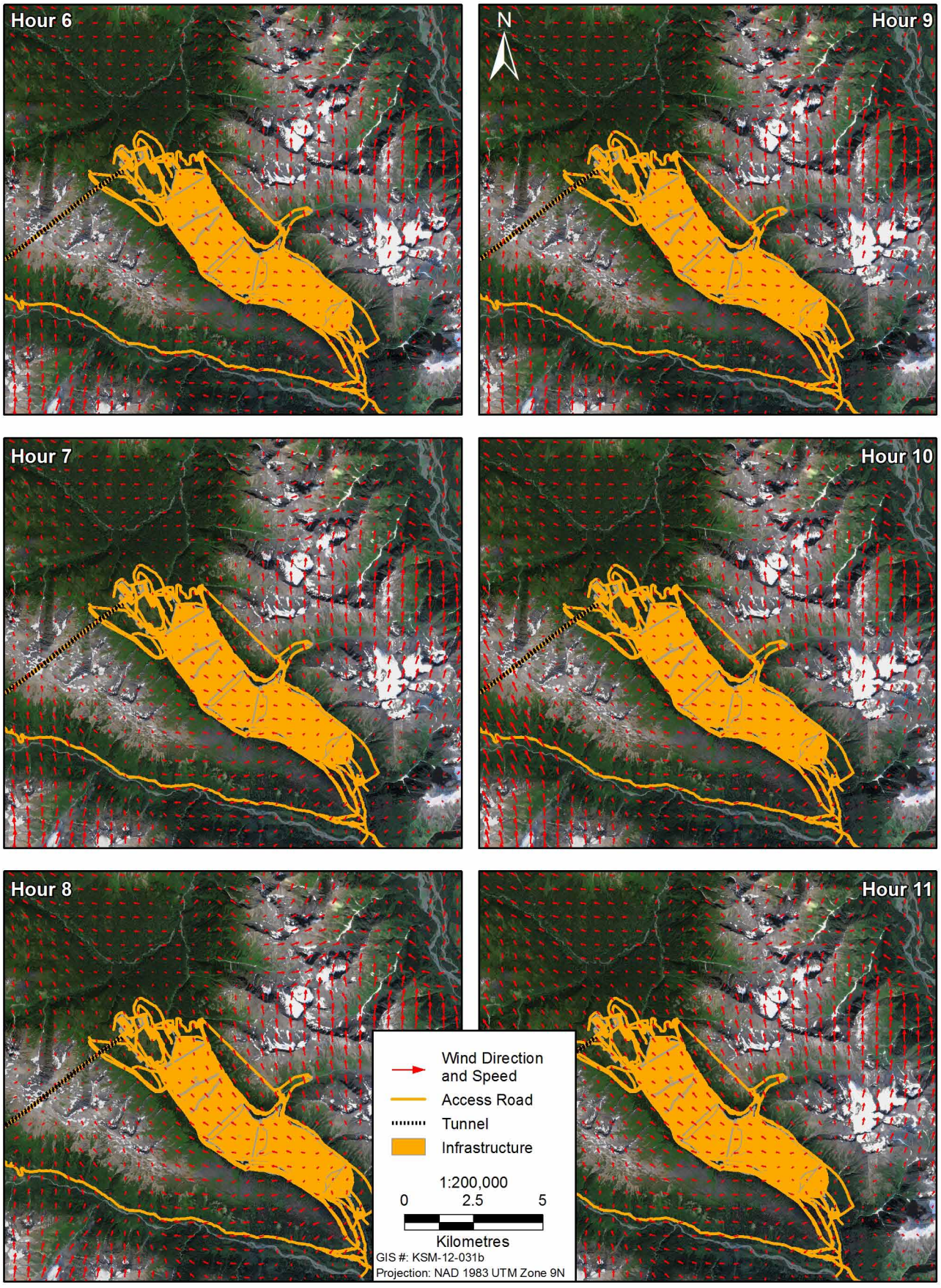

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KSM Project: 0 to 18 m (Layer 1) Wind Speed and Direction, January 18, 2009 - Hours 6 to 11

Figure 4-9

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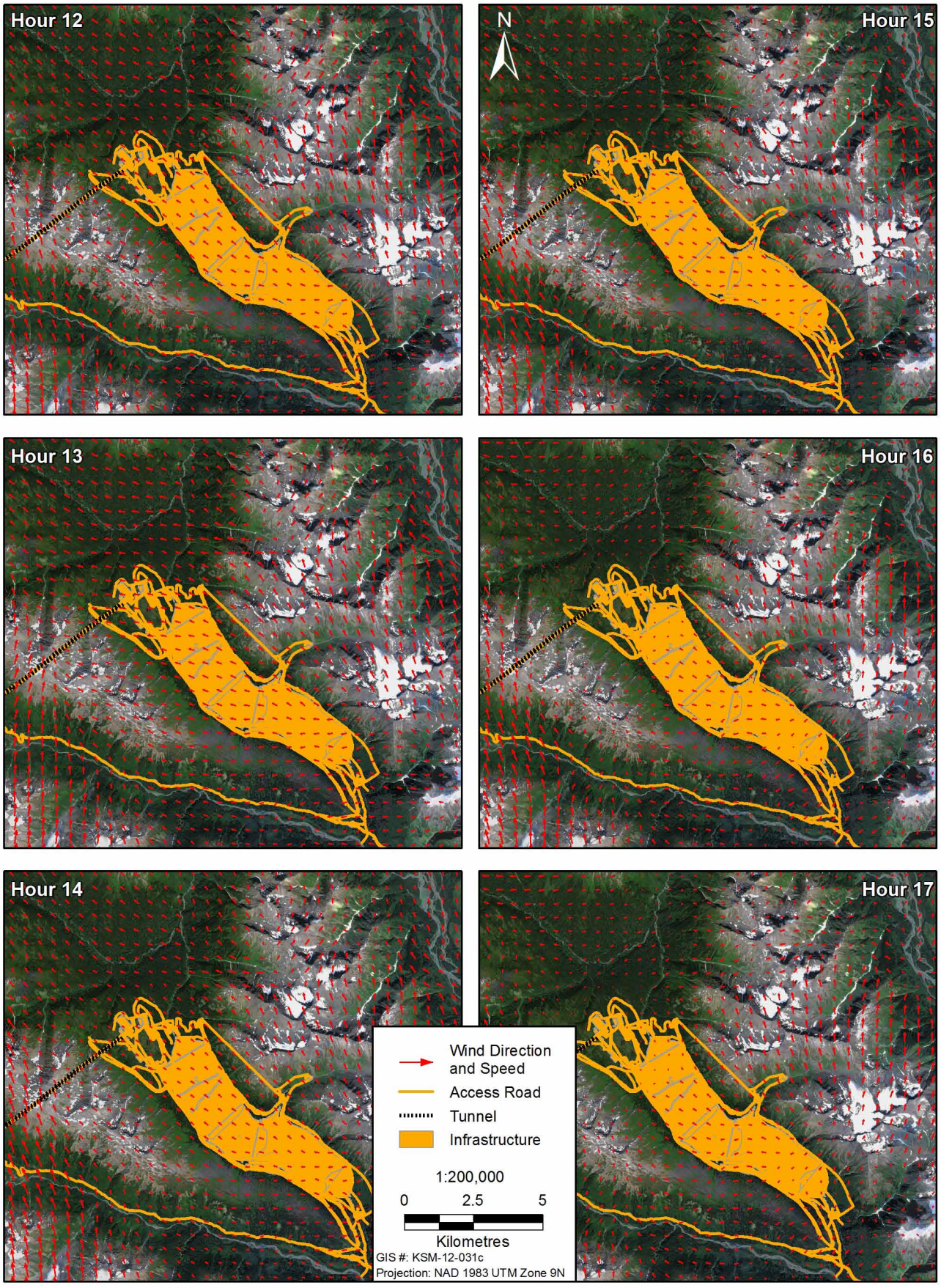

SEABRIDGE GOLD
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KSM Project: 0 to 18 m (Layer 1) Wind Speed and Direction, January 18, 2009 - Hours 12 to 17

Figure 4-10

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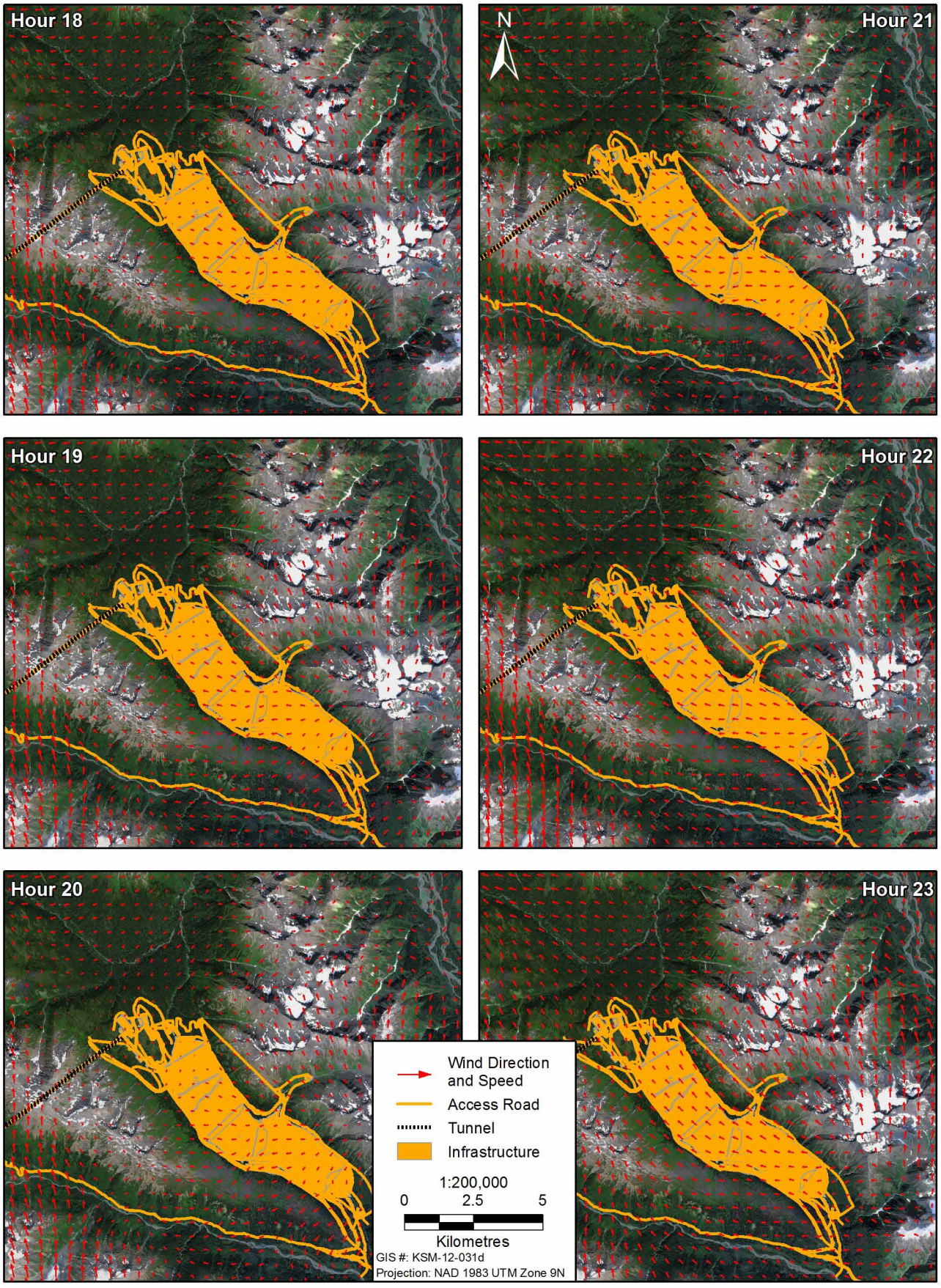

SEABRIDGE GOLD
KSM PROJECT

KSM Project: 0 to 18 m (Layer 1) Wind Speed and Direction, January 18, 2009 - Hours 18 to 23

Figure 4-11

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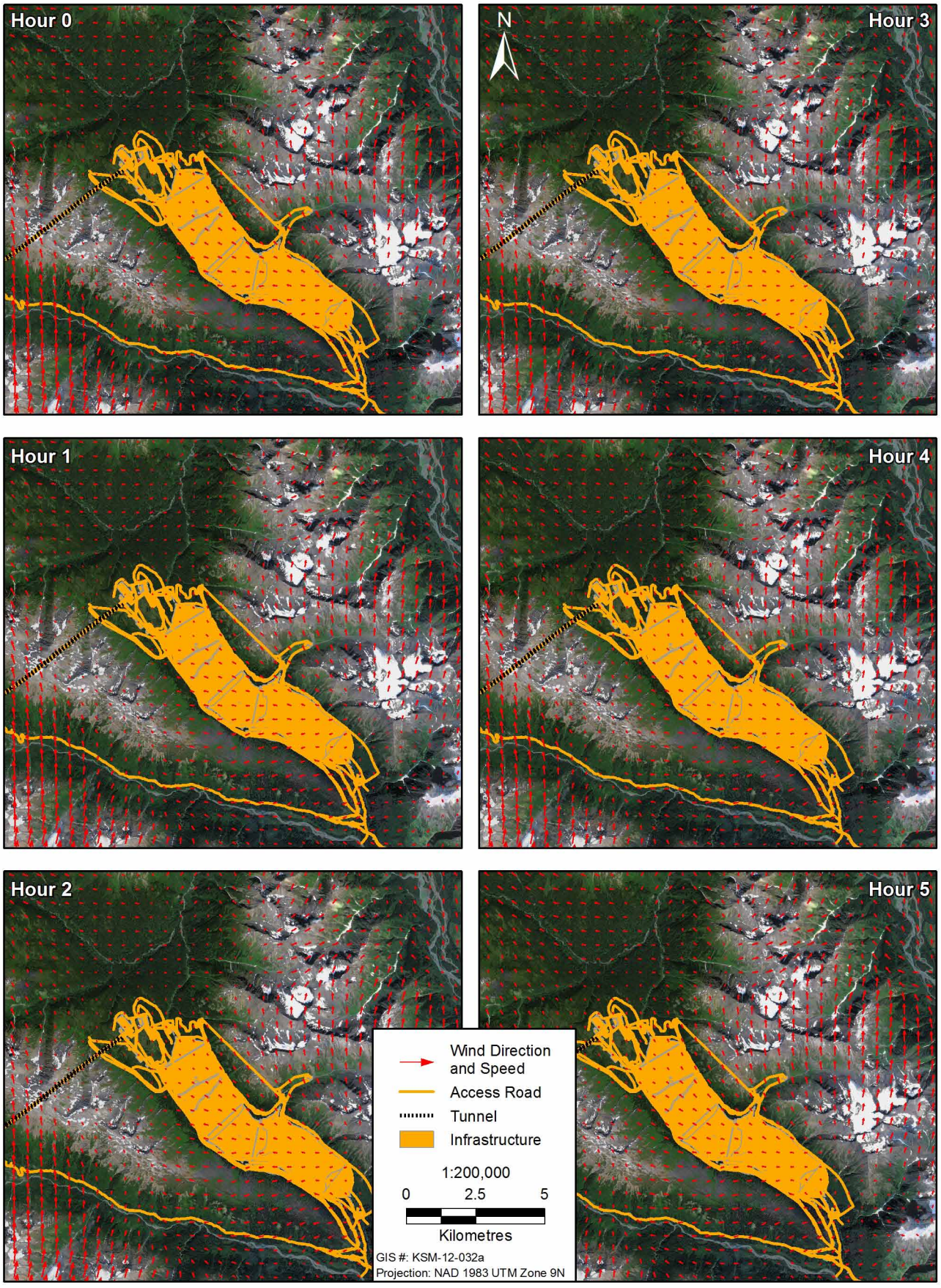

SEABRIDGE GOLD
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KSM Project: 18 to 30 m (Layer 2) Wind Speed and Direction, January 18, 2009 - Hours 0 to 5

Figure 4-12

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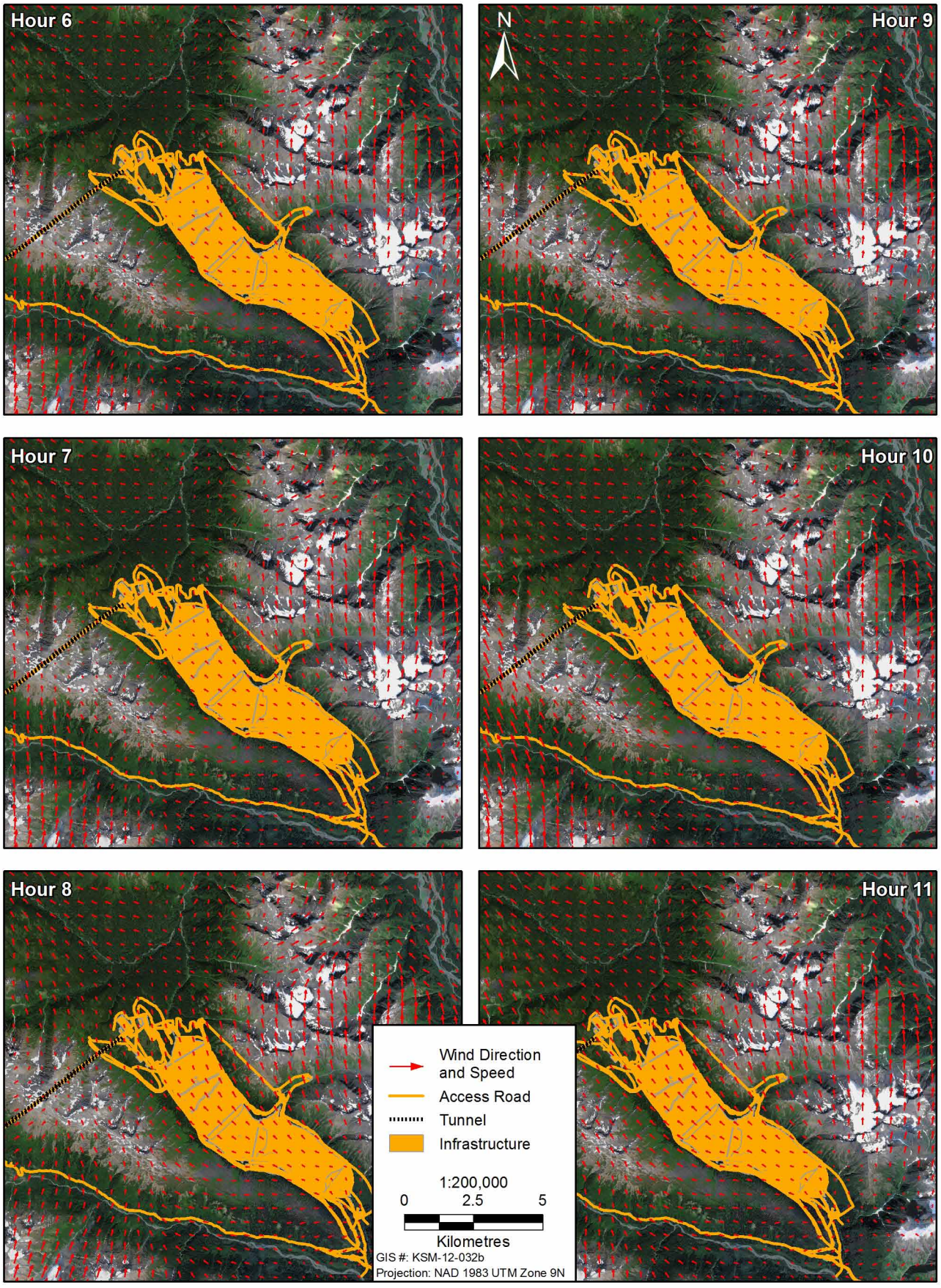

SEABRIDGE GOLD
KSM PROJECT

KSM Project: 18 to 30 m (Layer 2) Wind Speed and Direction, January 18, 2009 - Hours 6 to 11

Figure 4-13

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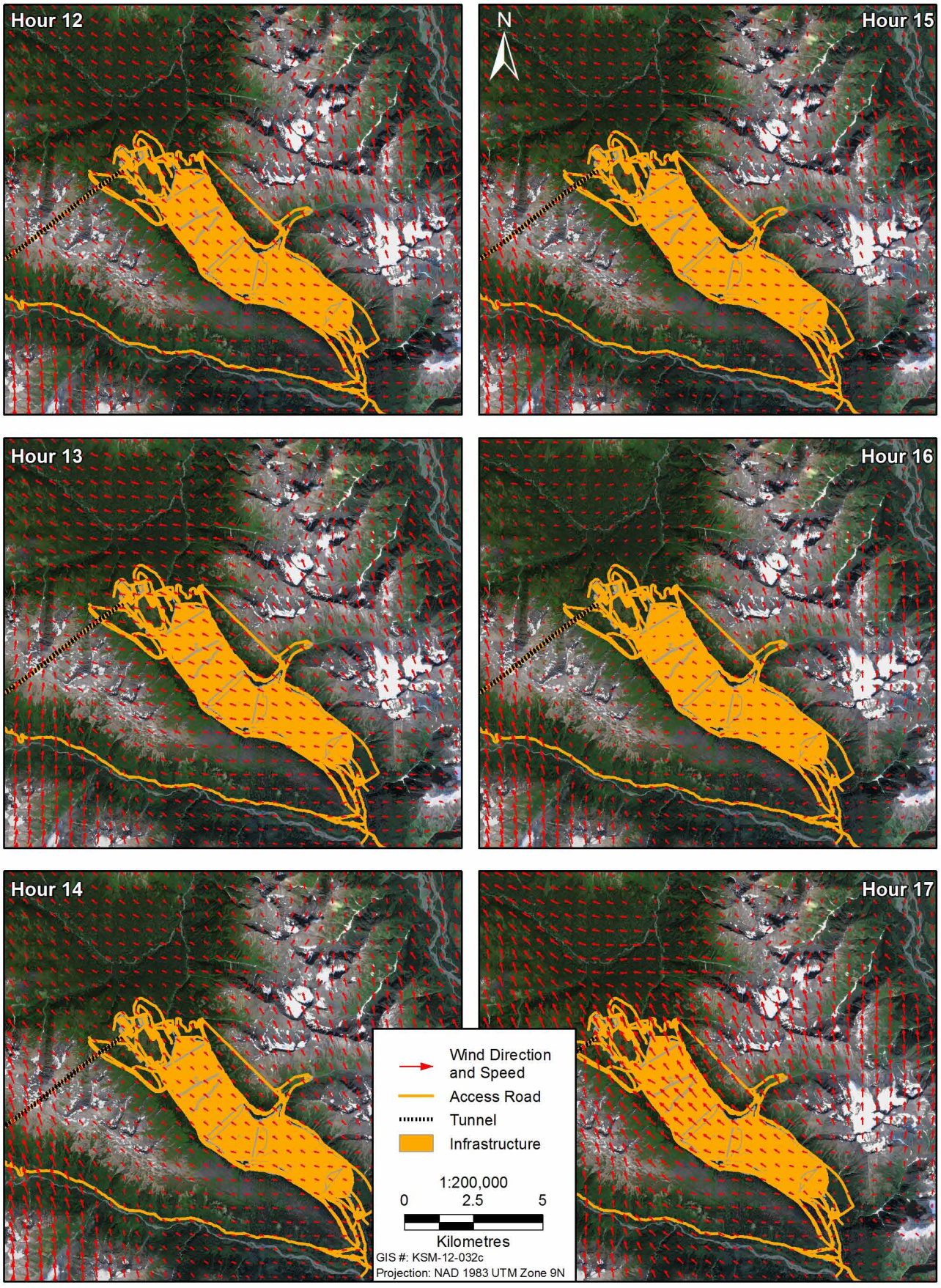

SEABRIDGE GOLD
KSM PROJECT

KSM Project: 18 to 30 m (Layer 2) Wind Speed and Direction, January 18, 2009 - Hours 12 to 17

Figure 4-14

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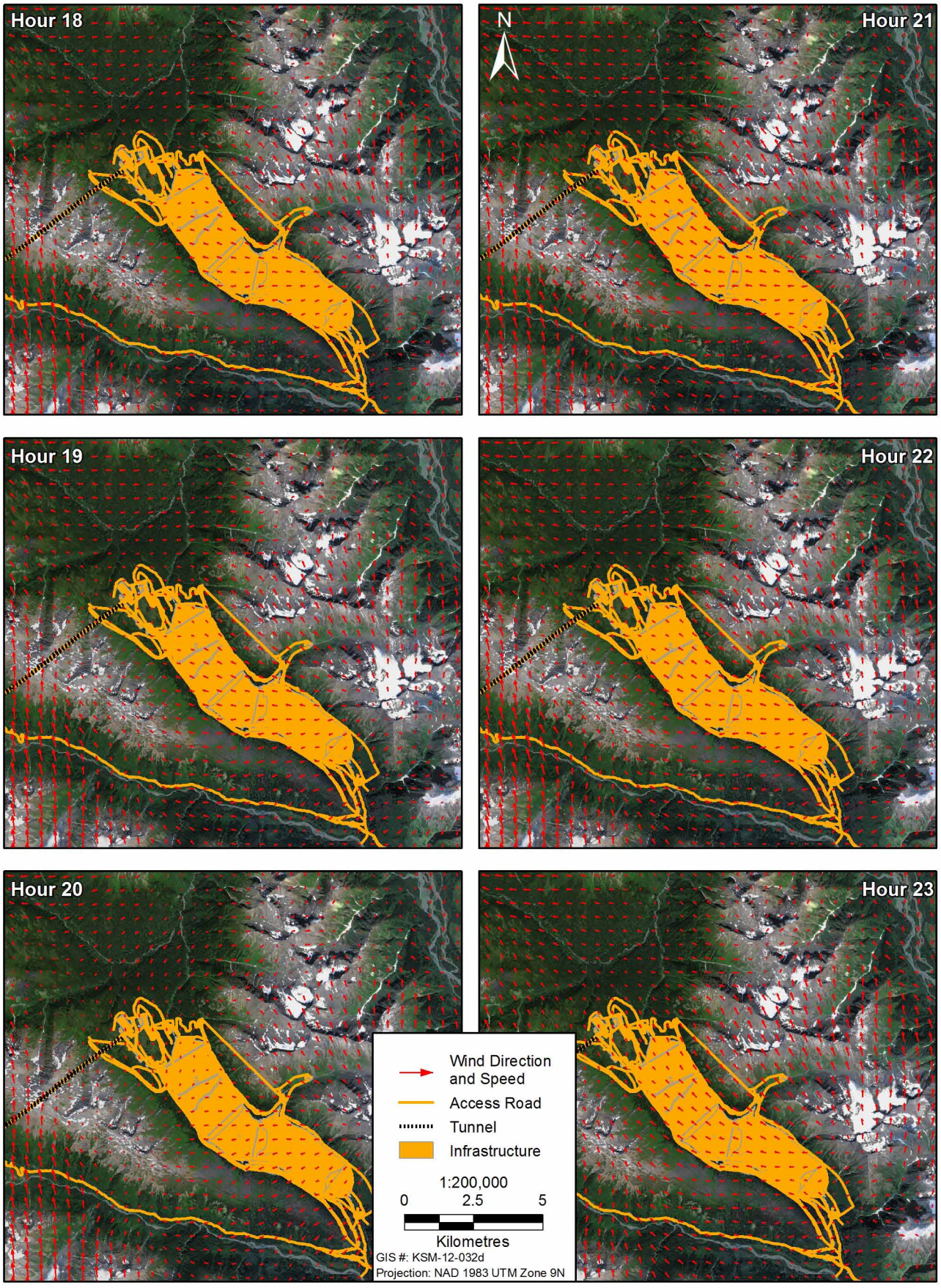
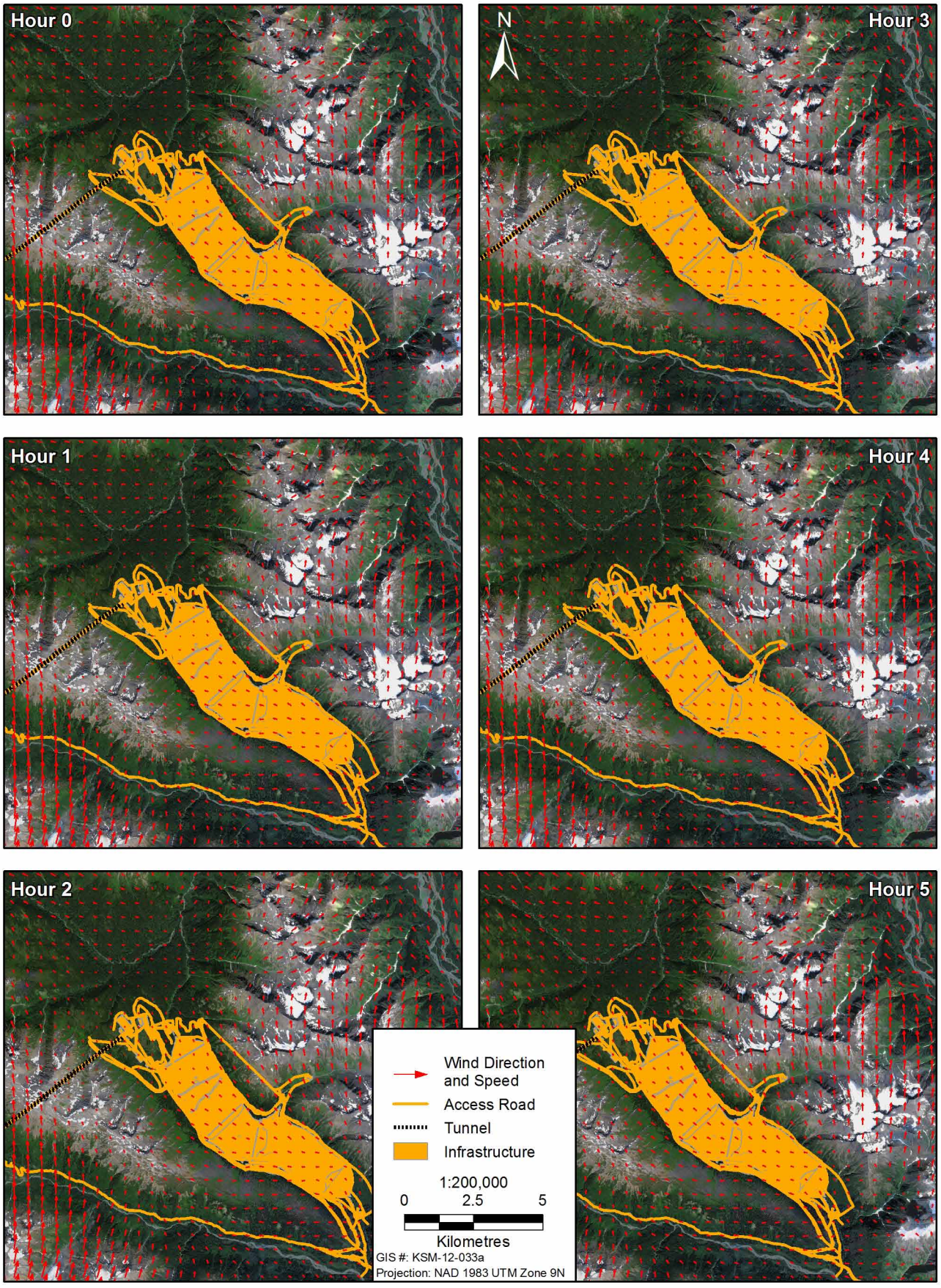


KSM Project: 18 to 30 m (Layer 2) Wind Speed and Direction, January 18, 2009 - Hours 18 to 23

Figure 4-15

SEABRIDGE GOLD KSM PROJECT

Rescan Engineers & Scientists

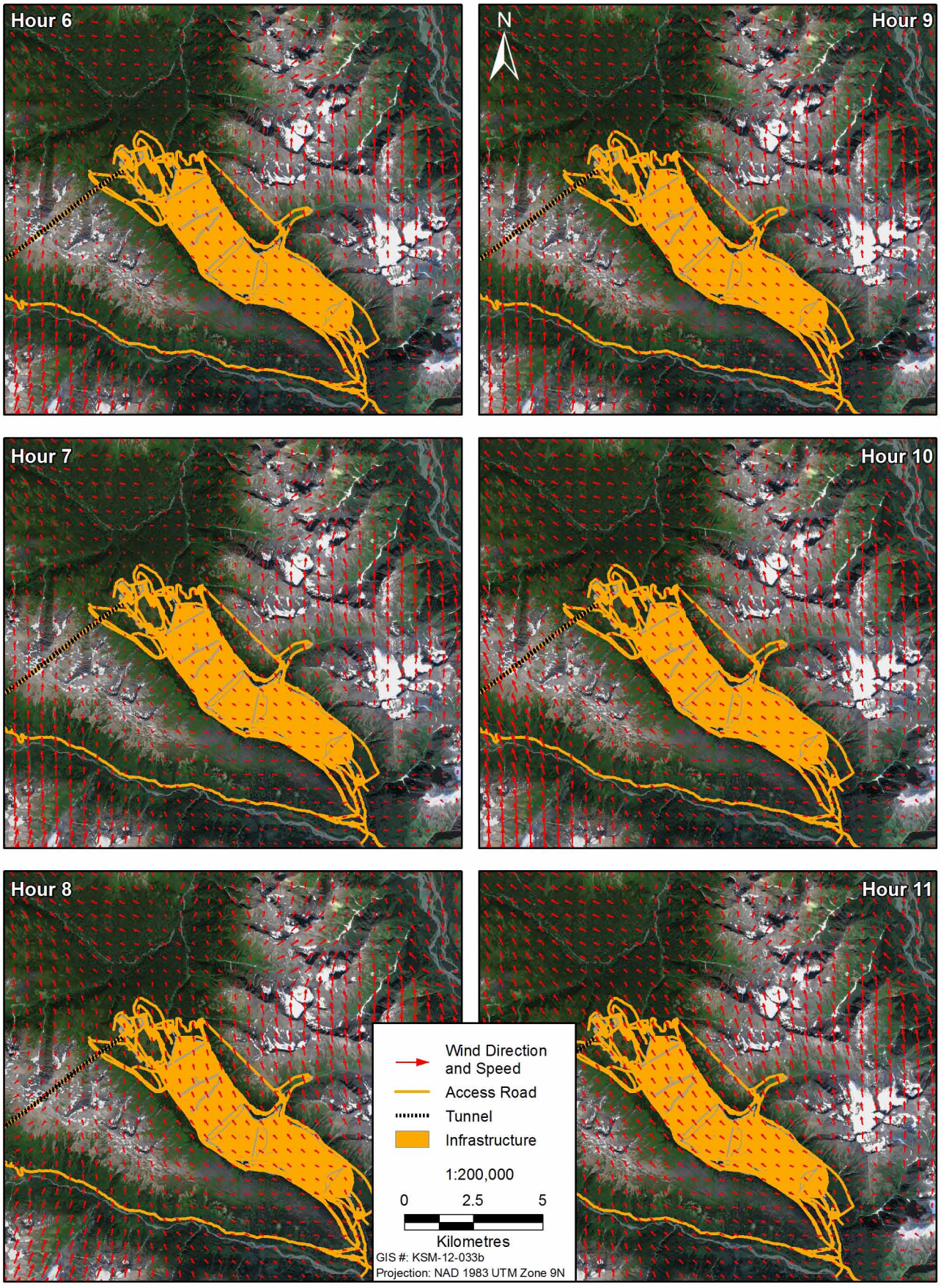


SEABRIDGE GOLD
KSM PROJECT

KSM Project: 30 to 50 m (Layer 3) Wind Speed and Direction, January 18, 2009 - Hours 0 to 5

Figure 4-16

Rescan™ Engineers & Scientists

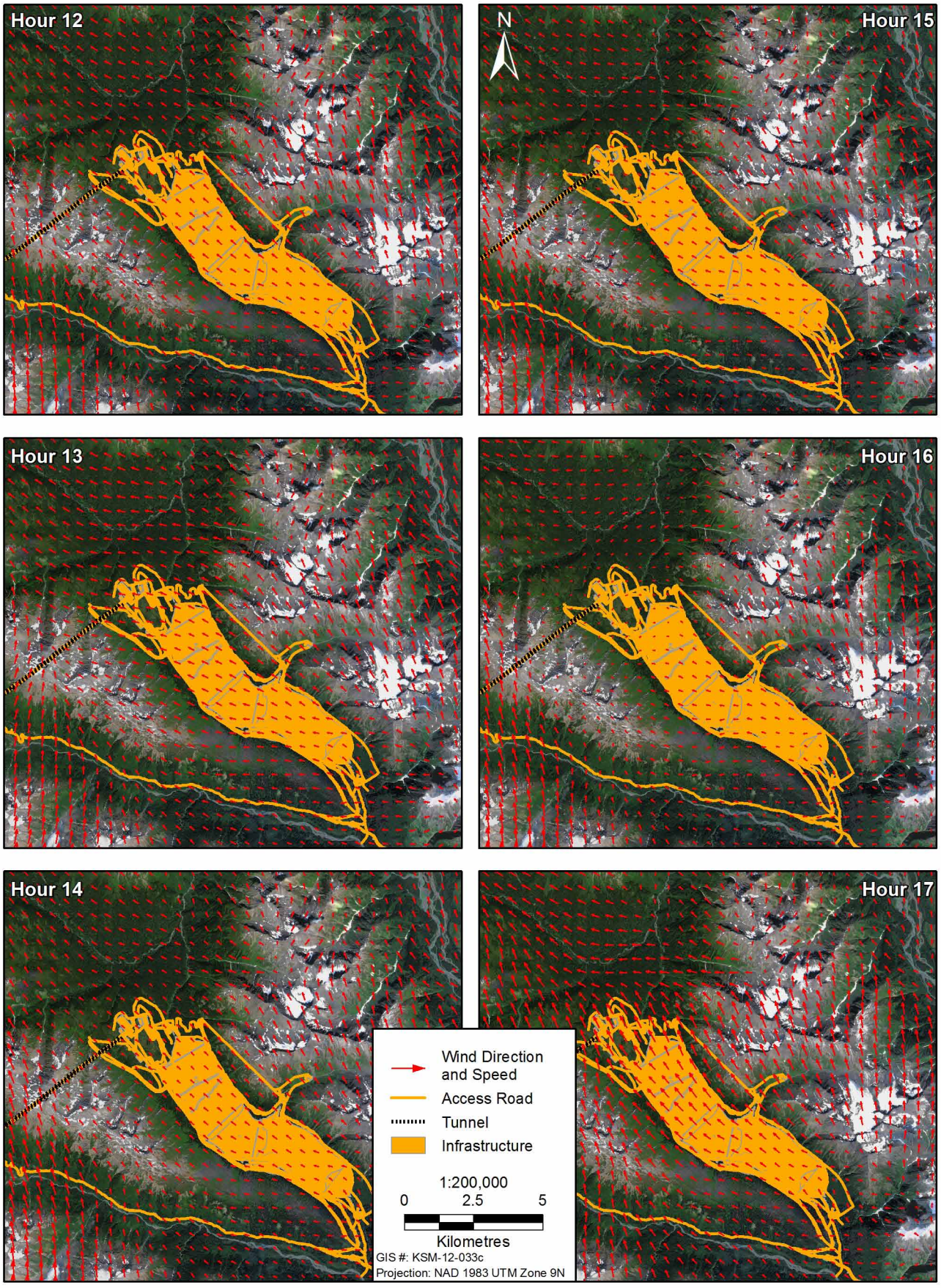


SEABRIDGE GOLD
KSM PROJECT

KSM Project: 30 to 50 m (Layer 3) Wind Speed and Direction, January 18, 2009 - Hours 6 to 11

Figure 4-17

Rescan™ Engineers & Scientists



SEABRIDGE GOLD
KSM PROJECT

KSM Project: 30 to 50 m (Layer 3) Wind Speed and Direction, January 18, 2009 - Hours 12 to 17

Figure 4-18

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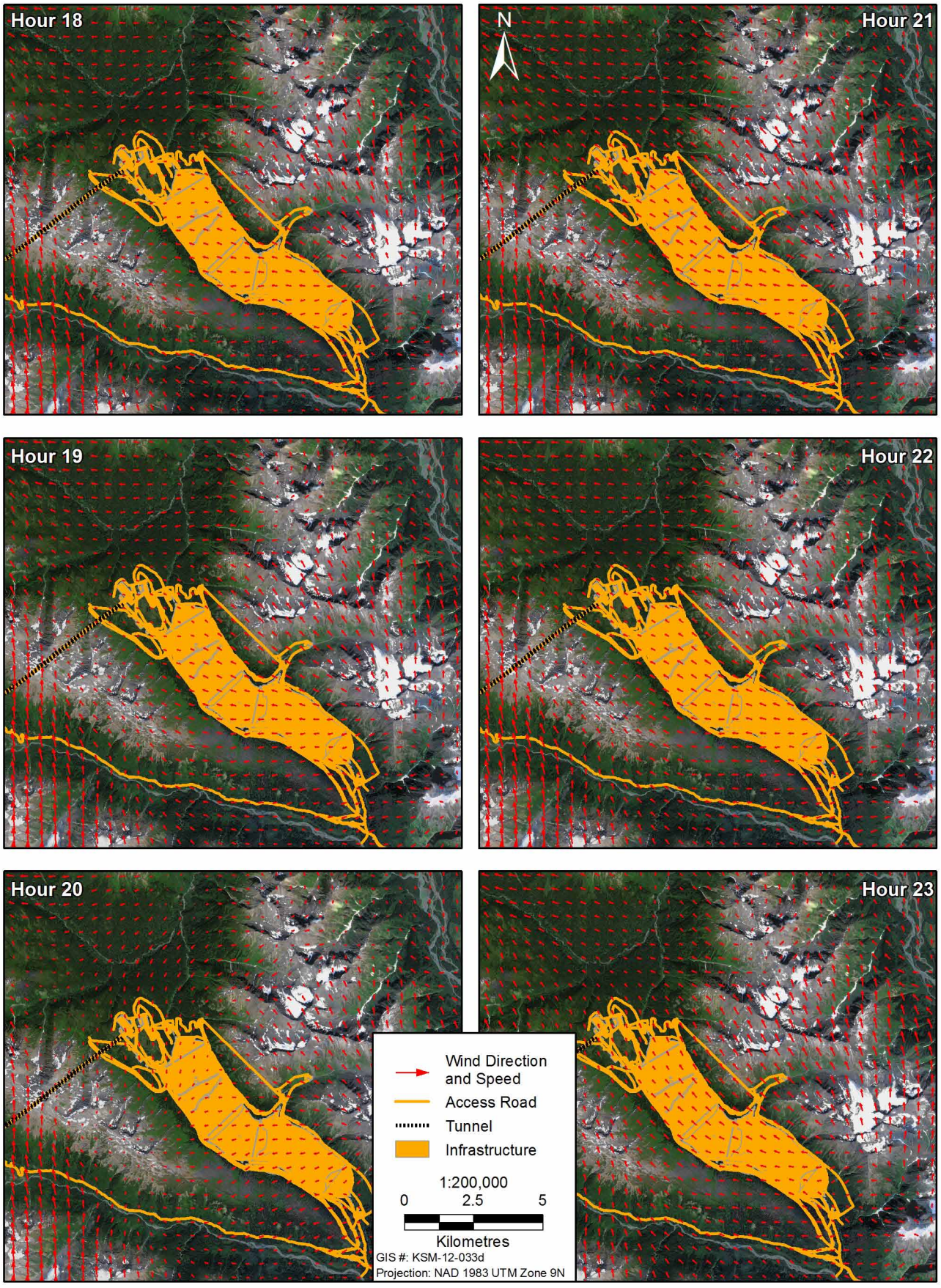
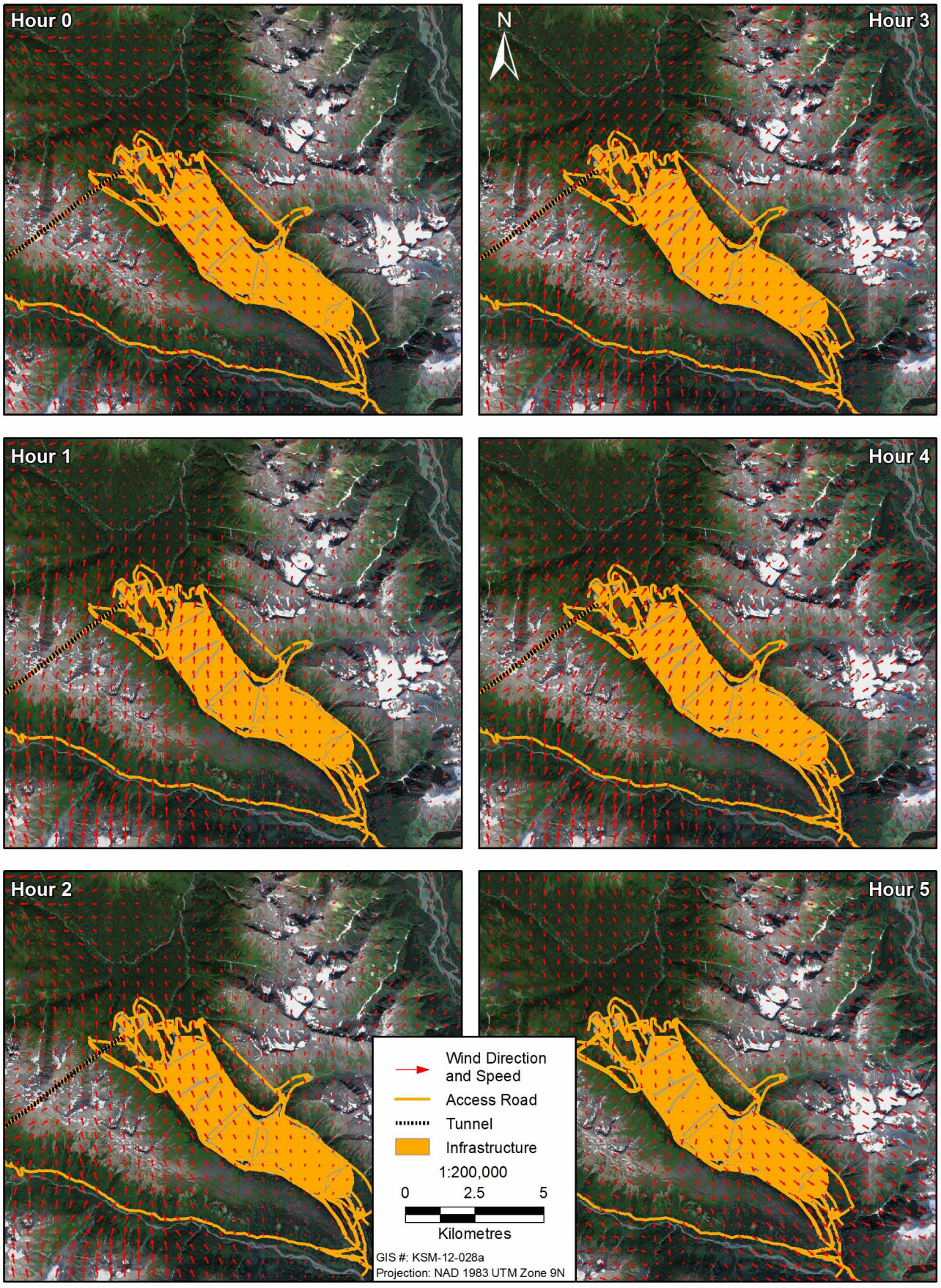


SEABRIDGE GOLD
KSM PROJECT

KSM Project: 30 to 50 m (Layer 3) Wind Speed and Direction, January 18, 2009 - Hours 18 to 23

Figure 4-19

Rescan™ Engineers & Scientists

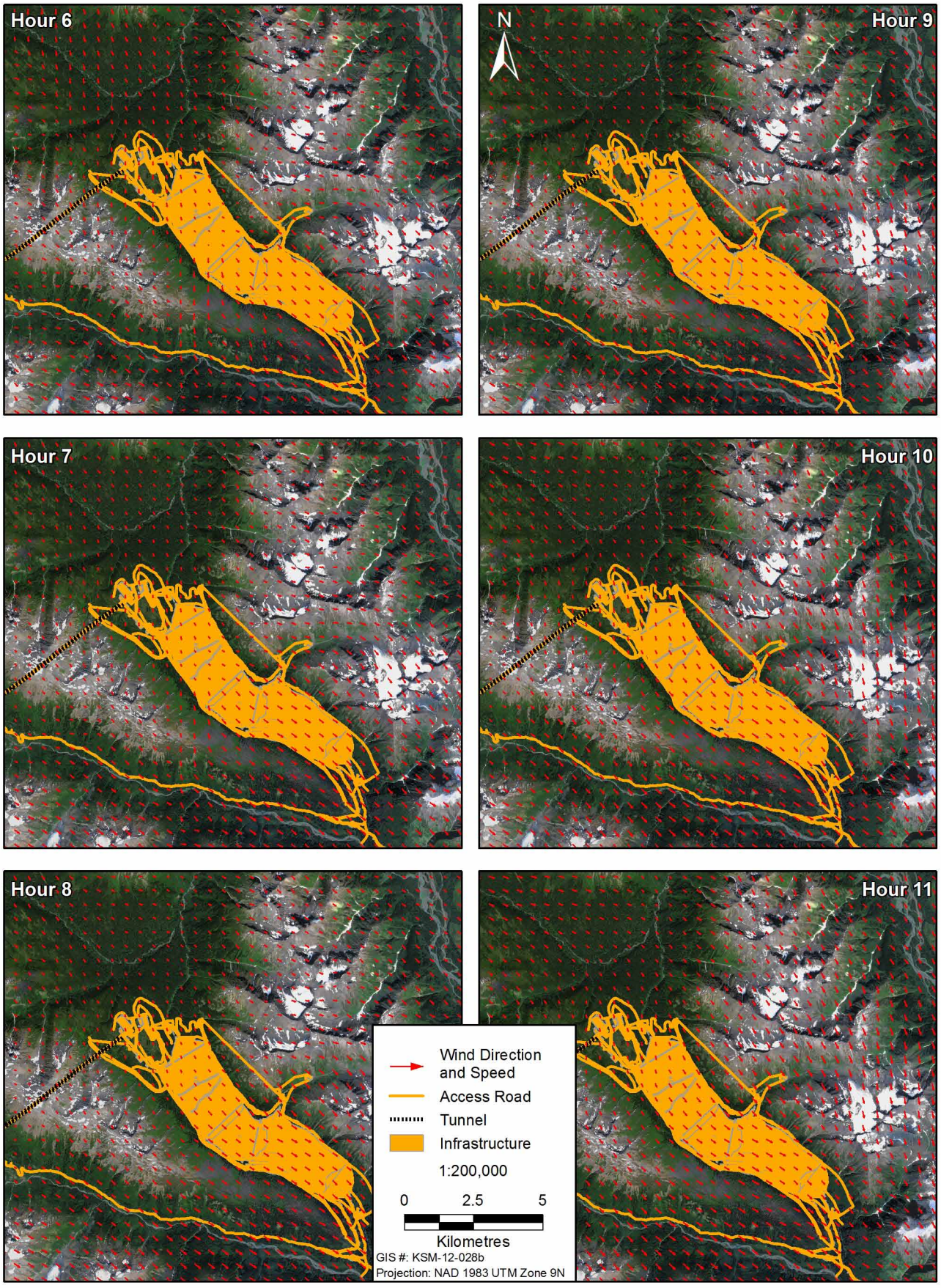


SEABRIDGE GOLD
KSM PROJECT

KSM Project: 0 to 18 m (Layer 1) Wind Speed and Direction, June 30, 2009 - Hours 0 to 5

Figure 4-20

Rescan™ Engineers & Scientists

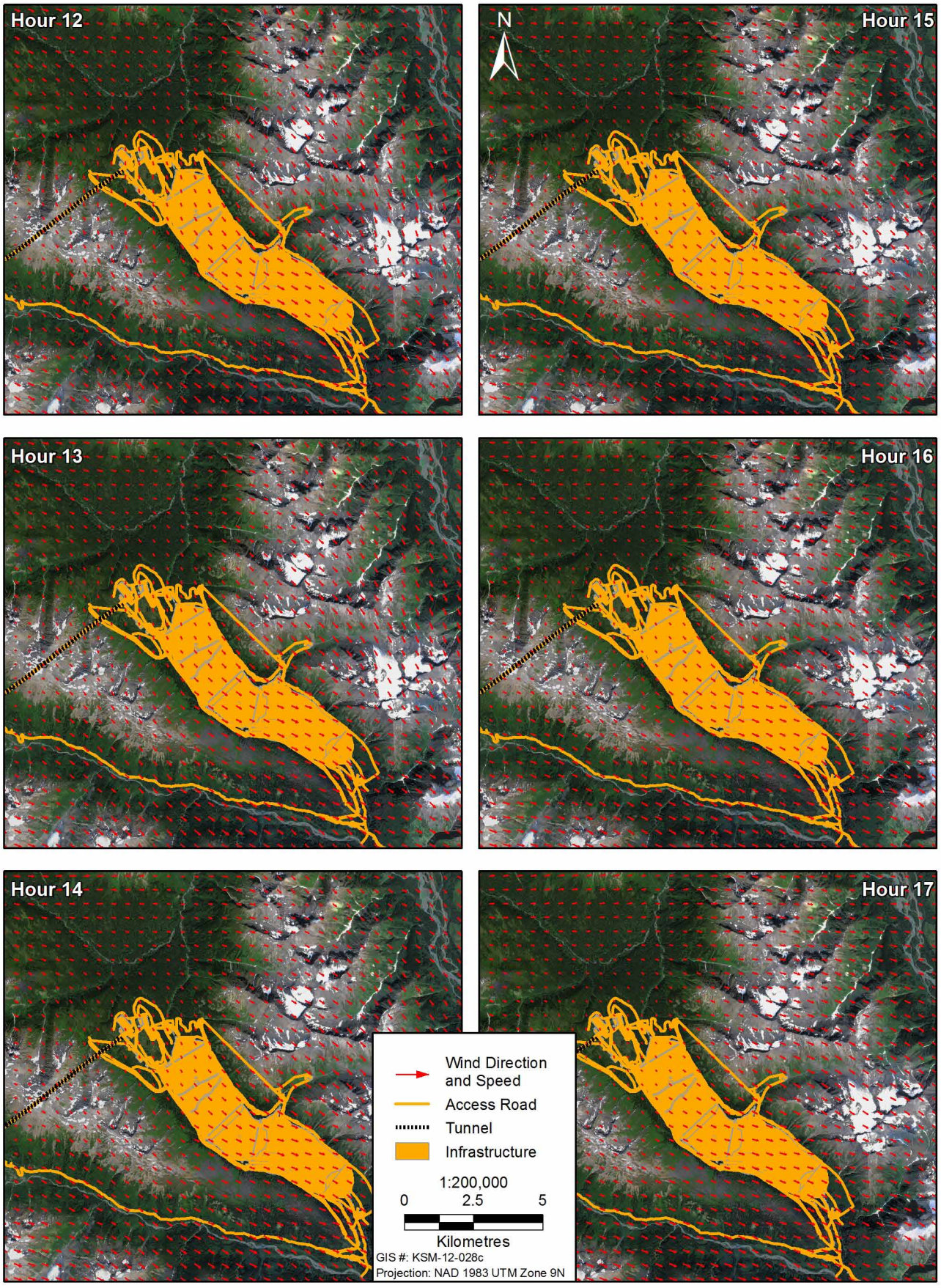


SEABRIDGE GOLD
KSM PROJECT

KSM Project: 0 to 18 m (Layer 1) Wind Speed and Direction, June 30, 2009 - Hours 6 to 11

Figure 4-21

Rescan™ Engineers & Scientists

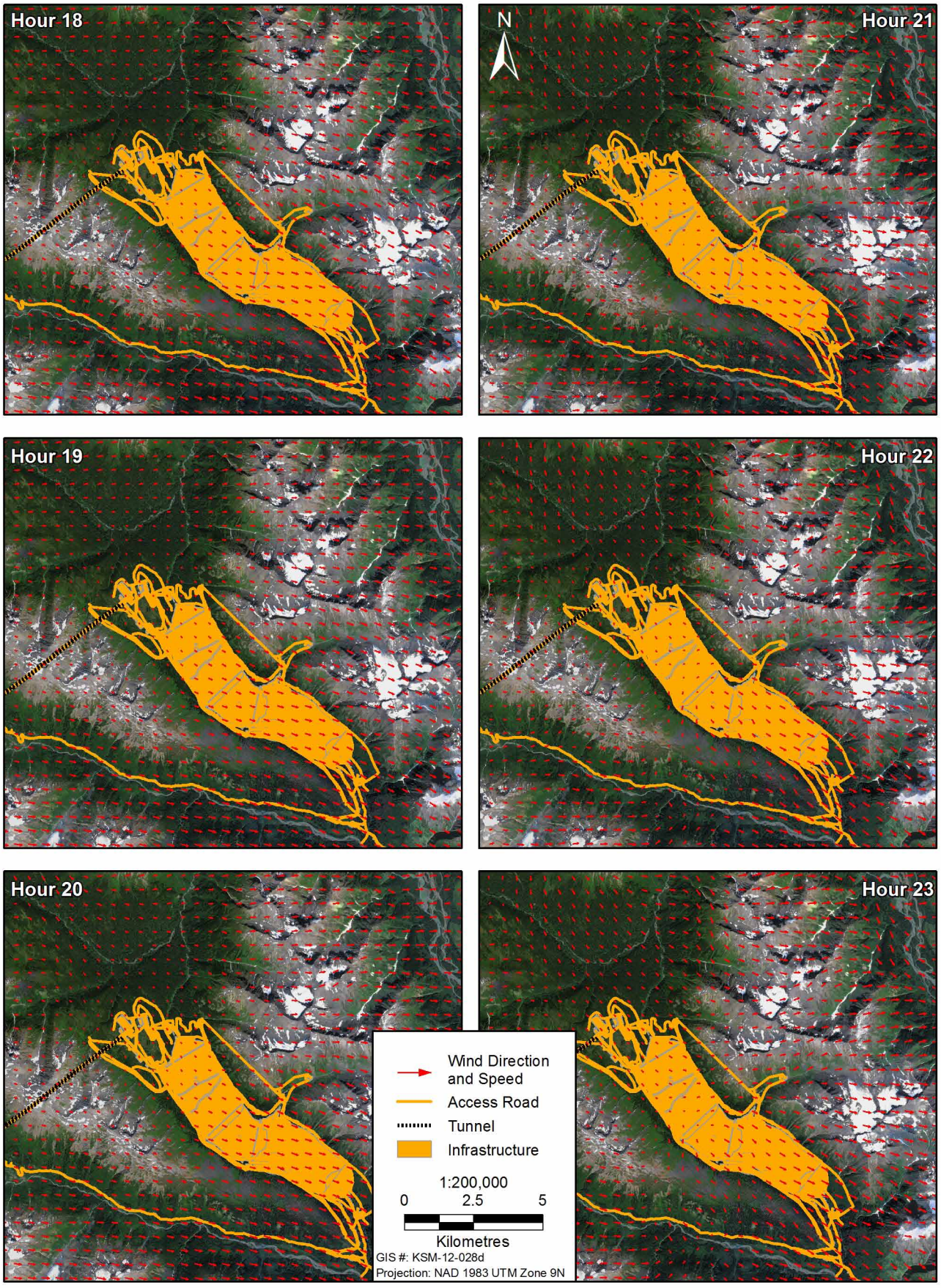


SEABRIDGE GOLD
KSM PROJECT

KSM Project: 0 to 18 m (Layer 1) Wind Speed and Direction, June 30, 2009 - Hours 12 to 17

Figure 4-22

Rescan™ Engineers & Scientists

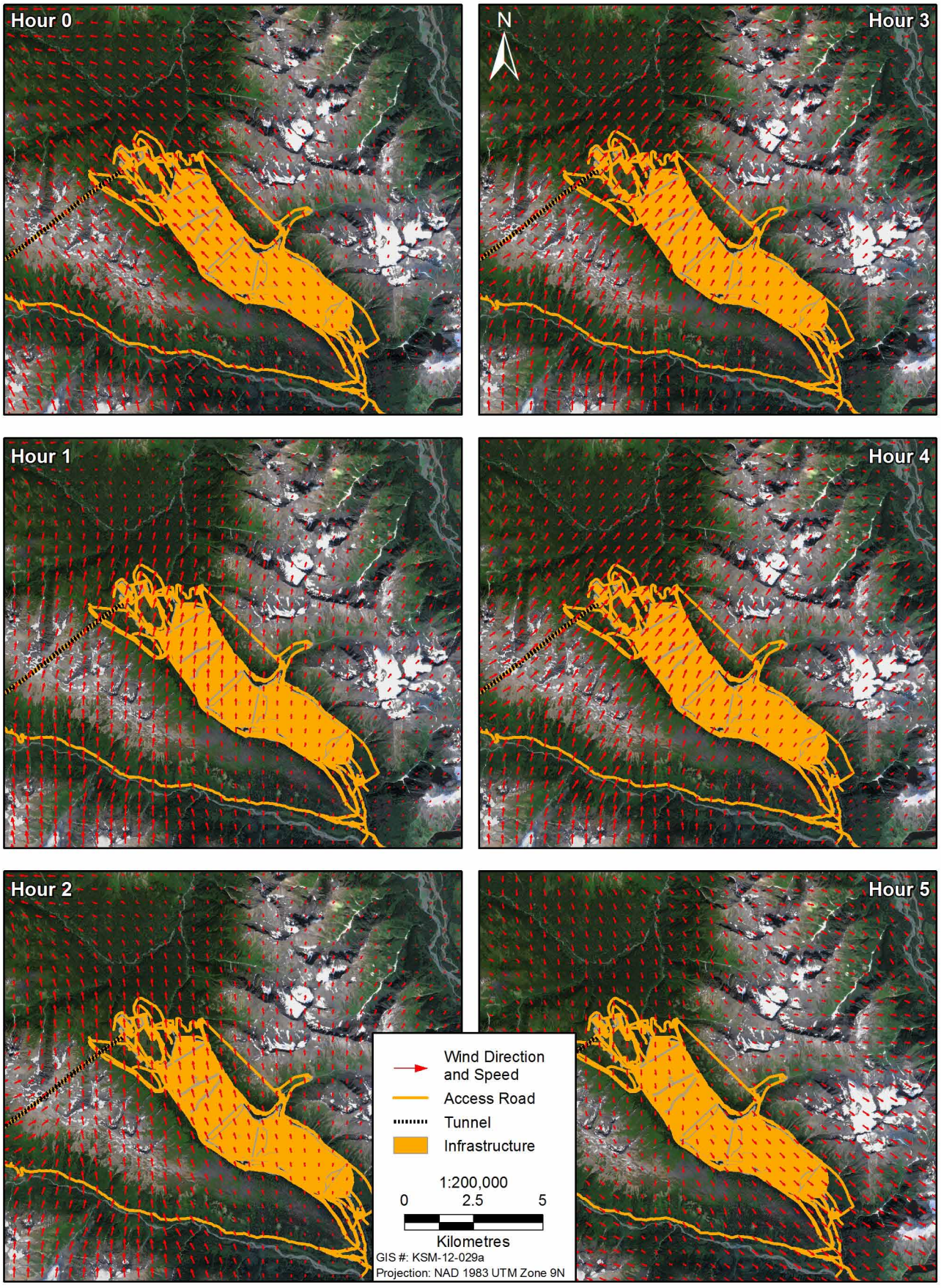


SEABRIDGE GOLD
KSM PROJECT

KSM Project: 0 to 18 m (Layer 1) Wind Speed and Direction, June 30, 2009 - Hours 18 to 23

Figure 4-23

Rescan™ Engineers & Scientists

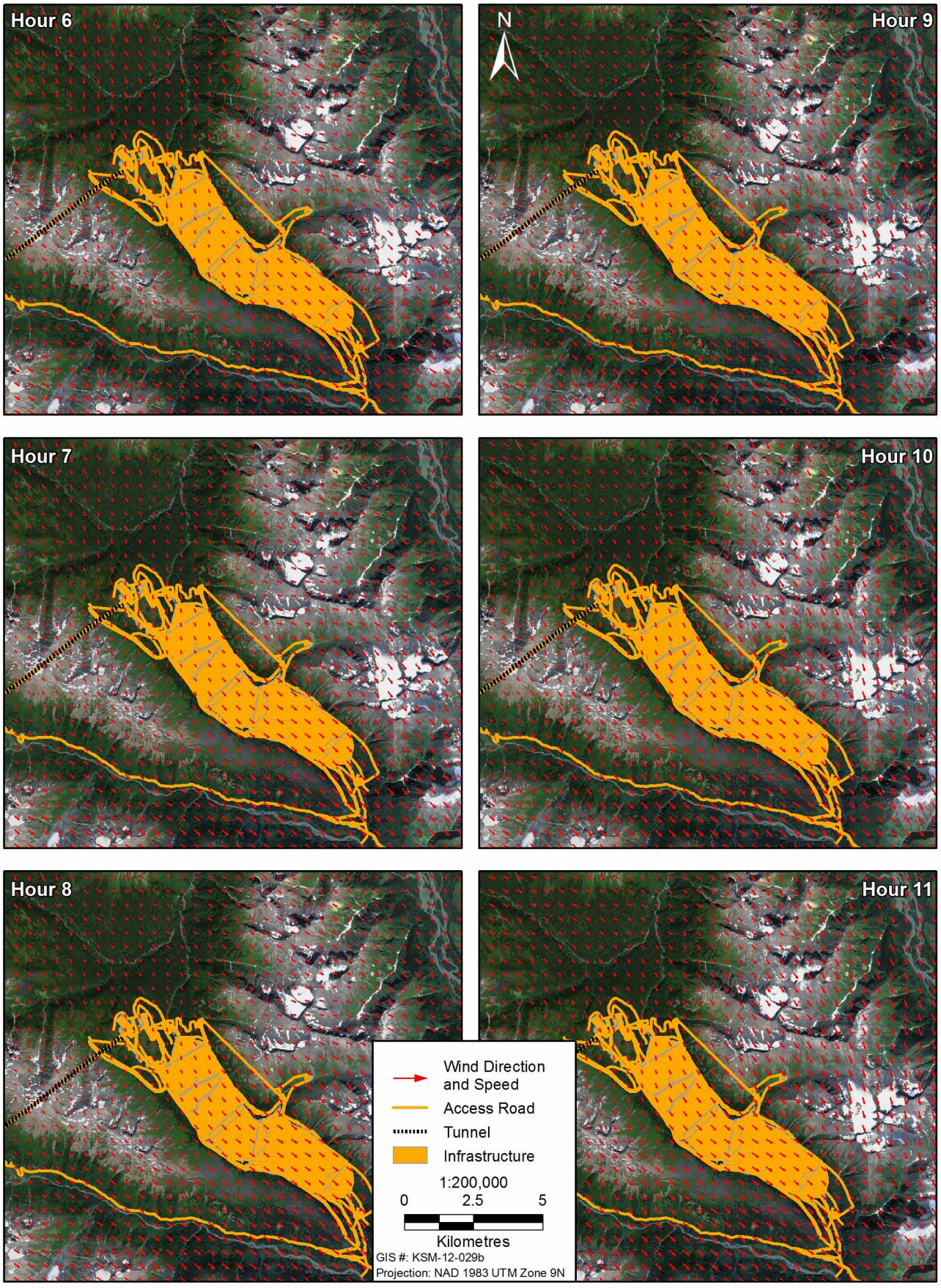


SEABRIDGE GOLD
KSM PROJECT

KSM Project: 18 to 30 m (Layer 2) Wind Speed and Direction, June 30, 2009 - Hours 0 to 5

Figure 4-24

Rescan™ Engineers & Scientists

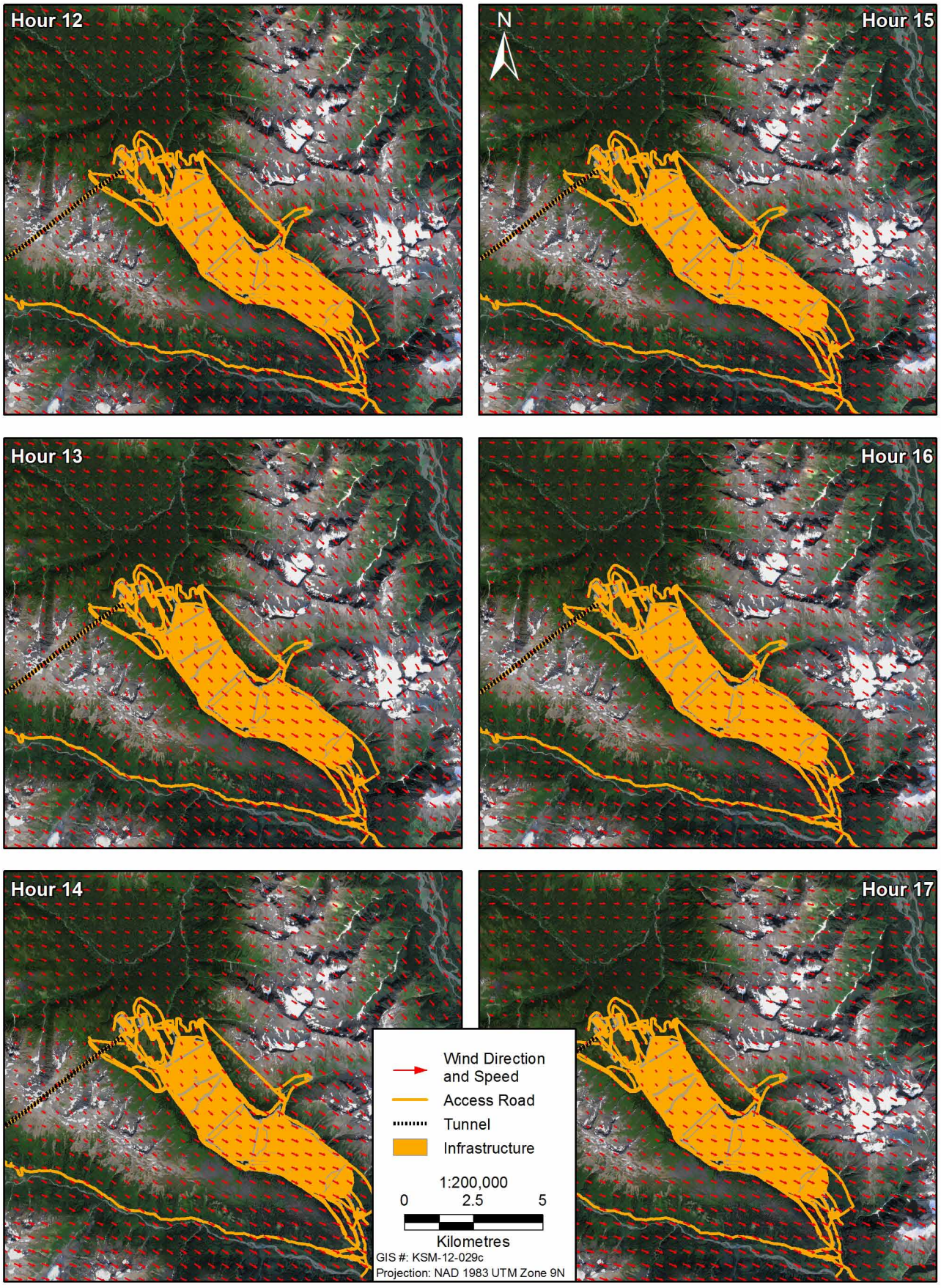


SEABRIDGE GOLD
KSM PROJECT

KSM Project: 18 to 30 m (Layer 2) Wind Speed and Direction, June 30, 2009 - Hours 6 to 11

Figure 4-25

Rescan™ Engineers & Scientists

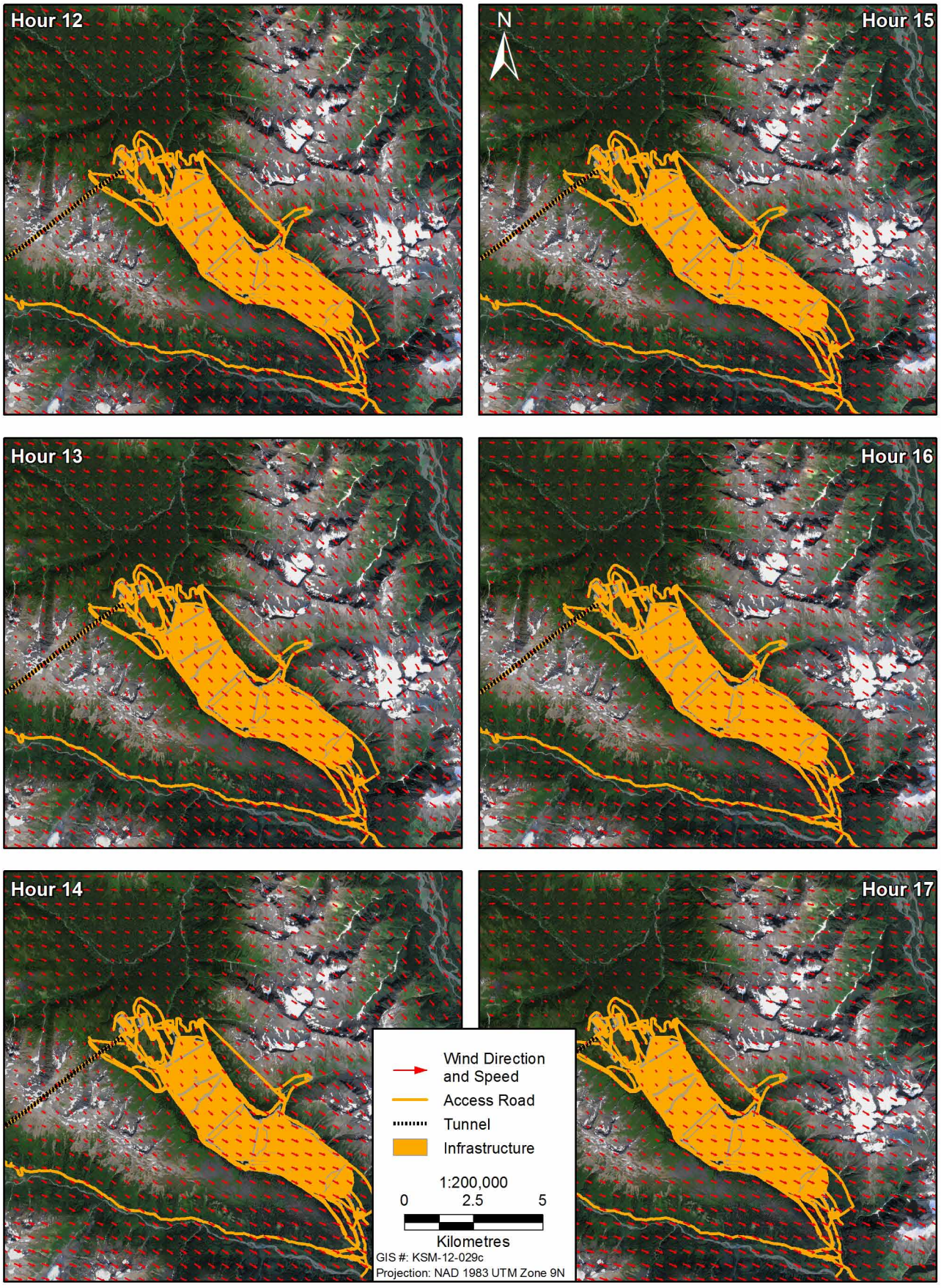


SEABRIDGE GOLD
KSM PROJECT

KSM Project: 18 to 30 m (Layer 2) Wind Speed and Direction, June 30, 2009 - Hours 12 to 17

Figure 4-26

Rescan™ Engineers & Scientists

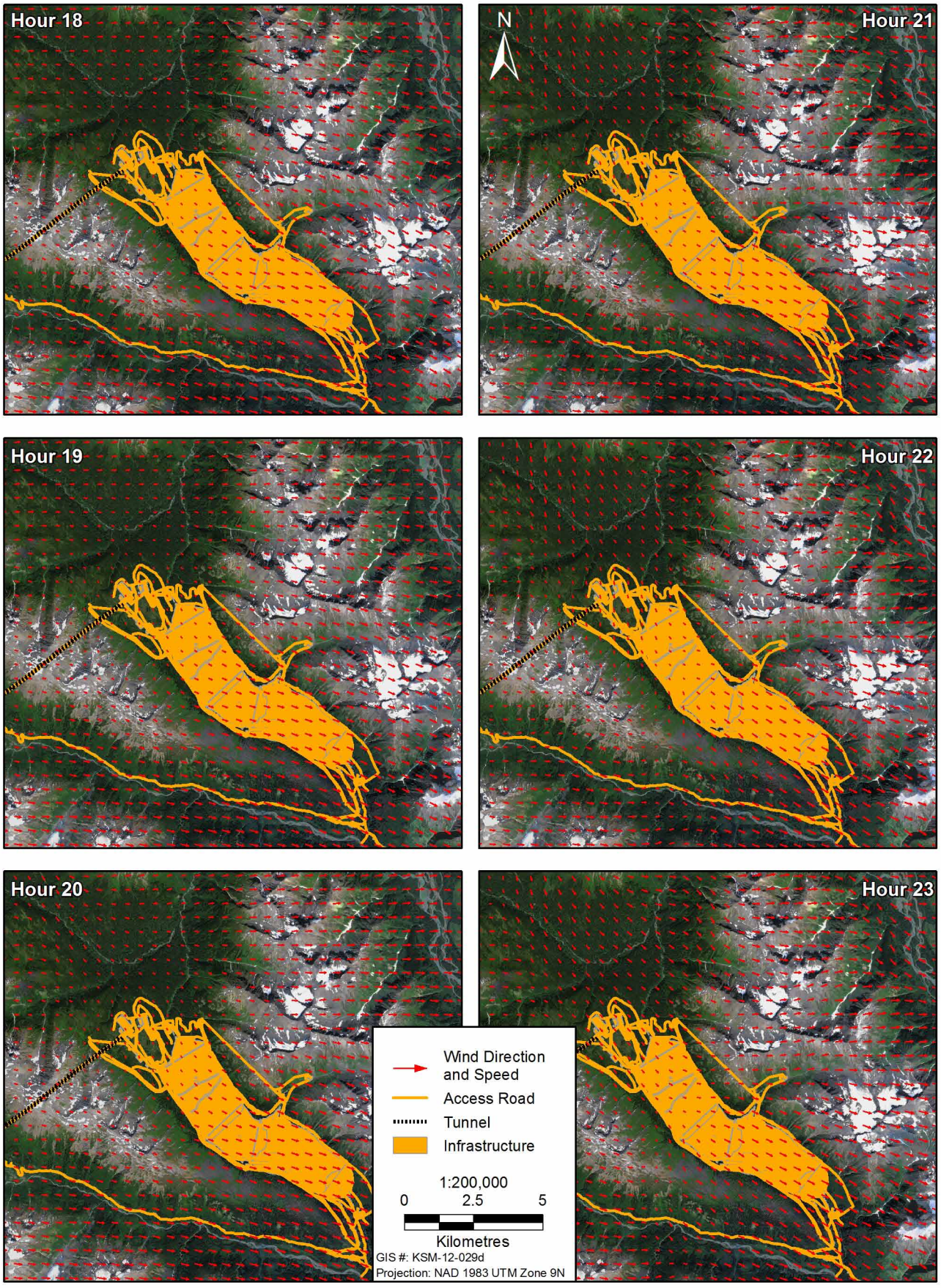


SEABRIDGE GOLD
KSM PROJECT

KSM Project: 18 to 30 m (Layer 2) Wind Speed and Direction, June 30, 2009 - Hours 12 to 17

Figure 4-26

Rescan™ Engineers & Scientists

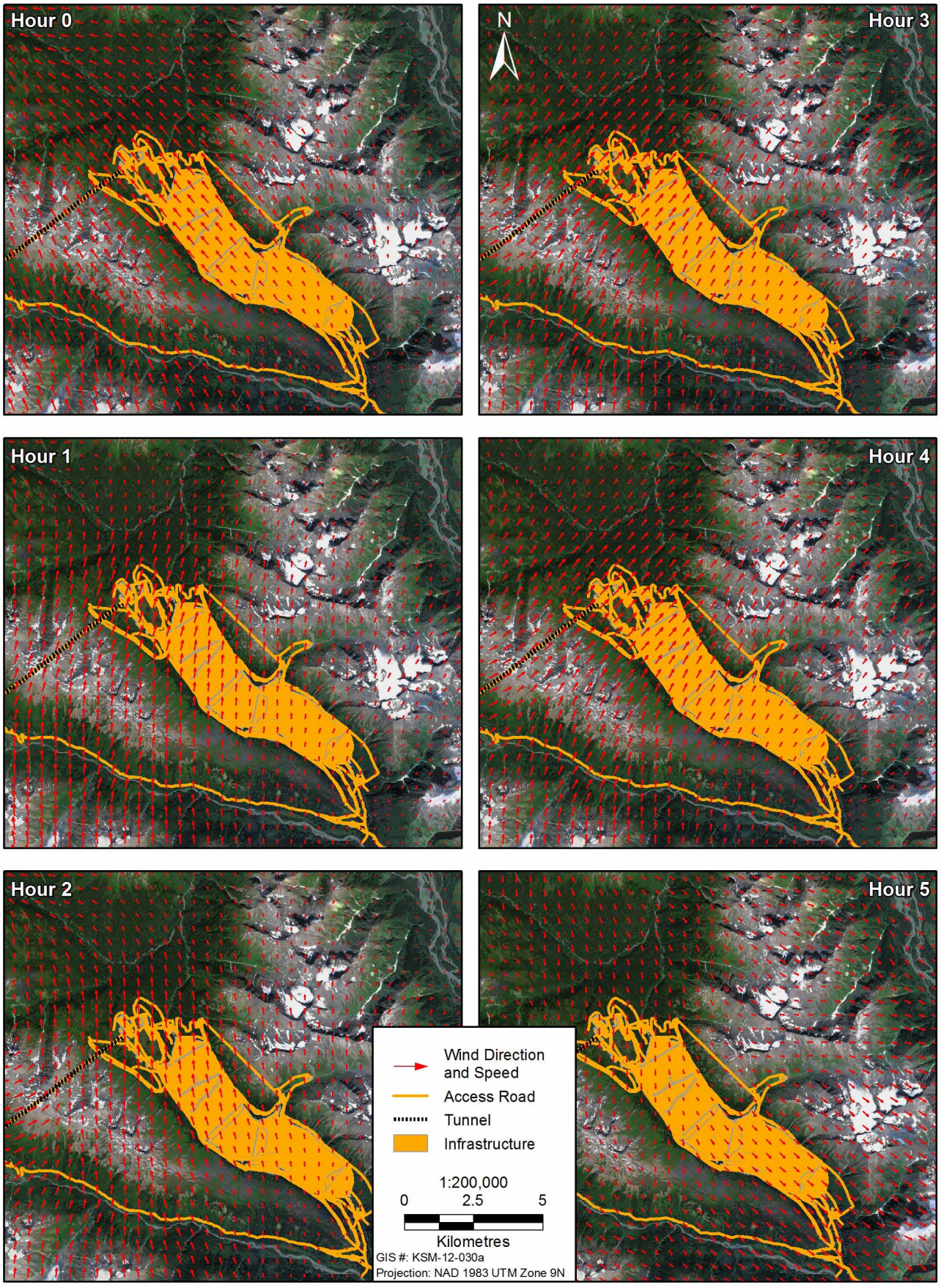


SEABRIDGE GOLD
KSM PROJECT

KSM Project: 18 to 30 m (Layer 2) Wind Speed and Direction, June 30, 2009 - Hours 18 to 23

Figure 4-27

Rescan™ Engineers & Scientists

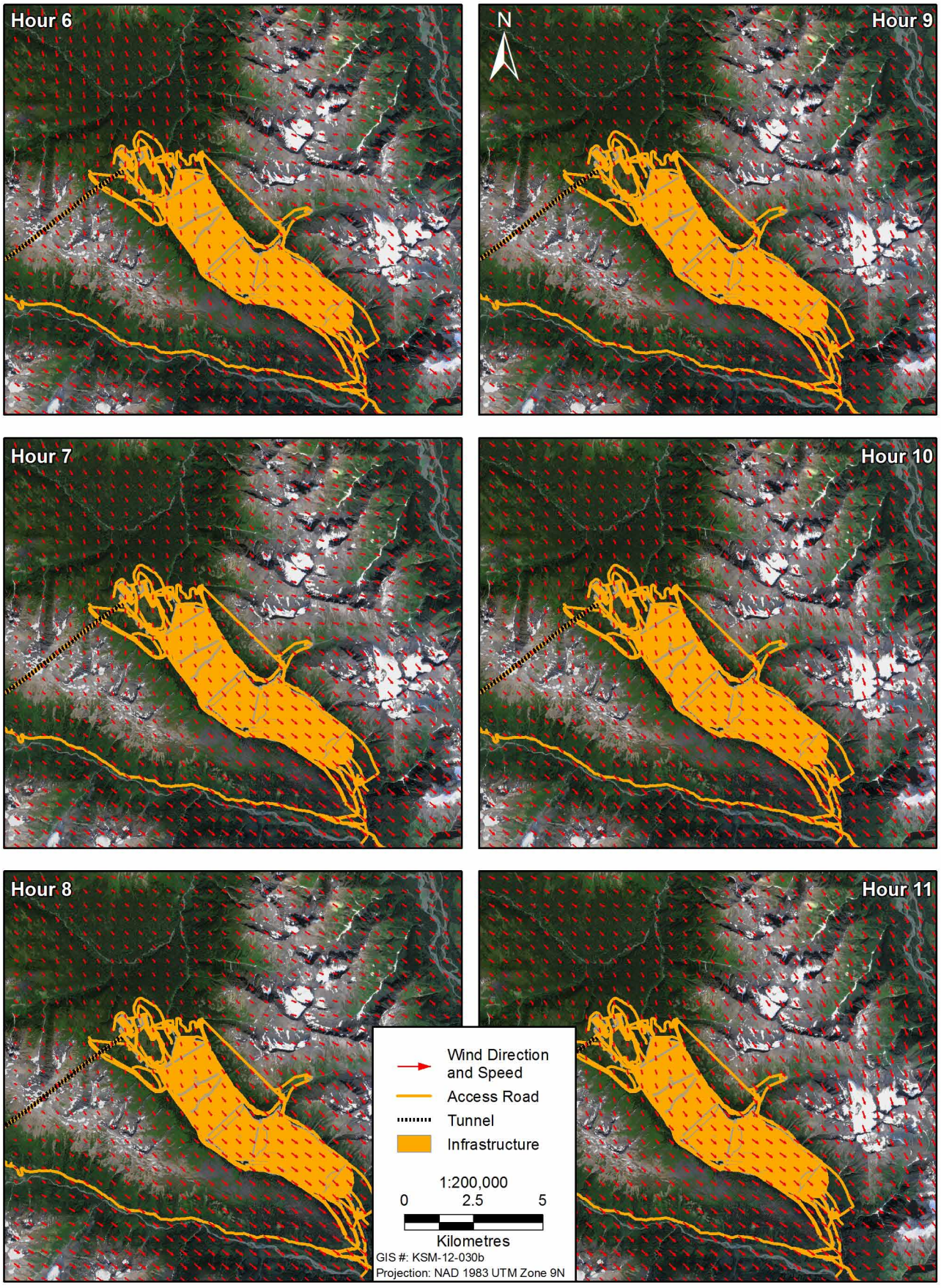


SEABRIDGE GOLD
KSM PROJECT

KSM Project: 30 to 50 m (Layer 3) Wind Speed and Direction, June 30, 2009 - Hours 0 to 5

Figure 4-28

Rescan™ Engineers & Scientists

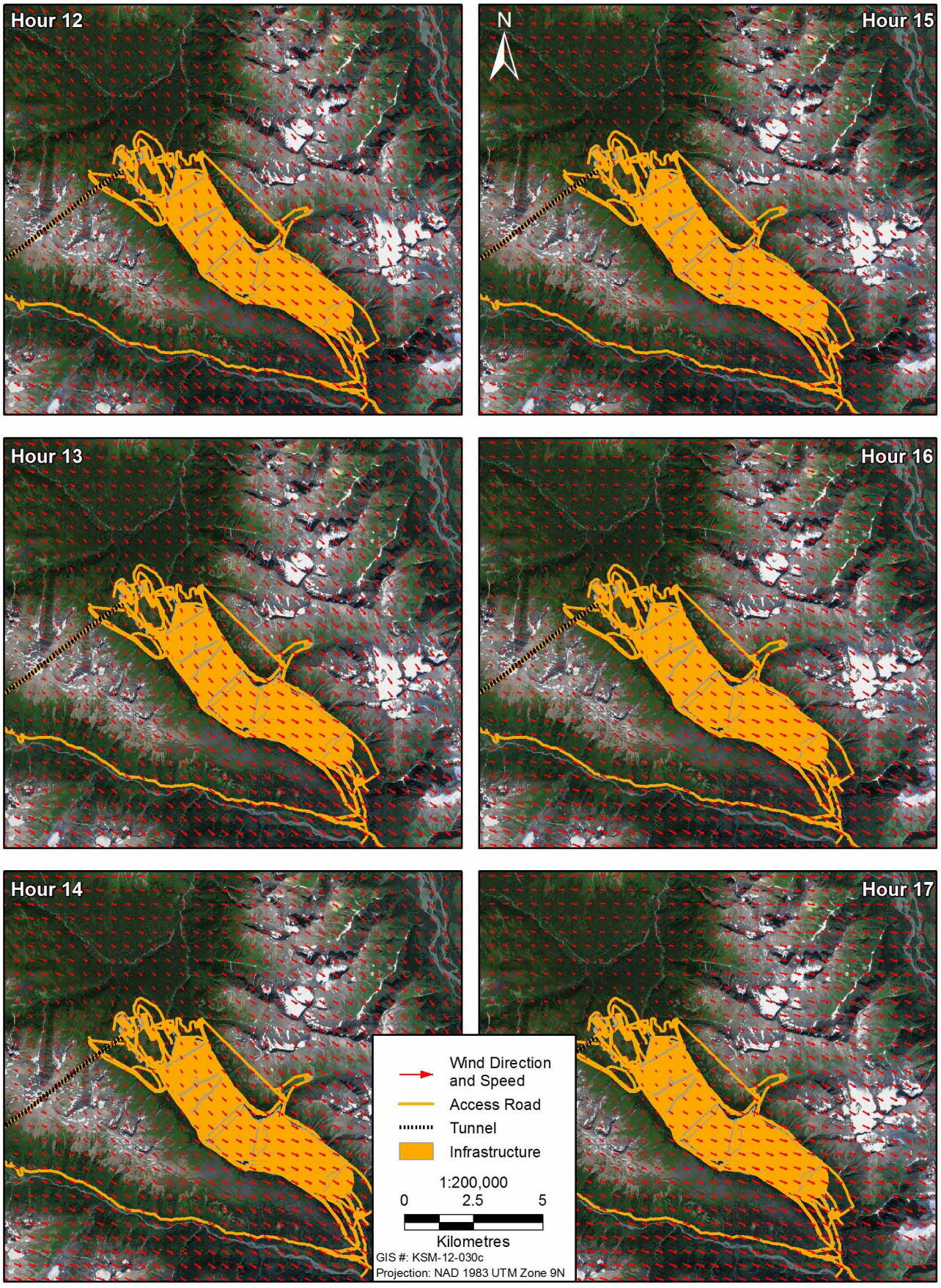


SEABRIDGE GOLD
KSM PROJECT

KSM Project: 30 to 50 m (Layer 3) Wind Speed and Direction, June 30, 2009 - Hours 6 to 11

Figure 4-29

Rescan™ Engineers & Scientists

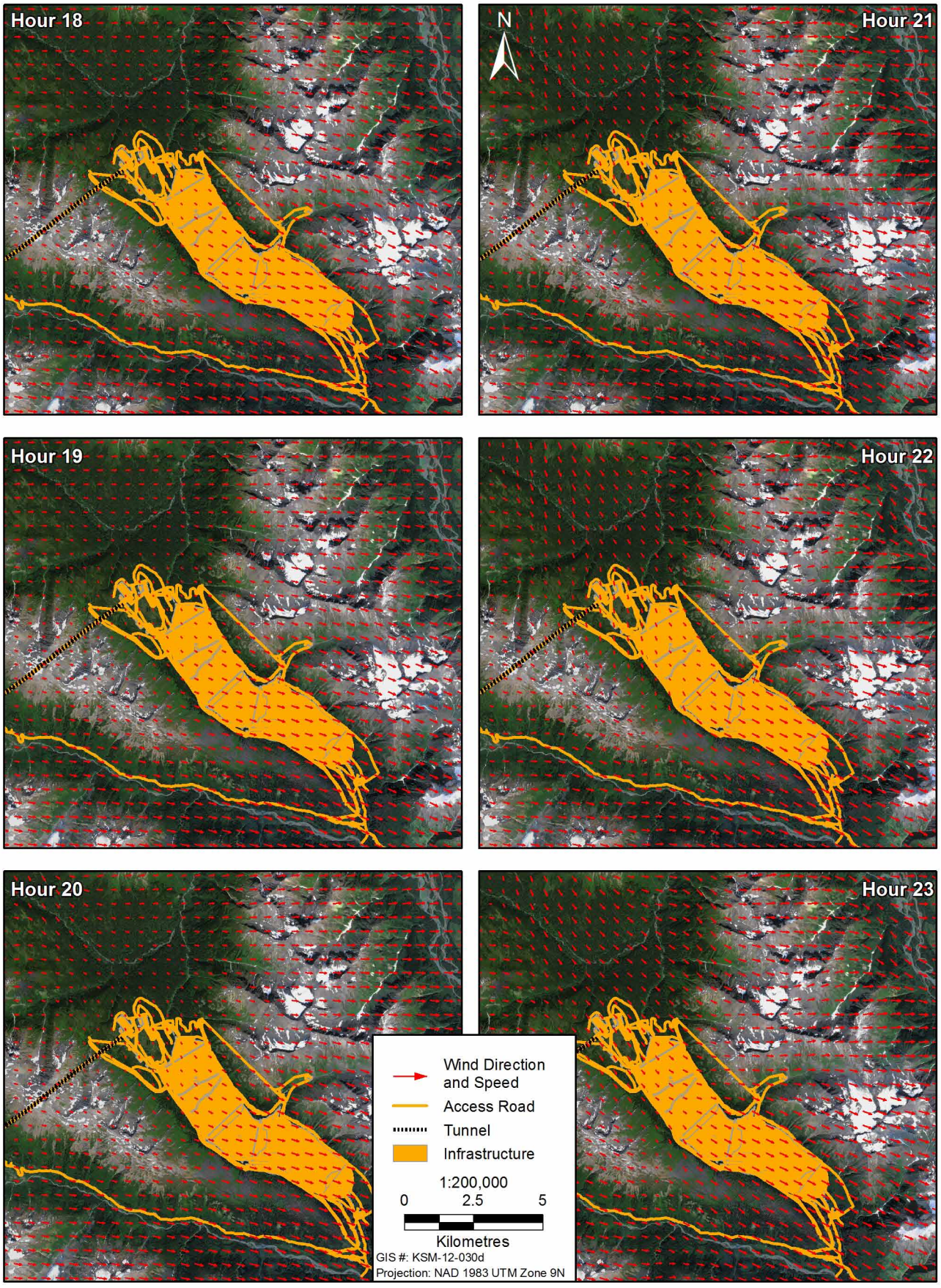


SEABRIDGE GOLD
KSM PROJECT

KSM Project: 30 to 50 m (Layer 3) Wind Speed and Direction, June 30, 2009 - Hours 12 to 17

Figure 4-30

Rescan™ Engineers & Scientists



SEABRIDGE GOLD
KSM PROJECT

KSM Project: 30 to 50 m (Layer 3) Wind Speed and Direction, June 30, 2009 - Hours 18 to 23

Figure 4-31

Rescan™ Engineers & Scientists

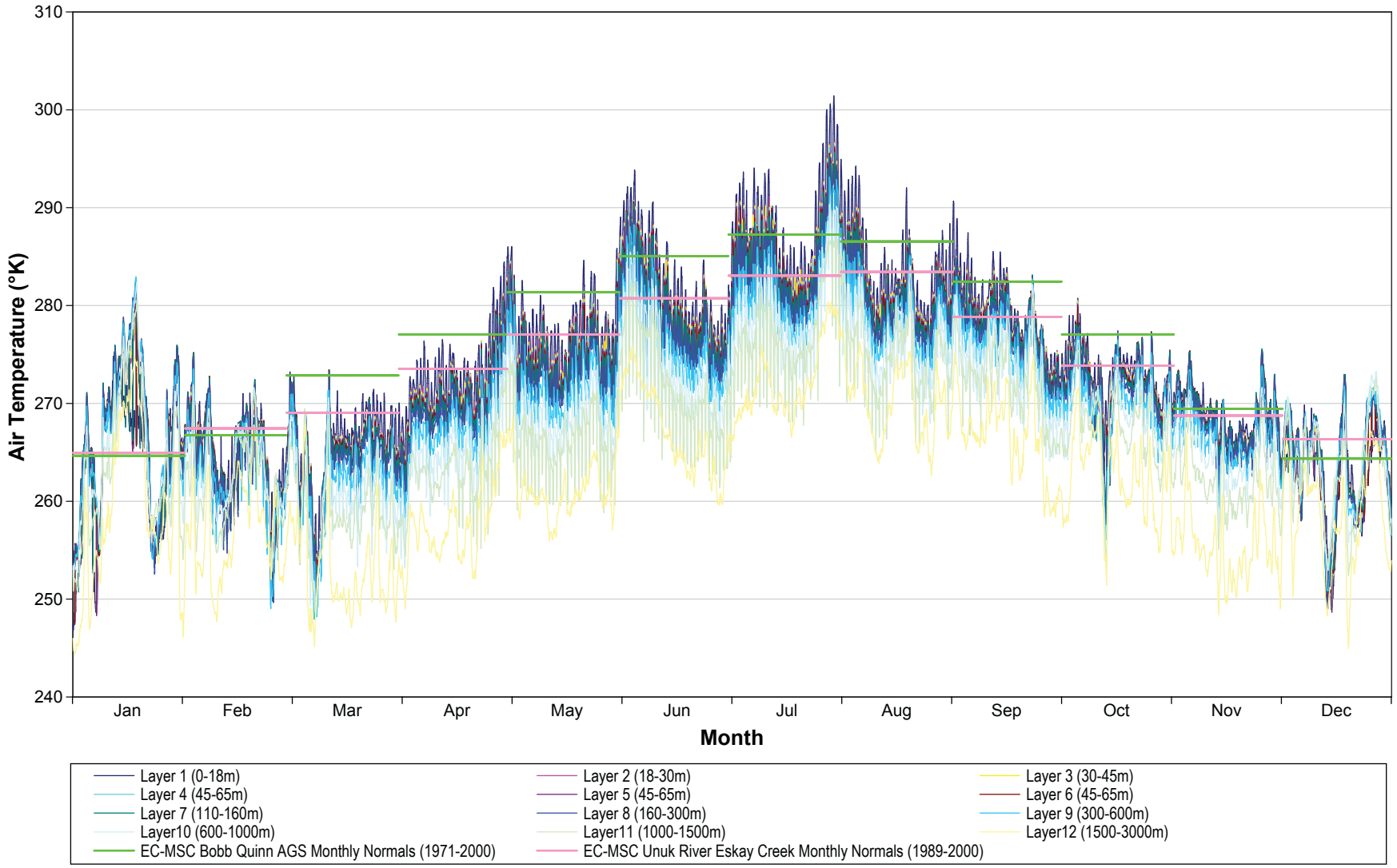


Figure 4-32

SEABRIDGE GOLD
KSM PROJECT

Comparison of CALMET Air Temperature to Regional Air Temperature Normals

Figure 4-32

Rescan™ Engineers & Scientists

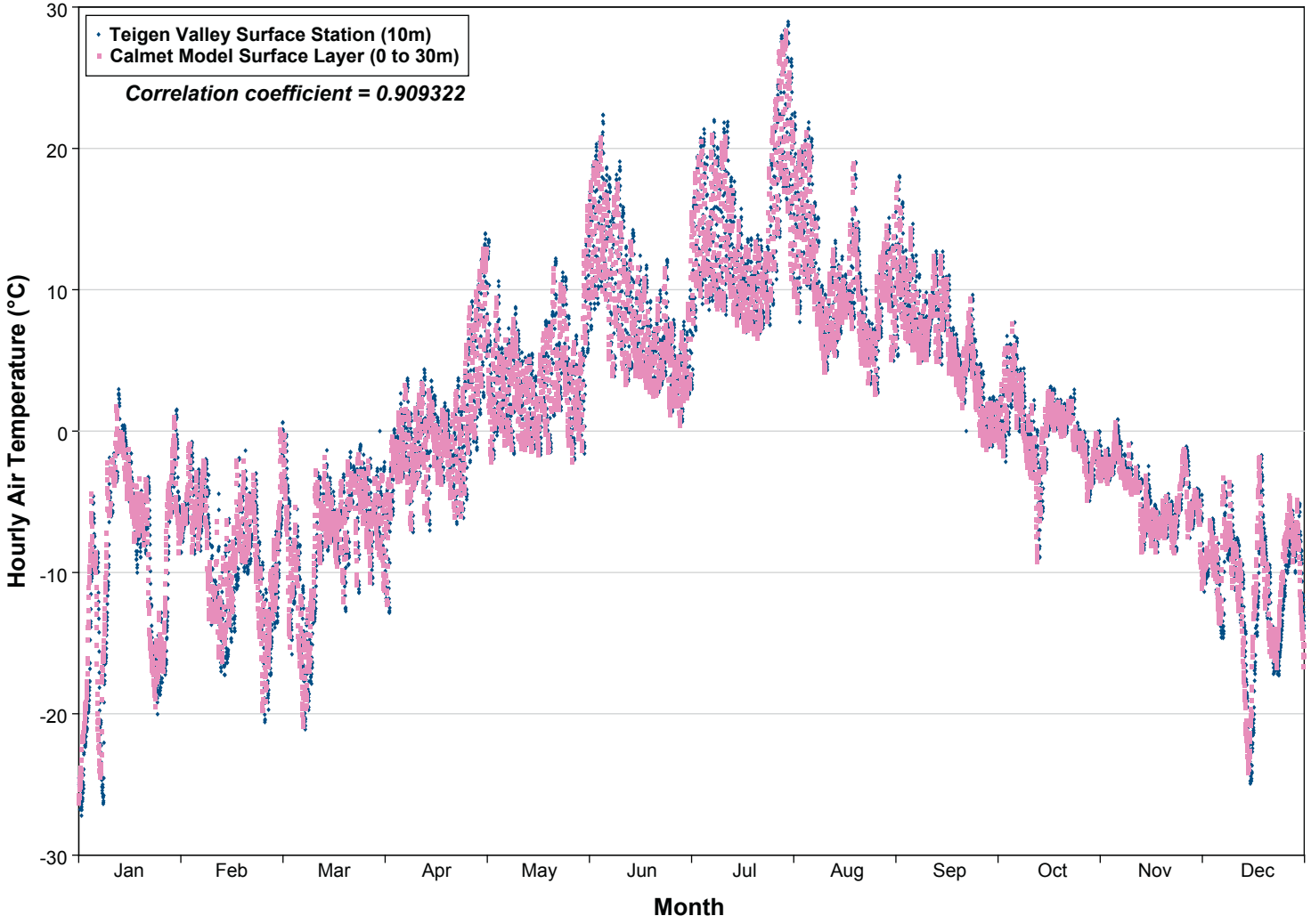


Figure 4-33

SEABRIDGE GOLD
KSM PROJECT

Surface Air Temperature Comparison in Teigan Valley for 2009 (Actual vs. CALMET Model)

Figure 4-33

Rescan™ Engineers & Scientists

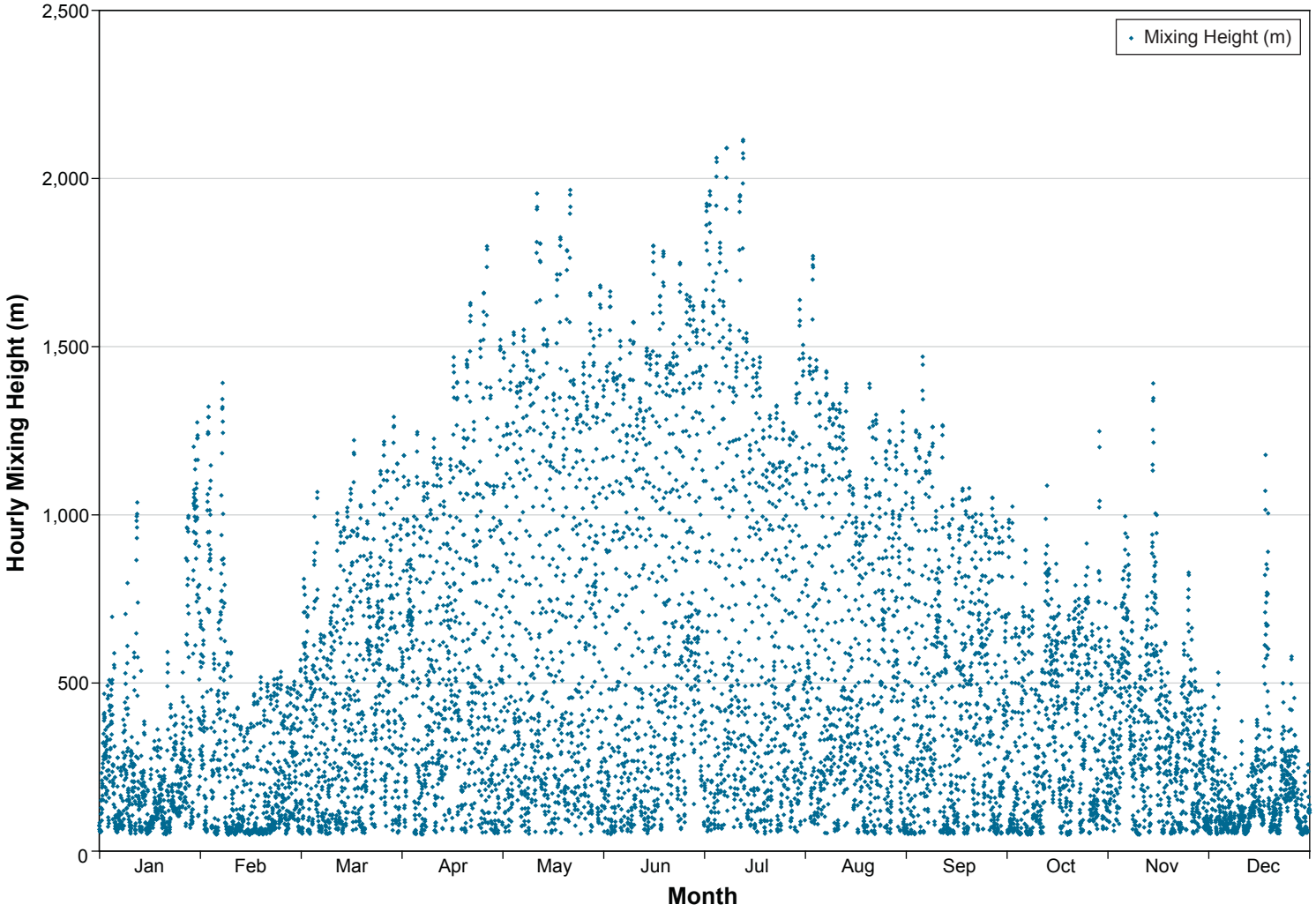


Figure 4-34

SEABRIDGE GOLD
KSM PROJECT

Hourly Mixing Heights in 2009

Figure 4-34

Rescan™ Engineers & Scientists

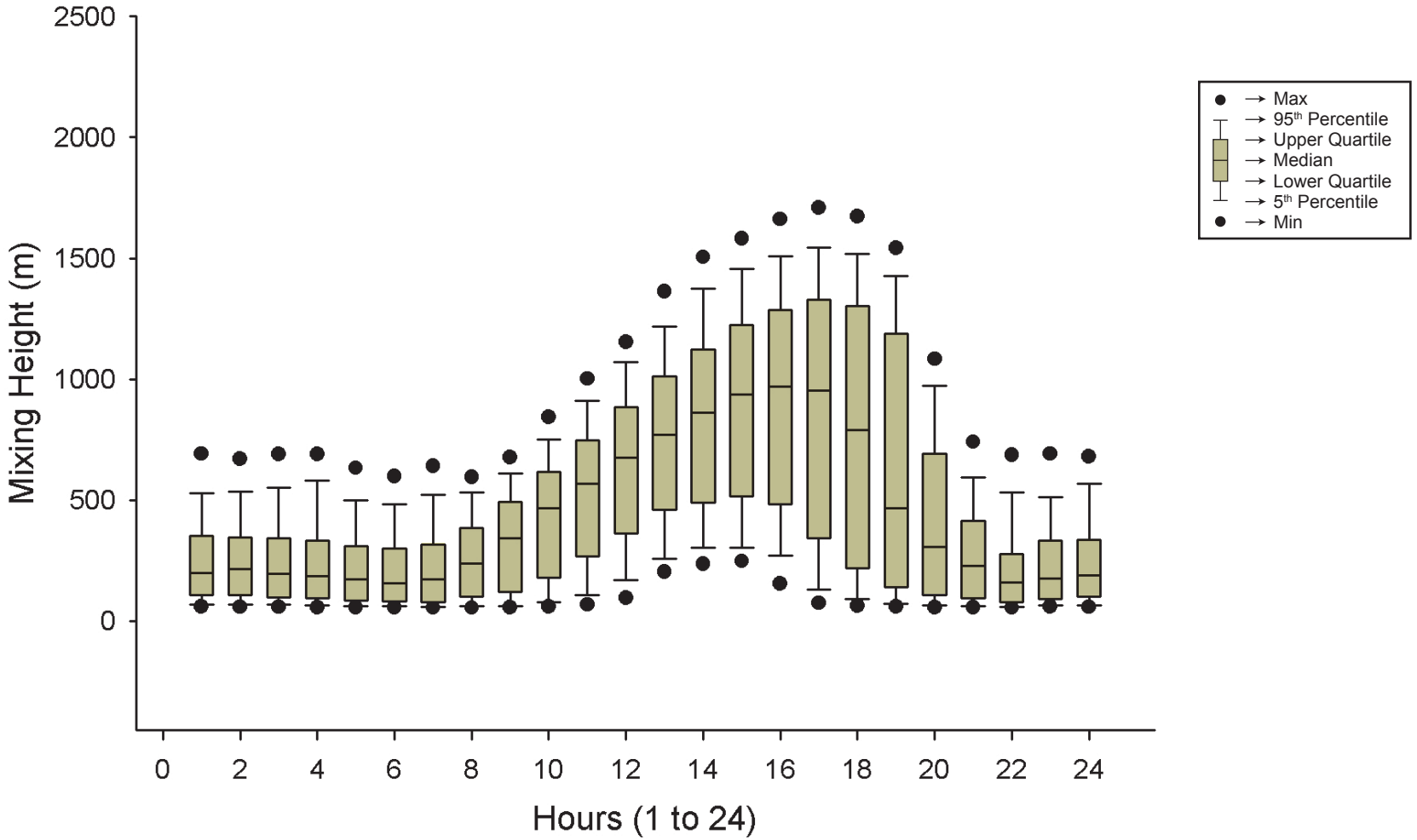


Figure 4-35

SEABRIDGE GOLD
KSM PROJECT

Diurnal Mixing Heights During 2009

Figure 4-35

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5. Assessment Level Determination

A Level 3 air dispersion modelling assessment is required for the KSM Project environmental assessment. The modelling will focus on releases of particulate matter (PM) (the most notable PM emissions are from the open pit activities, and road dust from the paved and unpaved access roads), carbon monoxide, nitrogen oxides and sulphur oxides. The environmental assessment will also include analysis of acidic deposition resulting from releases of gasses such as NO_2 and SO_2. The results of the completed air quality assessment will demonstrate compliance with applicable Canadian and BC ambient air quality objectives and guidelines. The air quality results will also be used in other sections of the environmental assessment report such as vegetation, wildlife and human health.

The meteorological and terrain factors described in Section 4 justify a Level 3 Assessment because of the curvilinear plume trajectories, multiple source types and the complex meteorology associated with the mountain valleys near the Project area. The nature of the mine layout provide a modelling challenge as the sources will be spread over a large area and several mountain valleys.

6. Selected Model

The CALPUFF air dispersion modelling system is proposed for the KSM Project environmental assessment for the reasons listed below:

- The Project area is surrounded by complex terrain which may result in plumes that tend to follow curvilinear trajectories.
- The Project involves multiple types of air emission sources.
- The assessment requires acid deposition rates resulting from air emissions.

The comparison table provided by Guidelines for Air Quality Dispersion Modelling in British Columbia is presented in Table 6-1.

Table 6-1. Comparison of Air Dispersion Models

	Core Models	Terrain (above stack base)	Hourly Meteorological Data	Multiple Stacks	Area, Volume, Line Sources	Chemical Transformation	Building Downwash	Plume Visibility	Stagnation Conditions	Deposition (Gases/Particles)	Acid Deposition (Nitrate/Sulphate)	Shoreline Effects	Regional Airshed Modelling	Long Distance Transport (> 50 km)	Roadway Emissions	Heavy Gases	Flares
Screening	SCREEN3	√			√		√										√
	ISC-PRIME/S	√		√	√		√										
Refined	ISC-PRIME	√	√	√	√		√			√							
	AERMOD	√	√	√	√		√			√							
	CALPUFF	√	√	√	√	√	√	√	√	√	√	√	√	√			
	RTDM3.2	√	√	√													

** No line-source treatment.*
*** Deposition of particles only.*
+ For ISC-PRIME/S and ISC-PRIME, terrain below stack height only: for RTDM3.2, terrain above stack height only.
++ For distances > 50 km.
 # Single or co-located multiple stacks in single run but can use SEQADD to account for multiple non co-located point sources.
Source: BCMOE 2008.

According to Table 6-1, the best-suited air dispersion models for the KSM project are AERMOD and CALPUFF. The terrain in the Project study area and big domain (> 50 km) are best modelled by the features in the CALPUFF modelling system.

7. Inputs — Source, Meteorological and Geophysical Information

7.1 SOURCES

The sources of air contaminants for the Project are typical of an open pit mine. The major air emissions come from fugitive dust and diesel consumption during the construction and operation phases.

The majority of the power generators used during construction will be removed after construction, but a few will be kept as backup generators during the operation phase.

The power required during operation will be mainly supplied from provincial transmission lines. The existing BC Hydro 138 kV transmission line does not have adequate capacity to supply an extension to the KSM project, however the currently-approved, new Northwest Transmission Line (NTL) project that will run north from the Skeena substation following in proximity to Highway 37 passing within 12 km of the KSM property will (Wardrop 2011).

Concentrate will be hauled via trucks on an 18 km long access road from the processing plant to Highway 37. From the junction, it will be trucked south to the port of Stewart BC where it will be loaded onto ocean going vessels for shipment overseas.

The vast majority of air emissions generated during the operation and construction of an open pit mine is from vehicular and equipment use. Therefore, the air emission inventory included the operation and construction vehicles, generators, routine hauling equipment and emergency equipment. The worst-case conditions for air emissions will be modelled for the assessment. Worst case air emissions coincided with the peak in construction activities and the operation year that had the maximum tonnage of waste rock moved and maximum fuel consumed.

For the construction phase of the Project, Year -1 will be the most active in terms of total waste moved, total fuel usage (therefore highest diesel equipment activities) and blasting explosives (Tables 7-1 and 7-2). For these reasons Year -1 was selected for the dispersion model as the worst case scenario for the construction phase.

Over the estimated 55-year mine life, Year 4 was selected to represent the worst case (Table 7-3). In terms of the highest amount of waste rock and ore moved, Year 4 is the worst case (7% higher than the second highest year in Year 3). For total fuel consumption from drilling, blasting, loading hauling and pit maintenance, Year 3 is the highest, but only less than 1% higher than that in Year 4. In terms of electric power consumption, Year 3 is the worst year and is approximately 4% higher than that in Year 4; however, electric power consumption does not have a direct impact of the air quality conditions in the Project area. The amount of explosives used in Year 4 is the highest and approximately 5% higher than explosives used in Year 3. Although Year 4 has fuel consumption that is less than 1% lower than that in Year 3, Year 4 has the highest waste rock and ore moved, and amount of explosives (7% and 5% higher, respectively). Therefore, Year 4 was selected to represent the worst case for operations. For both worst case scenarios, the CALPUFF air dispersion model will be run for an entire year (2009) to ensure that all climatic conditions are considered.

Tables 3-1 and 3-2 (previously presented) provided the summaries of the diesel emissions sources that will be included in the air dispersion modelling for the construction and operation scenarios,

respectively. Appendix A contains detailed information about the various air emission sources in the format specified in the BC MOE Guideline on Air Dispersion Modelling (2008).

The Guidelines for Air Quality Dispersion Modelling in BC (BC MOE, 2008) recommends that fugitive dust is modelled separately from the other parameters because fugitive dust emission estimations are based on AP-42 emission factors with low quality ratings and there can be large uncertainties. The air modelling results will be presented with the diesel and fugitive air emissions added to the background ambient air quality (see Chapter 8).

7.2 METEOROLOGICAL AND GEOPHYSICAL INFORMATION

The meteorological setting for the KSM Project was previously described in Section 4.

Geophysical data is an important component of the air dispersion modelling analysis because topography and ground cover both play an important role in the dispersion of air contaminants. The land use data was obtained from GeoBC Baseline Thematic Mapping website (GeoBC 2011). The data was translated from BC land use codes to USGS (US Geological Survey) land use codes (the format accepted by CALMET). The resulting map (Figure 4-5) was compared to the existing topography and land use to verify the accuracy of the land use codes and terrain files used for CALMET.

Table 7-1. KSM Project – Summarized Production Schedule (kt)

		Construction			Operation														
		Year																	
	Unit	-3	-2	-1	1	2	3	4	5	6	7	8	9	10	11 to 20	21 to 30	31 to 40	41 to 50	51 to 55	LOM
Ore from Mine To Mill	Mt	-	-	-	18	28	34	43	35	41	30	1	47	25	390	278	98	126	-	1,196
Au	g/t	-	-	-	0.997	0.846	0.823	0.785	0.795	0.866	0.967	0.771	0.756	0.871	0.627	0.572	0.264	0.225	-	0.596
Cu	%	-	-	-	0.268	0.264	0.280	0.256	0.222	0.238	0.256	0.095	0.183	0.223	0.155	0.213	0.538	0.405	-	0.248
Ag	g/t	-	-	-	2.73	3.12	2.10	1.82	1.71	2.93	4.26	4.88	3.45	3.26	3.06	1.41	1.61	0.78	-	2.25
Mo	ppm	-	-	-	23.1	19.2	31.8	72.1	84.5	50.6	27.0	77.7	40.3	44.2	71.0	44.4	-	-	-	45.3
Ore To Stockpile	Mt	1	6.3	7.6	30	0	4	30.5	56	53	7	14	35	27	65	-	-	-	-	337
Au	g/t	0.341	0.383	0.344	0.581	0.498	0.333	0.438	0.542	0.635	0.676	0.398	0.412	0.388	0.305	-	-	-	-	0.466
Cu	%	0.288	0.241	0.193	0.201	0.134	0.134	0.121	0.131	0.148	0.168	0.070	0.106	0.107	0.074	-	-	-	-	0.126
Ag	g/t	0.96	1.26	2.53	2.03	2.06	1.87	1.66	1.67	2.22	2.10	4.49	2.66	1.55	1.74	-	-	-	-	2.04
Mo	ppm	93.5	28.2	19.2	30.2	39.4	21.3	53.1	77.9	75.3	65.0	77.1	76.7	88.7	86.1	-	-	-	-	70.1
Stockpile Reclaim	Mt	-	-	-	10.0	16	13	4	13	6	17	47	-	22	85	104	-	-	-	337
Au	g/t	-	-	-	0.617	0.596	0.640	0.289	0.492	0.630	0.673	0.676	-	0.455	0.404	0.354	-	-	-	0.474
Cu	%	-	-	-	0.176	0.276	0.187	0.150	0.121	0.134	0.156	0.157	-	0.121	0.112	0.089	-	-	-	0.128
Ag	g/t	-	-	-	2.34	1.57	2.45	3.19	0.60	0.52	2.13	2.13	-	2.50	2.36	1.86	-	-	-	2.05
Mo	ppm	-	-	-	35.5	27.0	35.4	30.8	26.3	37.3	78.1	76.3	-	74.7	77.5	77.8	-	-	-	68.7
Stockpile Inventory	Mt	1	6.9	14.5	34	18	9	35	79	126	116	84	119	124	104	0	0	0	0	-
Mitchell Underground	Mt	-	-	-	-	-	-	-	-	-	-	-	-	-	-	33	199	189	16	438
Au	g/t	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.661	0.518	0.515	0.549	0.529
Cu	%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.210	0.166	0.159	0.124	0.165
Ag	g/t	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5.23	3.43	3.36	1.99	3.48
Mo	ppm	-	-	-	-	-	-	-	-	-	-	-	-	-	-	16.0	22.1	46.8	56.9	33.6
Iron Cap Underground	Mt	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	96	98	0.1	193
Au	g/t	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.518	0.383	0.287	0.450
Cu	%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.192	0.199	0.131	0.196
Ag	g/t	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5.30	5.33	5.23	5.32
Mo	ppm	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	19.1	26.9	18.6	23.0
Mill Feed	Mt	-	-	-	28	45	48	48	48	48	47	47	47	47	475	415	392	413	17	2,164
Au	g/t	-	-	-	0.860	0.755	0.772	0.741	0.714	0.836	0.860	0.678	0.756	0.676	0.587	0.524	0.455	0.395	0.547	0.550
Cu	%	-	-	-	0.235	0.268	0.254	0.246	0.195	0.225	0.219	0.156	0.183	0.175	0.148	0.182	0.265	0.244	0.125	0.208
Ag	g/t	-	-	-	2.59	2.55	2.20	1.94	1.41	2.62	3.48	2.19	3.45	2.90	2.93	1.83	3.43	3.04	2.01	2.74
Mo	ppm	-	-	-	27.6	22.1	32.8	68.4	69.0	48.9	45.6	76.4	40.3	58.5	72.2	50.5	15.9	27.8	56.6	44.6
Metal to the Mill																				
Au	M oz	-	-	-	0.8	1.1	1.2	1.1	1.1	1.3	1.3	1.0	1.2	1.0	9.0	7.0	5.7	5.3	0.3	38.3
Cu	M lb	-	-	-	144	264	267	258	204	236	229	163	191	184	1,544	1,664	2,295	2,218	46	9,907
Ag	M oz	-	-	-	2.3	3.7	3.4	3.0	2.2	4.0	5.3	3.3	5.3	4.4	44.8	24.4	43.3	40.4	1.1	190.8
Mo	M lb	-	-	-	1.7	2.2	3.4	7.2	7.2	5.1	4.8	8.0	4.2	6.1	75.5	46.2	13.7	25.3	2.1	212.7
Total Waste Mined	**Mt**	**29**	**46**	**54**	**135**	**142**	**147**	**127**	**66**	**75**	**116**	**128**	**88**	**65**	**523**	**917**	**347**	**207**	**64**	**3,287**
Total Pit Ore Mined	**Mt**	**0.6**	**6.3**	**7.6**	**47.5**	**28.6**	**38.5**	**73.8**	**91.4**	**94.7**	**37.2**	**15.4**	**82.0**	**52.4**	**455.1**	**277.8**	**98.1**	**126.1**	**-**	
Total Waste Rock and Ore Moved	**Mt**	**29.6**	**52.3**	**61.6**	**182.5**	**170.6**	**185.5**	**200.8**	**157.4**	**169.7**	**153.2**	**143.4**	**170.0**	**117.4**	**978.1**	**1194.8**	**445.1**	**333.1**	**64**	
Open Pit Strip Ratio (Waste Mined/Plant Feed)	t/t	-	-	-	4.8	3.2	3.1	2.7	1.4	1.6	2.5	2.7	1.9	1.4	1.1	2.4	3.5	1.6		2.1

Note: Waste mined in the production schedule in Table 7-1 includes re-handled waste and waste mined from borrow pit sources for construction purposes.

Table 7-2. Estimated Fuel and Explosive Consumption during the Project Construction

Fuel Consumption (m^3)	Year -6	Year -5	Year -4	Year -3	Year -2	Year -1
Drilling	93	208	357	486	1,058	1,239
Blasting	87	126	195	394	841	1,015
Loading	900	985	1,783	4,601	6,385	6,739
Hauling	1,485	1,814	2,883	8,049	19,388	18,784
Pit Maintenance	3,369	4,077	4,396	4,432	4,498	4,505
Total (m^3)	5,935	7,210	9,615	17,962	32,169	32,283
Explosives (tonne)	1,219	2,090	3,657	8,188	18,344	21,543

Table 7-3. Estimated Fuel and Explosive Consumption during the Project Operation

Year		1	2	3	4	5	6	7	8	9	10
Fuel Consumption (m^3)	Drilling	1,759	1,561	1,838	1,867	1,241	1,649	1,357	1,137	1,648	401
	Blasting	2,779	2,625	2,910	3,060	2,346	2,662	2,453	2,286	2,666	1,701
	Loading	9,984	9,238	9,184	9,523	9,511	9,493	9,586	9,555	9,667	7,734
	Hauling	56,413	54,624	56,013	55,818	42,008	42,048	42,177	41,109	35,954	28,038
	Pit Maintenance	6,360	6,348	6,334	6,325	6,343	6,209	6,716	6,732	6,736	6,736
	Total	**77,295**	**74,394**	**76,279**	**76,593**	**61,449**	**62,061**	**62,288**	**60,819**	**56,671**	**44,610**
Power Consumption (kwh)	Drilling	8,132,141	8,132,141	8,132,141	8,132,141	7,951,427	7,951,427	7,861,069	7,861,069	7,770,712	7,770,712
	Loading	16,882,771	19,089,749	22,111,334	21,238,594	14,098,707	16,719,668	15,876,112	19,262,581	15,206,209	12,170,191
	Total	**25,014,911**	**27,221,890**	**30,243,475**	**29,370,735**	**22,050,133**	**24,671,095**	**23,737,182**	**27,123,650**	**22,976,921**	**19,940,904**

Year		11 to 20	21 to 30	31 to 40	41 to 50	51 to 55
Fuel Consumption (m^3)	Drilling	278	463	2	2	-
	Blasting	1,600	1,741	716	536	-
	Loading	5,351	4,869	921	707	465
	Hauling	29,119	41,907	9,770	19,165	2,773
	Pit Maintenance	6,705	5,723	5,244	3,573	2,198
	Total	**43,053**	**54,703**	**16,653**	**23,983**	**5,436**
Power Consumption (kwh)	Drilling	7,680,355	7,680,355	4,078,262	3,051,034	-
	Loading	14,132,717	19,846,580	10,547,837	8,913,511	2,497,455
	Total	**21,813,072**	**27,526,935**	**14,626,099**	**11,964,545**	**2,497,455**

8. Determine Background Air Quality

To assess the full effects of air emissions from the mine activities, the ambient air quality predicted from the mine-related emissions will be added to the background air quality concentrations. The following section outlines the methods for estimating the background concentrations for each criteria air contaminant (CAC).

At present, there are no background ambient monitoring stations for SO_2, NO_2, and CO in north-western BC or Alaska. The best available estimates of ambient background concentrations are published by the Canadian Air and Precipitation Monitoring Network (CAPMoN). CAPMoN is a non-urban air quality monitoring network with siting criteria designed to ensure that the measurement locations are regionally representative (i.e., not affected by local sources of air pollution). Scientists examining atmospheric pollution in urban centres would consider most CAPMoN sites remote and pristine. There are currently 28 measurement sites in Canada and 1 in the United States (US). The closest CAPMoN site to the Project is the Saturna station, off the southern tip of Vancouver Island in the middle of the Straight of Georgia. Although the station is almost 1,000 km southeast of the Project area, it provides the best estimate of background concentrations available for BC. The second closest CAPMoN monitoring station is Snare Rapids in the Northwest Territories, approximately 100 km northwest of Yellowknife, NT. This station is approximately 1,300 km away from the Project and only collects precipitation and particulate matter data.

Daily measurements of SO_2 concentrations are available from the Saturna monitoring station from 1996 to 2002 (1997 missing). The average annual SO_2 concentrations for that period were reported as 2.3 $\mu g/m^3$ with an average standard deviation of 2 $\mu g/m^3$. Unfortunately, ambient NO_2 concentrations were not measured. The estimated background concentrations for SO_2, NO_2, and CO from a northern undisturbed remote area were assumed to represent conditions in the Project area for the purposes of this study (Cirrus 1998). The following values will be used:

- background SO_2 concentration: 4.0 $\mu g/m^3$ (1 hour and 24 hour), 2.0 $\mu g/m^3$ (annual);
- background NO_2 concentration: 21.0 $\mu g/m^3$ (1 hour and 24 hour), 5.0 $\mu g/m^3$ (annual);
- background CO concentration: 100 $\mu g/m^3$ (all averaging times).

The annual average SO_2 background concentration of 2.0 $\mu g/m^3$, for the northern undisturbed remote area, was in general agreement with the 1996 to 2002 average concentrations observed at the Saturna station (2.3 $\mu g/m^3$).

Consistent with McKendry 2006, the background ozone concentrations in BC are estimated in the range of 20 to 40 ppb (40 to 80 $\mu g/m^3$). For the KSM air dispersion modelling assessment it is proposed that the ozone baseline concentration be 30 ppb (60 $\mu g/m^3$).

The chemical transformation scheme used in CALPUFF (MESOPUFF-II) requires the background ammonia concentration. Since the model domain is approximately 25% forest, 37% tundra and 35% ice, a background concentration of 0.5 ppb was selected as suggested by the Interagency Workgroup on Air Quality Modelling (IWAQM) for forests (US EPA 1998).

The technical document about background concentrations of $PM_{2.5}$ and ozone in BC (McKendry 2006) was considered for particulate matter background concentrations but this reference does not contain

PM_{10} background concentrations because of a general lack of information about background PM_{10} concentrations in pristine environments in British Columbia. Therefore, the Galore Creek Project's measured 98 percentile background concentrations for PM_{10} and $PM_{2.5}$ will be used:

- background PM_{10} concentration: 3.4 µg/m^3 (24-hour);
- background $PM_{2.5}$ concentration: 1.3 µg/m^3 (24-hour).

Dustfall levels were monitored at five sites in 2008, nine sites in 2009 and 2010, and ten sites in 2011 inside the study area during the summer months which are typically the driest times of the year and do not allow for substantial dustfall mitigation by precipitation (Rescan 2012). Exceedances over the dustfall deposition guideline occurred several times in 2010. BC model guidelines (BC MOE 2008) state that if there are more than one representative monitoring sites, an acceptable approach is to take the 98th percentile of each site and take the average of the selected background levels. The 98th percentile dustfall rate of each station was calculated and the average of the 98th percentile value is 1.34 mg/dm^2/day.

9. Prepare Input Files, Run Models

The EPA-Approved version of CALPUFF (version 5.8) and its related processors will be used. This method was proposed in the conceptual model plan and approved to be used in the KSM Project environmental assessment by the BC MOE in a letter dated March 19, 2010.

The *Guidelines for Air Quality Dispersion Modelling in British Columbia* (BC MOE 2008) will be used for the switch settings for CALMET (Input group 5) and this guideline will also be used for the CALPUFF model runs (Input group 2).

Preliminary CALMET runs have been done to determine the size of the air dispersion study area and to test the CALMET outputs and generate wind fields. The CALMET wind fields were analyzed in Chapter 4.

10. Proposed Outputs

In the final report to be written after the dispersion modelling has been completed, the results will be presented in both tables and figures as appropriate. The results will also be compared to the most stringent BC and Canadian air quality objectives and standards shown in Table 10-1.

Table 10-1. Air Quality Standards/Objectives for BC and Canada

		Concentrations ($\mu g/m^3$)					
		Canada			BC		
Pollutant	Averaging Time	Maximum Desirable	Maximum Acceptable	Maximum Tolerable	Level A	Level B	Level C
SO_2	1-hour	450	900	-	450	900	900-1300
	24-hour	150	300	800	160	260	360
	Annual	30	60	-	25	50	80
NO_2	1-hour	-	400	1000	-	-	-
	24-hour		200	300	-	-	-
	Annual	60	100	-	-	-	-
CO	1-hour	15,000	35,000	-	14,300	28,000	35,000
	8-hour	6,000	15,000	20,000	5,500	11,000	14,300
TSP	24-hour	-	120	400	150	200	260
	Annual	60	70	-	60	70	75
PM_{10}	24-hour	-	-	-	-	50	-
$PM_{2.5}$	24-hour		30[a]			25[b]	
	Annual		-			8	
Dustfall	30-day		-		1.75 mg/dm^2/day for Residential areas and 2.9 mg/dm^2/day for all other areas		
Acid Deposition	Annual		-		750 eq/ha/yr median critical loads for BC		
Acid Precipitation	Annual	-					

Source: BC MOE (2009)
Notes: (-) dash indicates not applicable

a. Annual 98th percentile value, averaged over three consecutive years. Published by CCME.
b. Based on annual 98th percentile value

Each of the pollutant-averaging time combinations will be presented in both tables and isopleth contours (Table 10-2). All modelling results are based on a complete calendar year (2009) of modelling.

Table 10-2. Air Quality Standards and Objectives to Compare to Modelling Results

Pollutant	Averaging Time	Concentrations (µg/m^3)	
		Most Stringent Objective/Standard	Averaging Method for Each Receptor
SO_2	1-hour	450	Maximum hourly averages
	24-hour	150	Maximum daily averages
	Annual	25	Annual average
NO_2	1-hour	400	Maximum hourly averages, converted using OLM (60 µg/m^3)
	24-hour	200	Maximum daily averages, converted using OLM (60 µg/m^3)
	Annual	60	Annual average, converted using OLM (60 µg/m^3)
CO	1-hour	14,300	Maximum hourly averages
	8-hour	5,500	Maximum 8-hour averages
TSP	24-hour	120	Maximum daily averages
	Annual	60	Annual average
PM_{10}	24-hour	50	Maximum daily averages
$PM_{2.5}$	24-hour	25	98th percentile daily averages
	Annual	8	Annual average
Dust Deposition	30-day	1.75 mg/dm^2/day for Residential areas and 2.9 mg/dm^2/day for all other areas	Maximum 30-day averages
Acid deposition from sulphate	Annual	750 eq/ha/year median critical loads for BC	Annual average of acid deposition rate and loading from sulphate and nitrate (eq/ha/year)
Acid precipitation from nitrate	Annual		

References

British Columbia Environmental Assessment Office (BC EAO). 2011. KSM (Kerr-Sulphurets-Mitchell) Project Application Information Requirements as approved. Victoria, BC.

British Columbia Ministry of Air Quality Objectives and Standards

British Columbia Ministry of Environment (BC MOE). 2008. British Columbia Air Dispersion Modelling Guidelines. Victoria, BC.

Cirrus. 1998. Diavik Diamond Project – Environmental effects report, climate and air quality. Yellowknife, NT: Report prepared for Diavik Diamond Mines Inc. by Cirrus Consultants.

Cole, H. S. and J. E. Summerhays. 1979. A review of techniques available for estimating short-term NO2 concentrations. J Air Pollut Contr Assoc 29:812–17.

Environment Canada 2010. Sulphur in Diesel Fuel Regulations. http://www.ec.gc.ca/energie-energy/default.asp?lang=En&n=7A8F92ED-1 (accessed August 2012).

Environment Canada - Meteorological Services of Canada (EC-MSC). 2004. MSC Guidelines for Co-operative Climatological Autostations, Version 3.0. Environment Canada, MSC, Surface Weather, Climate & Marine Division, Atmospheric Monitoring Water Survey Branch.

Environment Canada. 2002. Sulphur in Diesel Fuel Regulations. SOR/2002-254. Ottowa, ON.

GeoBC. 2011. Baseline Thematic Mapping prepared by Base Mapping and Geomatic Services Branch (BMGS). https://apps.gov.bc.ca/pub/geometadata/metadataDetail.do?recordUID=43171&recordSet=ISO19115 (accessed August 2012).

McKendry, I.G. 2006. Background Concentrations of PM2.5 and Ozone in British Columbia, Canada. Geography/Atmospheric Science, The University of British Columbia. Prepared for British Columbia Ministry of Environment. March 2006.

Scire, J.S. 2000. A User's Guide for the CALPUFF Dispersion Model. Earth Tech, Inc. Concord, MA.

United States Environmental Protection Agency (US EPA). 1995. Compilation of Air Pollutant Emission Factors, Volume 1 – Stationary, Point and Area Sources (Including Supplements). US EPA Office of Air Quality Planning and Standards, Office of Air and Radiation, Research Triangle Park, NC.

United States Environmental Protection Agency (US EPA). 2005. User's Guide for the Final NONROAD2005 Model. US EPA Assessment and Standards Division, Office of Transportation and Air Quality. Prepared with assistance from Cumulus, Inc. and ENVIRON International Corp. Research Triangle Park, NC.

United State Environmental Protection Agency (US EPA) 1998. Interagency Workgroup on Air Quality Modelling (IWAQM) Phase 2 Summary Report and Recommendations for Modelling Long Range Transport Impacts.

United States Environmental Protection Agency (US EPA) 2006. AP-42 Chapter 13 Miscellaneous Source Section 2.4 Industrial Wind Erosion.

United States Environmental Protection Agency (US EPA) 1995. AP 42, Fifth Edition Compilation of Air Pollutant Emission Factors, Volume 1 - Stationary Point and Area Sources, Research Triangle Park, NC.

Rescan Environmental Services 2012. KSM PROJECT 2008 to 2011 Air Quality Baseline.

Wardrop Engineering Inc. 2011. Kerr-Sulphurets-Mitchell (KSM) Prefeasibility Study Update 2011, Prepared for: Seabridge Gold Inc. Prepared by: Wardrop Engineering Inc., Vancouver, BC.

Langston et al. 2008. Clark Country (Nevada) Paved Road Dust Emission Studies in Support of Mobile Monitoring Technologies 2008.

Personal Communications

2009. Email correspondence and phone conversation with Dr. Ian McKendry, Atmospheric Science Program, University of British Columbia. September 9, 2009.

Appendix A

Detailed Model Plan in Guidelines for Air Quality Modelling in British Columbia

Rescan™
Engineers and Scientists

Appendix A. Detailed Model Plan in Guidelines for Air Quality Modelling in British Columbia

GENERAL INFORMATION

Date:	September 18, 2012
Facility Name:	KSM (Kerr-Sulphurets-Mitchell) Project
Company:	Seabridge Gold Inc.
Location (Lat., Long.):	56.64N, 129.97W
Air Quality Consultant and Contact Name:	Derek Shaw, M.A.Sc., P.Eng. Manager, Atmospheric Department Tina Liu, M.A.Sc., E.I.T. Atmospheric Scientist Rescan Environmental Services Ltd. 6th floor, 1111 West Hastings Street Vancouver, BC, V6E 2J3 Tel: (604) 689-9460
Ministry Contact Name:	Mr. Ben Weinstein Air Quality Meteorologists BC Ministry of Environment 3726 Alfred Avenue Smithers, British Columbia, V0J 2N0
Anticipated Date of Ministry Review Completed:	October 1, 2012

Are changes to this original plan anticipated? *Answer YES or NO*. If yes, refer to the final table of this template.

YES

Does this detailed plan follow a modelling approach similar to that taken in a previous air quality assessment already reviewed and accepted by the Ministry? *Answer YES or NO*. If yes, provide the project name and ministry contact:

YES

Galore Creek Project, Novagold Canada Inc.

Reviewed by: Mr. Ben Weinstein, Air Quality Meteorologist
BC Ministry of Environment, Smithers, BC.

DISPERSION MODEL

Model Specifics

List model(s) and version to be used. (See Section 2.3, 2.4). Note: Follow model specific guidance in Section 9.

EPA-Approved version of CALPUFF - Version 5.8, level 070623, CALMET - Version 5.8 and CALPOST - Version 5.6394. level 070622.

Specify any non-guideline models or versions (i.e., beta-test versions) planned for use. (See Section 2.1.4.) Provide rationale.

NO

If modifications to any of the models are planned, provide a description and the rationale. (See Section 2.1.5.)

NO

DEFAULT SWITCH SETTINGS

For ISC-PRIME/S, ISC-PRIME, RTDM3.2, AERMOD identify any switch settings that could be different than the recommended defaults. (See corresponding Sections 9.1.3, 9.2.2, 9.3.4.) Provide rationale.

None of these air dispersion modelling programs will be used for the Project.

For CALPUFF/CALMET identify any switch settings in CALMET Input Group 5 and CALPUFF Input Group 2 that could be subject to deviation from the "black (do not touch)" defaults as per Tables 9.8 and 9.9. Provide rationale.

The Guidelines for Air Quality Dispersion Modelling in British Columbia (BC MOE 2008) will be used for switch settings.

BC Guidelines tables 9.6 and 9.7 will be used for the CALMET and Table 9.8 will be used for CALPUFF switch settings.

PLANNED MODEL OUTPUT: AIR QUALITY ASSESSMENT NEEDS

What model output is required for decision makers and stakeholders? (i.e., what is the purpose of the assessment? – See Section 2.2.). *Underline your selection(s), as appropriate.*

- Air Quality: concentrations, depositions, visibility, fogging, icing, other (specify)
- Tables and Maps:

  Spatial distribution maps of air quality parameters (maximums, exceedance frequencies, annual averages)

  Tables of maximum short and long time average air quality parameters (locations and associated meteorological conditions)

  Tables of air quality parameters at select receptors of interest (maximums, frequency distributions)

  Tables of air quality parameters under certain emission situations (upsets, start-up)

  Output spatial scale: near-field (<10 km), local (<50 km), regional (>50 km)

  Other (specify): special output will be provided for vegetation, wildlife or health risk assessments to be assessed in relevant sections.

Note: The ministry should define a list of required outputs. However, the list should also reflect the anticipated information needs of stakeholders that have been identified in meetings with the consultant/industry/public and/or through the Environmental Assessment process.

PLANNED GEOPHYSICAL INPUT

Planned Model Domain and Receptors Underline your selection(s), as appropriate.

- Map of domain and receptor grid provided (See Sections 6.1, 6.2.)

  The CALPUFF modelling domain for the Project is 60 x 100 km. The receptor grid will follow the recommended spacing described in BC Guidelines section 6.2. In addition to the recommended receptor spacing, the access roads will be considered sources, therefore receptor spacing applied around the access roads will be dense and conform to section 6.2. The study area and receptor spacing are presented in Figure 2-1.

- Anticipated sensitive receptors: See Section 6.4.

  The anticipated sensitive receptors are

- construction camps and mine camps if they are active during the modelled year;
- exploration cabins;
- wildlife sensitive locations; and
- Bell II lodge.

  The locations of these sensitive receptors are shown in Figure 2-1.

Planned Geophysical Data Input *Underline your selection(s), as appropriate*. (See Section 8.)

- Terrain data (specify source of data):

  Local Scales from: GeoBC 1:20,000 BC Trim Dataset

  Regional Scales from: Shuttle Radar Topography Mission (SRTM) by the National Aeronautics and Space Administration (NASA) and the National Geospatial-Intelligence Agency (NGA)

  3 arc second digital elevation model, 3 arc seconds corresponds to approximately 90 m on the ground.

- Land use (specify source of data):

  GeoBC – Base Thematic Mapping Present Land Use.

  http://aardvark.gov.bc.ca/apps/metastar/metadataDetail.do?recordUID=43171&recordSet=ISO19115

If Surface Roughness required, use Table 9.3. If this table is not used, indicate source of data.

CALMET default surface roughness is used.

If Albedo required, use Table 9.4. If this table is not used, indicate source of data.

CALMET default Albedo is used. If Bowen ratio required, use Table 9.5. If this table is not used, indicate source of data.

CALMET default Bowen ratio is used. If building downwash is applicable, use BPIP-PRIME. If not BPIP-PRIME, indicate method used to specify downwash parameters.

BPIP-PRIME IS USED. PLANNED EMISSION SOURCES AND CHARACTERISTICS

Emission Source Description Underline your selection(s), as appropriate.

The modelling study will be performed for Preproduction (Construction) and Production phase separately. Modelling results for fugitive sources will be reported separately because of uncertainties (such as variations in day by day construction work load, changing pit size and depth during operations) as indicated in BC Guidelines 5.3.

Construction Phase

Source	Type: Point (P), Area (A), Line (L), Vol. (V) Indicate Type	Air Contaminants (SO_2, NO_2, $PM_{2.5}$* ...)	Basis of Emissions (Section 5) *Underline your selection(s), as appropriate.*
P&H 250XPC: Drill	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
Sandvik D245S	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
FEL Blast Hole Stemmer CAT 930H	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
Hydraulic Shovel EX8000	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
Dozer CAT D10	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
Wheel Dozer CAT 834H	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
Fuel/Lube Truck CAT 740	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
Front End Loader CAT 988	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
Front End Loader CAT 988H	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
Excavator - 390kW - CAT 390	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
Water Pump - 1400 gal/min - LH8110	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
Light Plant - 20kW -	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
Crane - 250t - LTM1250	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):

(continued)

Construction Phase (continued)

Source	Type: Point (P), Area (A), Line (L), Vol. (V) Indicate Type	Air Contaminants (SO_2, NO_2, $PM_{2.5}$* ...)	Basis of Emissions (Section 5) *Underline your selection(s), as appropriate.*
Excavator - 283kW - CAT 345	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
Mobile Screening Plant - Sanvik QA430	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
Crane - 100t - LTM1100	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
FEL - 373kW - CAT988	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
Crane - 40t - LTM1040	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
Forklift - 30t - Hyster H650HSD	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
Forklift - 10t - Hyster H210HD	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
Haul Truck CAT 797F	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
Water Truck 777F	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
Dozer D10T	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
Grader CAT 24M	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
Dozer - 433kW - DAT D10T	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
Tractor/Trailer - 170t - CAT 789	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
Crew Cab Pickup - Chevy Silverado 3500	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
Ambulance -	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
Mine Rescue Truck -	A	NOx, SO2, CO, TSP, PM10, PM2.5	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):

(Continued)

Construction Phase (continued)

Source	Type: Point (P), Area (A), Line (L), Vol. (V) Indicate Type	Air Contaminants (SO_2, NO_2, $PM_{2.5}$* ...)	Basis of Emissions (Section 5) *Underline your selection(s), as appropriate.*
47 passenger -	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
Maintenance Truck - 1t - Ford F550	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
Fire Truck - T800 Kenworth	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
Picker Truck - C500 Kenworth	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
Scraper - 345kW - CAT 637	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
Snow Cat - 8 passenger - Tucker 1643RE	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
Service Truck - T300 Kenworth	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
Welding Truck - T300 Kenworth	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
Powerline Truck -	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
Pick-ups	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
Pick-ups	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
Water Truck	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
Flat Decks	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
Man-lift	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
Sewage Truck	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):

(continued)

Construction Phase (continued)

Source	Type: Point (P), Area (A), Line (L), Vol. (V) Indicate Type	Air Contaminants (SO_2, NO_2, $PM_{2.5}$* ...)	Basis of Emissions (Section 5) *Underline your selection(s), as appropriate.*
Fork Lift	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
20 ton Crane	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
Busses	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
Loaders	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
Tracker/Trailer	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
Service Truck	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
Grader	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
Pick-ups	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
Flat Decks	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
12-ton High Boy	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
777 Heavy lift Crane	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
Man-lifts	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
Tracker/Trailer	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
Fuel Truck	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
Service Truck	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):

(continued)

Construction Phase (continued)

Source	Type: Point (P), Area (A), Line (L), Vol. (V) Indicate Type	Air Contaminants (SO_2, NO_2, $PM_{2.5}$* ...)	Basis of Emissions (Section 5) *Underline your selection(s), as appropriate.*
Tracker/Trailer	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
D8-R	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
D10-R	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
315	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
330	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
365	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
375	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
EX1800	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
14-G	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
16-G	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
777-D	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
773-Water	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
730-Water	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
740	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
583	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):

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Construction Phase (continued)

Source	Type: Point (P), Area (A), Line (L), Vol. (V) Indicate Type	Air Contaminants (SO_2, NO_2, $PM_{2.5}$* ...)	Basis of Emissions (Section 5) *Underline your selection(s), as appropriate.*
825	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
Drills	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
Pumps	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
Light Towers	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
Service	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
Pick-ups	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
Bus	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
Pick-ups	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
Pick-ups	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
Water Truck	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
Flat Decks	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
Man-lift	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
Sewage Truck	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
Fork Lift	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
20 ton Crane	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):

(continued)

Construction Phase (continued)

Source	Type: Point (P), Area (A), Line (L), Vol. (V) Indicate Type	Air Contaminants (SO_2, NO_2, $PM_{2.5}$* ...)	Basis of Emissions (Section 5) *Underline your selection(s), as appropriate.*
Busses	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
Loaders	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
Tracker/Trailer	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
Service Truck	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
Grader	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
Pick-ups	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
Flat Decks	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
12-ton High Boy	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
777 Heavy lift Crane	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
Man-lifts	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
Tracker/Trailer	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
Fuel Truck	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
Service Truck	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
Tracker/Trailer	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
Cat D8-R Dozer	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):

(continued)

Construction Phase (continued)

Source	Type: Point (P), Area (A), Line (L), Vol. (V) Indicate Type	Air Contaminants (SO_2, NO_2, $PM_{2.5}$* ...)	Basis of Emissions (Section 5) *Underline your selection(s), as appropriate.*
Cat D10-R Dozer	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
Cat 315 Excavator	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
Cat 330 Excavator	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
Cat 350 Excavator	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
Cat 365 Excavator	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
Komatsu EX1800	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
Cat 980 Loader	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
Cat 14 Grader	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
Cat 16 Grader	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
Cat 777-D Truck	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
Cat 773 Water Truck	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
Cat 730 Water Truck	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
Cat 740 Articulated Truck	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
Cat 583 Compactor	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
Cat 825 Compactor	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):

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Construction Phase (continued)

Source	Type: Point (P), Area (A), Line (L), Vol. (V) Indicate Type	Air Contaminants (SO_2, NO_2, $PM_{2.5}$* ...)	Basis of Emissions (Section 5) *Underline your selection(s), as appropriate.*
Drills	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
Pumps	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
Light Towers	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
Service	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
Pick-ups	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
Bus	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
3.5yd Loader	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
30 T Truck	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
6yd Loader	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
Bolter	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
Boom Truck	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
Cobra 3 Tractor	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
Jumbo 2B E/H	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
Lube / Fuel Truck	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
Scissor Lift	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):

(continued)

Construction Phase (continued)

Source	Type: Point (P), Area (A), Line (L), Vol. (V) Indicate Type	Air Contaminants (SO_2, NO_2, $PM_{2.5}$* ...)	Basis of Emissions (Section 5) *Underline your selection(s), as appropriate.*
Tractors	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
Tunnel Construction Genset - Mine1	P	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
Tunnel Construction Genset - Mine2	P	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
Tunnel Construction Genset - adit	P	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
Tunnel Construction Genset - saddle1	P	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
Tunnel Construction Genset - saddle2	P	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
Tunnel Construction Genset - Treaty1	P	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
Tunnel Construction Genset - Treaty2	P	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
Camp # 5 800 person Treaty Plant Camp Generator1	P	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
Camp # 5 800 person Treaty Plant Camp Generator2	P	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
Camp # 6 120 Person Treaty Saddle Camp Generator	P	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
Camp # 10 400 Person Treaty Saddle Camp Generator	P	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
Camp # 5 800 person Treaty Plant Camp incinerator	P	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify): Emission rates from manufacturer adjusted based on camp size
Camp # 6 120 Person Treaty Saddle Camp incinerator	P	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify): Emission rates from manufacturer adjusted based on camp size

(continued)

Construction Phase (completed)

Source	Type: Point (P), Area (A), Line (L), Vol. (V) Indicate Type	Air Contaminants (SO_2, NO_2, $PM_{2.5}$* ...)	Basis of Emissions (Section 5) *Underline your selection(s), as appropriate.*
Camp # 10 400 Person Treaty Saddle Camp incinerator	P	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify): Emission rates from manufacturer adjusted based on camp size
Drilling and Blasting	A	SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
Road Dust	**A**	**TSP, PM_{10}, $PM_{2.5}$**	**proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):**
Land Clearing	A	TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
Construction of Building	A	TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
Bulldozing	A	TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
Grading	A	TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
Material Drop	A	TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):

Operation Phase

Source	Type: Point (P), Area (A), Line (L), Vol. (V) Indicate Type	Air Contaminants (SO_2, NO_2, $PM_{2.5}$* ...)	Basis of Emissions (Section 5) *Underline your selection(s), as appropriate.*
P&H 250XPC: Drill	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
Sandvik D245S	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
FEL Blast Hole Stemmer CAT 930H	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
Hydraulic Shovel EX8000	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):

(continued)

Operation Phase (continued)

Source	Type: Point (P), Area (A), Line (L), Vol. (V) Indicate Type	Air Contaminants (SO_2, NO_2, $PM_{2.5}$* ...)	Basis of Emissions (Section 5) *Underline your selection(s), as appropriate.*
Dozer CAT D10	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
Wheel Dozer CAT 834H	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
Fuel/Lube Truck CAT 740	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
Front End Loader CAT 988	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
Front End Loader CAT 988H	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
Excavator - 390kW - CAT 390	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
Water Pump - 1400 gal/min - LH8110	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
Light Plant - 20kW -	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
Crane - 250t - LTM1250	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
Excavator - 283kW - CAT 345	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
Mobile Screening Plant - Sanvik QA430	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
Crane - 100t - LTM1100	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
FEL - 373kW - CAT988	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
Crane - 40t - LTM1040	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
Forklift - 30t - Hyster H650HSD	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):

(continued)

Operation Phase (continued)

Source	Type: Point (P), Area (A), Line (L), Vol. (V) Indicate Type	Air Contaminants (SO_2, NO_2, $PM_{2.5}$* ...)	Basis of Emissions (Section 5) *Underline your selection(s), as appropriate.*
Forklift - 10t - Hyster H210HD	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
Haul Truck CAT 797F	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
Water Truck 777F	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
Dozer D10T	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
Grader CAT 24M	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
Dozer - 433kW - DAT D10T	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
Tractor/Trailer - 170t - CAT 789	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
Crew Cab Pickup - Chevy Silverado 3500	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
Ambulance -	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
Mine Rescue Truck -	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
47 passenger -	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
Maintenance Truck - 1t - Ford F550	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
Fire Truck - T800 Kenworth	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
Picker Truck - C500 Kenworth	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
Scraper - 345kW - CAT 637	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):

(continued)

Operation Phase (continued)

Source	Type: Point (P), Area (A), Line (L), Vol. (V) Indicate Type	Air Contaminants (SO_2, NO_2, $PM_{2.5}$* ...)	Basis of Emissions (Section 5) *Underline your selection(s), as appropriate.*
Snow Cat - 8 passenger - Tucker 1643RE	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
Service Truck - T300 Kenworth	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
Welding Truck - T300 Kenworth	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
Powerline Truck -	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
Backhoe Loader	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
Dump Truck (20 tonne capacity)	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
Bus - 37 Passenger	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
Forklift (1,800 kg capacity)	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
Bobcat	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
Forklift - Large (10,000 kg capacity)	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
Crane - 100T	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
Boom Truck - 20T	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
Loader F/E	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
Passenger Van	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
Truck 1/2 tonne	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):

(continued)

Operation Phase (continued)

Source	Type: Point (P), Area (A), Line (L), Vol. (V) Indicate Type	Air Contaminants (SO_2, NO_2, $PM_{2.5}$* ...)	Basis of Emissions (Section 5) *Underline your selection(s), as appropriate.*
Snow plow/sanding truck	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
Tool Truck	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
HDPE fusion machine	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
Culvert de-icing machine	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
Water Trucks	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
Backhoe Loader	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
Dump Truck (20 tonne capacity)	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
Forklift (1,800 kg capacity)	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
Bobcat	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
Forklift - Large (10,000 kg capacity)	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
Crane - 100T	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
Boom Truck - 20T	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
Loader F/E	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
Passenger van	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
Truck 1/2 tonne	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):

(continued)

Operation Phase (continued)

Source	Type: Point (P), Area (A), Line (L), Vol. (V) Indicate Type	Air Contaminants (SO_2, NO_2, $PM_{2.5}$* ...)	Basis of Emissions (Section 5) *Underline your selection(s), as appropriate.*
Snow plow/sanding truck	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
Tool Truck	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
HDPE fusion machine	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
Culvert press washer	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
Water Trucks	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
50 tonne haul trucks	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
Front end loader	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
Excavator	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
10 tonne	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
D7 tractor	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
pickup trucks	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
Water truck	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
fuel/service truck	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
50 tonne haul trucks	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
Front end loader	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):

(continued)

Operation Phase (continued)

Source	Type: Point (P), Area (A), Line (L), Vol. (V) Indicate Type	Air Contaminants (SO_2, NO_2, $PM_{2.5}$* ...)	Basis of Emissions (Section 5) *Underline your selection(s), as appropriate.*
Two Excavators	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
10 tonne roller	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
D7 tractor	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
Pickup trucks	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
Water truck	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
Fuel/service truck	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
D8 Tractors	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
Excavator	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
Light plants	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
Pickup truck	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
Road Grader	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
Water truck	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
Road Snow clearing equipment (Snowplow)	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
Diversion snow clearing equipment (D6 dozer)	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
Diversion snow clearing equipment (Snow blower)	A	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):

(continued)

Operation Phase (continued)

Source	Type: Point (P), Area (A), Line (L), Vol. (V) Indicate Type	Air Contaminants (SO_2, NO_2, $PM_{2.5}$* ...)	Basis of Emissions (Section 5) *Underline your selection(s), as appropriate.*
Mitchell Primary Crusher baghouse	P	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
Mitchell Coarse Ore Reclaim baghouse - before MTT	P	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
Mitchell Coarse Ore Reclaim baghouse - after MTT	P	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
Cone Crusher Building baghouse 1	P	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
Cone Crusher Building baghouse 2	P	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
Fine Ore Stockpile bagthouse	P	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
HPGR baghouse #1	P	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
Mitchell Operating Camp generator (350 person)	P	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
Treaty Operating Camp generator (250 person)	P	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
Mitchell Operating Camp incinerator (350 person)	P	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify): Emission rates from manufacturer adjusted based on camp size
Treaty Operating Camp incinerator (250 person)	P	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify): Emission rates from manufacturer adjusted based on camp size
Adits (Tunnel 1) exhaust	P	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify): Occupation Health and Safety BC Standard
Adits (Tunnel 2) exhaust	P	NOx, SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify): Occupation Health and Safety BC Standard
Drilling and Blasting	A	SO_2, CO, TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):

(continued)

Operation Phase (completed)

Source	Type: Point (P), Area (A), Line (L), Vol. (V) Indicate Type	Air Contaminants (SO_2, NO_2, $PM_{2.5}$* ...)	Basis of Emissions (Section 5) *Underline your selection(s), as appropriate.*
Road Dust	A	TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
Land Clearing	A	TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
Bulldozing	A	TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
Grading	A	TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):
Material Drop	A	TSP, PM_{10}, $PM_{2.5}$	proposed emission limits, manufacturer spec, emission factors, CEM, modelled emission rates stack sample , other (specify):

SOURCE EMISSION RATE VARIABILITY

Is the 25, 50, 75% emission scenario important? ***Answer YES or NO.*** **If yes, follow Section 5.4.1.**

NO

Are abnormal emission conditions important? ***Answer YES or NO.*** **If yes, follow Section 5.4.2.**

NO

PLANNED METEOROLOGICAL DATA INPUT AND PROCESSING

Surface Meteorological Data

Surface Met Data and Location (lat/long or indicate on map)	Data Source MOE, GVRD, MSC, Site Specific, Other (specify) [1]	Period of Record (start/end date) [2]	% of Wind Speeds = 0.0 [3]	Stability Class Method (if required)
Teigen Creek on-site surface station. (432012E, 6279647N)	Site specific	Since February 2008	2.96%	From CALMET model and MM5 data.
Mitchell Deposit on-site surface station. (421615E, 6265311N	Site specific	Since September 2008	5.47%	From CALMET model and MM5 data.
Unuk Teigen on-site surface station. (432260E, 6277120N)	Site specific	Since September 2008	3.97%	From CALMET model and MM5 data.

[1] If data from a nonministry, GVRD or MSC station is planned to be used, follow guidance in Section 7.2.3. Three privately operated meteorological stations will be used as surface meteorological data.
[2] For data completeness and data filling, follow guidance in Section 7.3.2.
Data is 100% complete for the modelling period (calendar year 2009) at Teigen and Unuk Teigen stations. And, 90.6% complete for Mitchell meteorological station.
[3] For light wind/calm treatment, follow guidance in Section 7.5.
Hourly wind speed readings less than 0.5 m/s were considered as calm wind conditions. Calm winds were recorded as 5.47 %, 3.47% and 4.09% at KSM Project's Mitchell, Teigen and Unuk Teigen stations respectively.
[4] For stability class, follow guidance on Section 7.6.
CALMET will provide stability class information for CALPUFF dispersion study. CALMET output was prepared using on-site surface meteorological data and MM5 model data. Hourly Pasquill-Gifford Stability classes obtained by PRTMET and frequency chart was presented in Figure 4-6 and 4-7.

Upper-Air Meteorological Data

Station Name	Period of Record (start/end date) [1]
Not Required	Not Required

[1] For data completeness and data filling, follow guidance in Section 7.3.2.

Mesoscale Meteorological Model Output Underline your selection(s), as appropriate

Model	Agency/ Organization Providing Data	Horizontal Grid Resolution (km)	Data Period (start/end date)	Forecast/ Hindcast	Planned Model Output Use [1] *Underline your selection(s), as appropriate.*
MM5	Lakes Environmental 419 Phillip Street, Waterloo, Ontario N2L 3X2 Canada	4 km	Jan 1 to Dec 31, 2009	Hindcast	CALMET "initial guess" Field CALMET "Step 1" Field CALMET as observations Pseudo upper-air sounding Input to straight-line, Gaussian model

[1] For testing MM model output, see Section 7.1.3.

DATA PROCESSING - UNDERLINE YOUR SELECTION(S), AS APPROPRIATE.

Anticipated data processing utilities (See Section 7.8.)

MPRM PCRAMMET

other (specify): three on-site meteorological stations were used for surface station data. SMERGE used for formatting and METSCAN used for QA/QC.

Anticipated mixing height method (See Section 7.7.)

- o upper-air soundings screening mixing height
- o special field study simple mixing height
- o modelled mixing height (from MM5 model by using CALMET)
- o other (specify):

PLANNED MODEL OUTPUT

Background Concentrations Underline your selection(s), as appropriate.

Anticipated method to define background concentrations as per Section 10.1

- o modelled sources (See Section 10.1.3.) monitoring data (See Section 10.1.2.)

- o establish monitoring program (See Section 10.1.3.)
- o other method (describe):

A detailed description of the background concentrations was provided in Section 8 of the detailed model plan.

CALPUFF/CALMET Model QA/QC

Section 10.2.1.1 and Section 10.2.1.2 of the Guidelines for Air Dispersion Modelling (BC MOE) will be used for QA/QC protocols.

SPECIAL TOPICS

Indicate the conditions that are planned to be considered as part of the assessment

Stagnation Conditions

Answer YES or NO. If yes, follow guidance in Section 11.2.

YES

Shore/Coastal Effects

Answer YES or NO. If yes, follow guidance in Section 11.3.

NO

Horizontally Oriented Stacks and Stacks with Raincaps

Answer YES or NO. If yes, follow guidance in Section 11.6

YES. The Mitchell-Teigen Tunnel exhaust portals are horizontally oriented and are modelled as horizontal oriented stacks. The parameters were calculated based on guidance in Section 11.6 of the BC Model Guideline.

Plume Condensation (Fogging) and Icing

Answer YES or NO. If yes, follow guidance in Section 11.7

NO

NO to NO_2 Conversion

Answer YES or NO. If yes, follow guidance in Section 11.4.

YES

Which method will be used? Underline your selection, as appropriate.

100% conversion

Ambient Ratio (Indicate monitoring station: See Section 11.4)

OLM (Specify background O_3 concentration: See Section 11.4)

Ozone concentrations were taken from Background concentrations of $PM_{2.5}$ and Ozone in British Columbia (Mckendry 2006).

AERMOD PVRM (Specify background O3 concentration and how it was selected, and if non-default equilibrium ratios and in-stack ratios are used, specify and provide rationale: See Section 11.4)

Not Required