BC EAO EAC Application – Tenas Project

Section 4.0 Environmental Effects Assessment
Chapter 1 Atmospheric Environment Valued Component

May 2022

VERSION 1.0

Submitted to:	BC Environmental Assessment Office
Pursuant to:	*Environmental Assessment Act,* S.B.C. 2002, c.43
Submitted by:	Telkwa Coal Limited Suite 1410 – 409 Granville Street Vancouver, BC V6C 1T2

Tenas Project

Section 4.0 Environmental Effects Assessment
Chapter 1 Atmospheric Environment Valued Component

TABLE OF CONTENTS

Table of Contents i
List of Figures iii
List of Tables iv
List of Appendices vi
Abbreviations and Acronyms vii
Units of Measure ix
Executive Summary x
1. Introduction 1
2. Regulatory Context 3
2.1 Air Quality 3
2.2 Greenhouse Gas (GHG) Emissions 4
2.3 Noise 4
2.4 Vibration 5
3. Scope of the Assessment 6
3.1 Issues Scoping 6
3.2 Rationale for Selection of Atmospheric Environment Valued Component (VC) 6
3.2.1 Valued Component (VC) 6
3.2.2 Subcomponents 7
3.2.3 Indicators 9
3.2.4 Assessment Boundaries 9
3.2.4.1 Spatial Boundaries 10
3.2.4.2 Temporal Boundaries 13
3.2.4.3 Administrative Boundaries 14
3.2.4.4 Technical Boundaries 14
4. Existing Conditions 15
4.1 Background Information and Studies 15
4.1.1 Traditional Knowledge (TK) 15
4.1.2 Scientific and Other Information 15
4.1.2.1 Climate 16
4.1.2.2 Air Quality 16
4.1.2.3 Greenhouse Gas (GHG) Emissions 17

4.1.2.4 Noise 17
4.1.3 Baseline Studies 17
4.2 Description of Existing Conditions 19
4.2.1 Climate 19
4.2.2 Air Quality 25
4.2.2.1 Particulate Matter 25
4.2.2.2 Nitrogen Dioxide (NO_2) and Sulphur Dioxide (SO_2) 27
4.2.2.3 Dustfall 27
4.2.2.4 Summary 28
4.2.3 Greenhouse Gas (GHG) Emissions 29
4.2.4 Noise 30
4.2.5 Vibration 31
5. Assessment of Project-related Effects 32
5.1 Potential Project-related Interactions with the Atmospheric Environment Valued Component (VC) 32
5.2 Potential Project-related Effects 37
5.2.1 Air Quality Subcomponent 37
5.2.1.1 Operation Phase 37
5.2.2 Greenhouse Gas (GHG) Emissions Subcomponent 49
5.2.2.1 Operation Phase 49
5.2.3 Noise Subcomponent 49
5.2.3.1 Operation Phase 49
5.2.4 Vibration 50
5.2.4.1 Operation Phase 50
5.3 Mitigation Measures 50
5.3.1 Limit Project Footprint and Project Area 51
5.3.2 Reclamation Measures 52
5.3.3 Transport Measures 52
5.3.4 Blasting Measures 52
5.3.5 Coal Processing Measures 53
5.3.6 Load Management for Processed Coal Trucks 53
5.3.7 Drop Height Reduction 53
5.3.8 Vehicle and Equipment Fleet Selection and Maintenance 53
5.3.9 Wood or Oil Stove Replacement Program 54
5.3.10 Summary of Mitigation Measures 54
5.4 Residual Effects and Significance of Residual Effects 55
5.4.1 Description of Evaluation Criteria 55
5.4.1.1 Residual Effects Characteristics 55
5.4.1.2 Likelihood 57
5.4.1.3 Significance Determination 57
5.4.2 Air Quality Subcomponent 58

5.4.3 Residual Effect Characteristics 58
5.4.3.1 Likelihood 59
5.4.3.2 Significance Determination 59
5.4.4 Greenhouse Gas (GHG) Emissions Subcomponent 59
5.4.4.1 Residual Effect Characteristics 59
5.4.4.2 Likelihood 60
5.4.4.3 Significance Determination 60
5.4.5 Noise Subcomponent 60
5.4.5.1 Residual Effect Characteristics 60
5.4.5.2 Likelihood 60
5.4.5.3 Significance Determination 61
5.5 Summary of Project-related Residual Adverse Effects and Significance 61
6. Cumulative Effects Assessment (CEA) 63
6.1 Cumulative Effects Assessment (CEA) – Air Quality Subcomponent 65
6.1.1 Potential Cumulative Effects 65
6.1.2 Additional Mitigation Measures 66
6.1.3 Cumulative Effects and Characterisation of Significance 66
6.2 Cumulative Effects Assessment (CEA) – Greenhouse Gas (GHG) Emissions Subcomponent 66
6.2.1 Potential Cumulative Effects 66
6.2.2 Additional Mitigation Measures 67
6.2.3 Cumulative Effects and Characterisation of Significance 67
6.3 Cumulative Effects Assessment (CEA) - Noise Subcomponent 68
6.3.1 Potential Cumulative Effects 68
6.3.2 Additional Mitigation Measures 69
6.3.3 Cumulative Effects and Characterisation of Significance 69
6.4 Summary of Cumulative Effects Assessment (CEA) 69
7. Summary of Effects Assessment on the Atmospheric Environment Valued Component (VC) 71
8. Follow-up Strategy 72
9. References 73

LIST OF FIGURES

Figure 3.2-1: Air Quality Local and Regional Study Areas 11
Figure 3.2-2: Noise Local and Regional Study Areas 12
Figure 4.2-1: Temperature regime from Smithers Airport climate normals 20
Figure 4.2-2: Precipitation regime from Smithers Airport climate normals 20
Figure 4.2-3: Wind roses for the Air Quality Regional Study Area (RSA) - Smithers St Josephs, 2015 21

Figure 4.2-4: Wind roses for the Air Quality Regional Study Area (RSA) - Telkwa, 2015 22
Figure 4.2-5: Wind roses for the Air Quality Regional Study Area (RSA) - Pine Creek, 2015 23
Figure 4.2-6: Wind roses for the Air Quality Regional Study Area (RSA) - Tenas Deposit, 2018 24
Figure 4.2-7: Seasonal variation in measured particulate matter less than 10 microns in diameter (PM_{10}) concentrations 26
Figure 4.2-8: Seasonal variation in measured particulate matter less than 2.5 microns in diameter ($PM_{2.5}$) concentrations 26
Figure 4.2-9: Summary of measured dustfall deposition rates 28
Figure 5.2-1: Maximum Predicted 24-hour TSP Concentrations ($\mu g/m^3$) 39
Figure 5.2-2: Predicted Annual TSP Concentrations ($\mu g/m^3$) 40
Figure 5.2-3: Maximum Predicted 24-hour PM_{10} Concentrations ($\mu g/m^3$) 41
Figure 5.2-4: Maximum Predicted 24-hour $PM_{2.5}$ Concentrations ($\mu g/m^3$) 42
Figure 5.2-5: Predicted Annual $PM_{2.5}$ Concentrations ($\mu g/m^3$) 43
Figure 5.2-6: Maximum Predicted 1-hour NO_2 Concentrations ($\mu g/m^3$) 44
Figure 5.2-7: Maximum Annual NO_2 Concentrations ($\mu g/m^3$) 45
Figure 5.2-8: Maximum Predicted 1-hour SO_2 Concentrations ($\mu g/m^3$) 46
Figure 5.2-9: Predicted Annual SO_2 Concentrations ($\mu g/m^3$) 47
Figure 5.2-10: Maximum Predicted 30-Day Dustfall Deposition ($\mu g/m^3$) 48
Figure 6-1: Map of Projects and Activities for Cumulative Effects Assessment 64

LIST OF TABLES

Table 2.1-1: Ambient Air Quality Criteria 3
Table 2.3-1: Permissible Sound Levels 5
Table 3.2-1: Summary of Rationale for Selection of Atmospheric Environment Valued Component (VC) and Subcomponents and their Linkages 8
Table 3.2-2: Indicators for Atmospheric Environment Valued Component (VC) and Subcomponents 9
Table 3.2-3: Spatial Boundary Definitions for the Atmospheric Environment Valued Component (VC) 10
Table 3.2-4: Temporal Boundaries for the Tenas Project 13
Table 4.1-1: Environmental Assessment Certificate (EAC) Application Alternate References 15
Table 4.1-2: Air Quality Monitoring Data 17

Table 4.1-3: Summary of Desktop and Field Studies Related to Atmospheric Environment Valued Component (VC) 18

Table 4.2-1: Summary of Particulate Matter less than 10 Micron in Diameter (PM_{10}) and Particulate Matter less than 2.5 Microns in Diameter ($PM_{2.5}$) Monitoring Data 25

Table 4.2-2: Summary of Nitrogen Dioxide (NO_2) and Sulphur Dioxide (SO_2) Monitoring Data 27

Table 4.2-3: Summary of Background Air Quality Concentrations 29

Table 4.2-4: Greenhouse Gas (GHG) Emission Intensities from Bituminous Coal Mining Facilities 30

Table 4.2-5: Summary of Baseline Noise Measurements, 1998 30

Table 4.2-6: Summary of Baseline Noise Measurements, 2017 - 2018 31

Table 5.1-1: Potential for an Interaction between the Atmospheric Environment Valued Component (VC) and the Tenas Project 32

Table 5.1-2: Interactions between Atmospheric Environment Subcomponents and the Tenas Project 34

Table 5.2-1: Maximum Predicted Concentrations and Deposition Rates 38

Table 5.2-2: Estimated Greenhouse Gas (GHG) Emissions 49

Table 5.2-3: Maximum Predicted Noise Levels 50

Table 5.3-1: Summary of Potential Effects and Mitigation Measures for the Atmospheric Environment Valued Component (VC) 54

Table 5.4-1: Effect Characteristics Considered When Determining the Significance of Residual Effects on the Atmospheric Environment Valued Component (VC) 55

Table 5.4-2: Summary of Effect Characteristics Ratings for the Air Quality Subcomponent 58

Table 5.4-3: Summary of Effect Characteristics Ratings for the Greenhouse Gas (GHG) Emissions Subcomponent 59

Table 5.4-4: Summary of Effect Characteristics Ratings for the Noise Subcomponent 60

Table 5.5-1: Summary of Residual Adverse Effects for the Atmospheric Environment Valued Component (VC) Subcomponents 62

Table 6-1: Projects Included in the Assessment of Atmospheric Environment Valued Component (VC) Based on Spatial and Temporal Interaction 63

Table 6.1-1: Summary of Cumulative Effects for the Air Quality Subcomponent 66

Table 6.2-1: Projected Greenhouse Gas (GHG) Emissions in British Columbia (BC) and Canada 67

Table 6.2-2: Summary of Cumulative Effects for the Greenhouse Gas (GHG) Emissions Subcomponent 68

Table 6.3-1: Summary of Cumulative Effects for the Noise Subcomponent 69

Table 6.4-1: Summary of Cumulative Effects for the Atmospheric Environment Valued Component (VC) 70

LIST OF APPENDICES

Appendix 4.1-A Noise Modelling Report

Appendix 4.1-B Air Quality Modelling Report

Appendix 4.1-C Tenas Project 2017 to 2019 Baseline Report

ABBREVIATIONS AND ACRONYMS

Abbreviation or Acronym	Long form of Abbreviation or Acronym
3D	three-dimensional
AIR	Application Information Requirements
AQMP	Air Quality Management Plan (S13.0-C2)
ASTM	American Society for Testing and Materials
BC	British Columbia
BC EAO	British Columbia Environmental Assessment Office
BC MECCS	British Columbia Ministry of Environment and Climate Change Strategy
BC MOE	British Columbia Ministry of Environment
BC OGC	British Columbia Oil and Gas Commission
BC MFLNRORD	British Columbia Ministry of Forests, Lands, Natural Resource Operations and Rural Development
BLVD	Bulkley Valley Lakes District
BMPs	best management practices
C	Chapter
CACs	criteria air contaminants
CEA	cumulative effects assessment
CH_4	methane
CNR	Canadian National Railway
CO_2	carbon dioxide
CO_2e	carbon dioxide equivalents
CPP	Coal Processing Plant
Crossroads	Crossroads Cultural Resource Management
CUS	Cultural Use Study
DF	dustfall monitoring site
EA	environmental assessment
EAA	*Environmental Assessment Act*, SBC 2002, c 43 (Government of British Columbia [GovBC] 2018)
EAC	Environmental Assessment Certificate
ECCC	Environment and Climate Change Canada
EMA	*Environmental Management Act,* SBC 2003, c 53 (Government of British Columbia [GovBC] 2003)
FCM-RAC	Federation of Canadian Municipalities and Railway Association of Canada
GHG	greenhouse gas
GovBC	Government of British Columbia
GovCan	Government of Canada

Abbreviation or Acronym	Long form of Abbreviation or Acronym
LSA	Local Study Area
N_2O	nitrous oxide
NAPS	National Air Pollution Surveillance
NO_2	nitrogen dioxide
NO_X	oxides of nitrogen
OW	Office of the Wet'suwet'en
PAHs	polycyclic aromatic hydrocarbons
PCIC	Pacific Climate Impacts Consortium
PM	particulate matter
PM_{10}	particulate matter less than 10 microns in diameter
$PM_{2.5}$	particulate matter less than 2.5 microns in diameter
PPR2	Private Property Receptor 2 (Kerr Farm)
Project	Tenas Project
PSLs	permissible sound levels
ROM	run-of-mine
RSA	Regional Study Area
ROW	right-of-way
S	Section
S	noise monitoring site
SHARP	synchronized hybrid real-time particulate
SO_2	sulphur dioxide
TAC	Tenas Access Corridor
TCL	Telkwa Coal Limited
TCRC	Telkwa Coalmine Recreation Camp
TEOM	tapered element oscillating microbalance
TK	Traditional Knowledge
TSP	total suspended particulate
USA	United States of America
VC	Valued Component
VOCs	volatile organic compounds
WHO	World Health Organization

UNITS OF MEASURE

Abbreviation	Long form of Abbreviation or Acronym
%	percent
%HA	percent of high annoyance
°C	degrees Celsius
µg/m^3	microgram per cubic metre
cm	centimetre
dB	decibel
dBA	A-weighted decibel
dBC	C-weighted decibel
km	kilometre
km/h	kilometres per hour
kV	kilovolt
L_d	daytime noise level
L_{dn}	day-night noise level
L_n	nighttime noise level
m	metre
m^3	cubic metre
mg/dm^2/d	milligrams per square decimeter per day
mm	millimetre
Mt	million tonnes
t CO_2e/kt	tonnes carbon dioxide equivalent per kilotonne
TSP/$PM_{2.5}$	ratio of total suspended particulate to particulate matter less than 2.5 microns
V	volt

EXECUTIVE SUMMARY

The purpose of this chapter is to present an assessment of potential Project-related and cumulative effects on the Atmospheric Environment Valued Component (VC), including the subcomponents: Air Quality; Greenhouse Gas (GHG) Emissions; and Noise. The assessment of Project-related effects and cumulative effects was conducted according to the methods set out in **Section (S) 3.0 Assessment Methodology** of the **Environmental Assessment Certificate (EAC) Application**.

Existing conditions related to the Atmospheric Environment VC are described to provide context for the effects assessment. The region has a borderline humid continental/subarctic climatic regime characterised by cold winters and cool to warm summers. Located in the lee of the Coast Mountains, the region receives little precipitation. Little seasonality in precipitation is observed other than a somewhat drier spring. Wind conditions in the region vary depending on elevation, slope, aspect, and proximity to the Bulkley and Telkwa rivers.

Particulate matter (PM) currently represents the main air quality concern in the region, with ambient concentrations within populated areas exceeding the relevant ambient air quality criteria up to 8 percent (%) of the time. Major contributors to elevated levels of particulate matter include wood smoke as well as springtime snowmelt and associated accumulation of winter traction material on road surfaces. Dustfall deposition rates near unpaved roads such as the Telkwa Coalmine Road also tend to be high, occasionally exceeding the now rescinded provincial objectives. Concentrations of PM and dustfall deposition rates in more remote areas tend to be lower. Concentrations of nitrogen dioxide (NO_2) and sulphur dioxide (SO_2), both in populated and remote areas, are generally low and remain well below the relevant ambient air quality criteria.

Total GHG emissions in Canada and BC in 2018 were estimated to be 729 and 65.5 million tonnes (Mt) of carbon dioxide equivalent (CO_2e), respectively. The largest contributors to existing GHG emissions are related to the transportation, and the oil and gas industries. The industry profile based on other bituminous coal mining facilities in Canada ranges from 49 to 95 tonnes CO_2e per kilotonne of processed coal.

Existing noise levels are highest in populated areas and lowest in remote locations. The primary sources contributing to measured noise levels in Telkwa and near the proposed Rail Loadout is vehicle traffic along Highway 16 and rail traffic along the Canadian National Railway (CNR) rail line. Existing noise levels in the outlying residential subdivisions are typically dominated by livestock and local vehicle traffic. Noise levels in more remote locations including the Minesite and Coal Processing Plant (CPP) tend to be dominated by wildlife and other natural sources.

While all phases of the Project have the potential to result in effects to the Atmospheric Environment VC, the Operation Phase is expected to have the greatest effects. Therefore, the assessment focussed on the Operation Phase. Predicted effects associated with the Operation Phase encompass any potential effects during the Construction, Decommissioning and Reclamation, and Post-closure phases, and are effectively captured through the assessment of the Operation Phase.

Emissions of criteria air contaminants (CACs) were estimated for all Project activities during a select peak year (Year 5) of the Operation Phase. Estimated emissions were then input in the CALPUFF dispersion modelling system to estimate maximum ambient concentrations and dustfall deposition rates in the air quality Local Study Area (LSA). Project contribution to maximum predicted concentrations of PM and NO_2, as well as maximum predicted dustfall deposition rates, may exceed the relevant ambient air quality criteria in a small area surrounding the Minesite and CPP. Maximum predicted concentrations for all contaminants are expected to remain below the relevant ambient air quality criteria at sensitive receptors including the

Telkwa Coalmine Recreation Camp (TCRC) and nearby residences. In the populated area of Telkwa, maximum predicted concentrations of PM may exceed the ambient air quality criteria due to high background concentrations; however, the Project contribution is very low, less than 3% of background particulate matter less than 10 microns in diameter (PM_{10}) and particulate matter less than 2.5 microns in diameter ($PM_{2.5}$) concentrations.

Emissions of GHGs were estimated for all Project activities during Year 5 of the Operation Phase. Total annual GHG emissions associated with the Project is estimated to be 68,973 tonnes. The largest sources of GHG emissions are fuel combustion in mobile Minesite equipment and fugitive releases of coalbed methane. Project-related GHG emissions represent 0.10% of existing GHG emissions in BC and 0.010% of existing GHG emissions in Canada. The GHG emission intensity associated with the Project is within the range of the industry profile.

Project-related effects on continuous noise were considered by estimating sound power levels associated with all equipment and activities associated with the Operation Phase. The CadnaA noise propagation modelling software was used to estimate potential changes in ambient noise levels. Maximum daytime and nighttime noise levels at the nearest residences and at the TCRC are expected to remain below permissible sound levels. Nighttime noise levels may exceed the permissible sound level at several residences within the surrounding residential subdivisions; however, these exceedances are related to background noise levels rather than the Project. The change in the percentage of high annoyance at all sensitive receptors is expected to remain well below the threshold for severe noise impact.

Project-related vibration effects are expected to be limited for the following reasons:

- Train speeds within the Rail Infrastructure will be low; at a maximum speed of approximately 10 kilometres per hour (km/hr) and up to 20 km/hr while entering and exiting the Rail Infrastructure;
- Project results in less than a 1.0% increase above the current train activity on the CNR rail line; and
- Nearest residences are over 500 metres (m) away, well beyond the vibration influence area of 75 m recommended by the Federation of Canadian Municipalities and the Railway Association of Canada (FCM-RAC) (2013).

In summary, changes in air quality and noise are predicted to remain below relevant guidelines and thresholds at sensitive receptors. Changes in GHG emissions are predicted to be small relative to provincial and federal totals, and within the industry profile. Therefore, potential residual effects on the Atmospheric Environment VC were rated as **Not Significant**.

Reasonably foreseeable future projects in the area may have overlapping effects on air quality and noise. However, based on the location of these projects and the type of projects, overlapping effects are expected to be minimal. Ambient concentrations and noise levels are expected to remain below relevant guidelines and thresholds at sensitive receptors. Cumulative effects on GHG emissions were assessed based on projected provincial and federal totals which incorporate reasonably foreseeable future development. GHG emissions are projected to decrease in the future. Therefore, cumulative effects on the Atmospheric Environment VC were **Not Significant**.

1. INTRODUCTION

This chapter presents an assessment of potential Tenas Project (Project)-related and cumulative effects on the Atmospheric Environment Valued Component (VC), including the subcomponents: Air Quality; Greenhouse Gas (GHG) Emissions; and Noise.

Air quality refers to the degree to which the atmosphere is free from contaminants and substances at levels that could lead to nuisance or measurably affect human health, wildlife, and vegetation. The contaminants most relevant to the Project include criteria air contaminants (CACs) which refer to a group of commonly occurring contaminants including particulate matter (PM), nitrogen dioxide (NO_2), and sulphur dioxide (SO_2). Although provincial objectives are no longer in effect, dustfall, which refers to the total deposition of PM onto surfaces, is also included in this assessment as a matter of community interest.

Other contaminants such as metals and polycyclic aromatic hydrocarbons (PAHs) may also be released by the Project. These contaminants are not included in the assessment on the Atmospheric Environment VC due to the lack of relevant ambient air quality criteria for these compounds. Results for metals and PAHs were used in the assessment of the Human Health VC (**Section (S) 8.0** of the **Environmental Assessment Certificate (EAC) Application**).

GHGs refer to a group of gases that build up in the atmosphere and have the potential to contribute incrementally to climate change. The GHGs most relevant to the Project include carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O). These gases are typically aggregated into carbon dioxide equivalents (CO_2e), which represent an equivalent quantity of CO_2 that has the same global warming potential as the combined gases.

Noise is defined as unwanted sound in the environment, and is the energy added to the air in the form of acoustical waves. Exposure to noise may be associated with public annoyance, sleep disturbance, and other health impacts. Noise is measured in decibels (dB), which expresses the ratio of the sound pressure level relative to a fixed reference value using a logarithmic scale. For environmental noise assessments, the A-weighted decibel (dBA) is used, which represents the relative loudness perceived by the human ear which is less sensitive to low audio frequencies.

While vibration has been screened out as a subcomponent in the Valued Components Scoping Document (TCL 2019) it is considered in this assessment as a matter of community interest. Vibration is an oscillatory motion that propagates as waves through the ground and into nearby buildings, creating ground-borne vibration effects such as movement of floors, shaking of items on shelves, rattling of windows, and interference with sensitive equipment.

This assessment is comprised of the following subsections:

- **Regulatory Context:** This subsection describes the regulatory framework relevant to the Atmospheric Environment VC;
- **Scope of the Assessment:** The VC selection process is described. Following the confirmation of Atmospheric Environment as a VC, subcomponents and indicators for the VC are selected, and assessment boundaries for the analysis are established;
- **Existing Conditions:** The existing conditions of the Atmospheric Environment VC are described;
- **Assessment of Project-related Effects:** Potential interactions between the Project and the Atmospheric Environment VC are identified and evaluated to determine the potential for those interactions to result in adverse effects on selected subcomponents. Mitigation measures to

eliminate, reduce, or control the potential adverse Project effects are outlined. Residual effects are then characterised, and their significance determined;

- **Cumulative Effects Assessment (CEA):** Cumulative effects on the Atmospheric Environment VC are described, considering the adverse residual effects of the Project in combination with the adverse residual effects of past, present, and reasonably foreseeable future projects, and activities. Additional mitigation measures to eliminate, reduce, or control cumulative effects are outlined. Cumulative effects are then characterised, and their significance determined; and
- **Follow-up Strategy:** Due to uncertainties inherent in the analysis and the changing nature of the landscape, a monitoring program is presented to verify assessment predictions and evaluate mitigation effectiveness. Adaptive management program(s) to be implemented to address any unexpected Project effects on the Atmospheric Environment VC are discussed.

2. REGULATORY CONTEXT

This environmental assessment (EA) has considered applicable federal and provincial legislation, regulations, strategies, guidelines, plans, and best management practices (BMPs) relevant to the Atmospheric Environment VC, and includes information provided by Indigenous groups. Applicable recommendations in provincial land use plans and designations were also considered.

The Tenas Project Application Information Requirements (AIR) for the Project, approved by the British Columbia Environmental Assessment Office (BC EAO) in 2022, outlines the requirements of the EA for the Atmospheric Environment VC to meet the provincial EA requirements under the BC *Environmental Assessment Act*, SBC 2002, c 43 (Government of British Columbia [GovBC] 2002) (*EAA*). The EA for the Atmospheric Environment VC follows these guidelines and legislated requirements and is consistent with the requirements of the Project AIR.

Legislation specific to the Atmospheric Environment VC, and the Air Quality; GHG Emissions; and Noise subcomponents, as well as Vibration, which was of community interest, and descriptions of the data requirements to assess the environmental effects are presented in the following subsections.

2.1 Air Quality

Air quality is managed in British Columbia (BC) through a range of provincial acts and regulations. Under authority provided in the *Environmental Management Act,* SBC 2003, c 53 (GovBC 2003) (*EMA*), BC has established a suite of ambient air quality criteria. These criteria are non-statutory objectives used to gauge existing air quality, guide decisions on EAs and authorizations, and to inform regulatory development. The relevant ambient air quality criteria for this assessment are listed in **Table 2.1-1.**

PM is often defined in terms of size fractions. There are air quality criteria for:

- total suspended particulate (TSP): PM less than approximately 30 microns in diameter that tend to remain suspended in the atmosphere for some time;
- PM_{10}: PM less than 10 microns in diameter, sometimes termed inhalable particulate matter; and
- $PM_{2.5}$: PM less than 2.5 microns in diameter, sometimes termed fine particulate matter.

As smaller size fractions are associated with greater health effects, there is more focus on the air quality criteria for PM_{10} and $PM_{2.5}$.

Dustfall criteria in BC were originally established back in 1979 as a method of assessing the dustiness of an area from an aesthetic or nuisance perspective. Given performance issues with standard dustfall sampling methodology and their limited use in determining impacts on human or environmental health, these criteria were rescinded in 2006. While these criteria have been rescinded, they are used in this assessment to provide context for potential Project-related effects. There are two (2) criteria for the mining industry, the lower criterion of 1.7 milligrams per square decimeter per day (mg/dm^2-d) is typically applied to residential land uses and the upper criterion of 2.9 mg/dm^2-d is typically applied to all other land uses.

Table 2.1-1: Ambient Air Quality Criteria

Contaminant	Averaging Period	Criteria (µg/m^3)
TSP	24-hour	120
	Annual	60[a]

Contaminant	Averaging Period	Criteria (µg/m^3)
PM_{10}	24-hour	50
$PM_{2.5}$	24-hour	25[b]
	Annual	8[c]
NO_2	1-hour	113[d]
	Annual	32
SO_2	1-hour	183[e]
	Annual	13

Source: *British Columbia Ministry of Environment and Climate Change Strategy (BC MECCS) 2020a*
Notes: *µg/m^3=microgram per cubic metre; mg/dm^2-d=milligram per square decimeter per day; TSP=total suspended particulate; PM_{10}=particulate matter less than 10 micron in diameter; $PM_{2.5}$=particulate matter less than 2.5 micron in diameter; NO_2=nitrogen dioxide; SO_2=sulphur dioxide*
a Based on annual geometric mean.
b Based on 98t^h percentile of daily average over one year.
c There is also a planning goal of 6 µg/m^3 to guide airshed planning efforts and to maintain good air quality in face of economic growth and development.
d Based on annual 98th percentile of daily 1-hour maximum, averaged over three (3) years.
E Based on annual 99th percentile of daily 1-hour maximum, averaged over three (3) years.

2.2 Greenhouse Gas (GHG) Emissions

As part of BC's climate action legislation, the province has established GHG reduction targets under the *Climate Change Accountability Act*, SBC 2007, c 42 (GovBC 2007a), formerly known as the *Greenhouse Gas Reduction Targets Act*, SBC 2007, c. 42 (GovBC 2007b). The targets for GHG emissions include a reduction of 40 percent (%) below 2007 levels by 2030, 60% below 2007 levels by 2040, and 80% below 2007 levels by 2050. To support these targets, industrial facilities in BC emitting over 10,000 tonnes of CO_2e per year are required to report their emissions under the *Greenhouse Gas Industrial Reporting and Control Act*, SBC 2014, c. 29 (GovBC 2014b). Facilities emitting over 25,000 tonnes of CO_2e per year need to have their emission reports verified by an independent third party.

The Act also introduces performance standards or GHG emission intensity benchmarks for industrial facilities. There are currently benchmarks for liquefied natural gas operations and coal-based electricity generation operations. It is expected that benchmarks for other facilities and sectors will be added later.

2.3 Noise

There are no federal or provincial regulations governing environmental noise from the Project.

The British Columbia Noise Control Best Practices Guideline (British Columbia Oil and Gas Commission [BC OGC] 2018) is used to inform the assessment of continuous noise. The guideline sets out permissible sound levels (PSLs) at receptors or dwellings, defined as permanently or seasonally occupied structures used for habitation, except for an employee or worker residence within the facility boundary. The PSLs, summarized in **Table 2.3-1** are assigned to each receptor based on the local dwelling density and proximity to heavily travelled transportation routes. Nighttime (10:00 p.m. to 7:00 a.m.) PSLs are designed to protect against disruption to normal sleep patterns. Daytime (7:00 a.m. to 10:00 p.m.) PSLs are set to be 10 dBA higher than the nighttime PSLs, recognizing that ambient sound levels during the day are generally higher than nighttime levels and nighttime noise disturbances are generally considered less acceptable. Where no receptors or dwellings are located within 1.5 kilometre (km) of a facility boundary, a nighttime PSL of 40 dBA should be met at the 1.5 km distance.

In addition to the PSLs, continuous noise is also assessed based on the percent of high annoyance (%HA), which provides information on aggregate community response to estimated noise levels. The %HA is calculated based on the day-night noise level (L_{dn}) as follows:

$$\%HA = 100/\left[1 + e^{(10.4-0.132L_{dn})}\right]$$

A Project-related change in the %HA greater than 6.5% is considered to represent a severe noise impact for which noise mitigation measures should be considered (Health Canada 2017).

Since the dBA discounts lower frequency sounds to which the human ear is less sensitive, low frequency noise may be a concern even when the PSLs and %HA threshold are achieved. The C-weighted decibel (dBC) is used to consider the effects of low frequency noise. As per the BC Noise Control Best Practices Guideline (BC OGC 2018), low frequency noise may be a concern if the Project-related dBC value minus the Project-related dBA value over the daytime or nighttime periods exceeds 20 dB.

Blasting noise is assessed separately and provided in **Appendix 4.1-A Noise Modelling Report** for reference use with the Wildlife VC discipline. This type of noise is short-term and generally has minimal effect on overall daytime and nighttime noise levels.

Table 2.3-1: Permissible Sound Levels

Proximity to Heavily Travelled Transportation Road or Rail Line (m)	Daytime/Nighttime PSL (dBA) by Dwelling Density[a]		
	1 to 8	9 to 160	>160
>500	50/40	53/43	56/46
30 to 500	55/45	58/48	61/51
<30	60/50	63/53	66/56

Notes: *<less than; >greater than; m=metre; dBA=A-weighted decibel; PSL=permissible sound levels*
[a] Refers to the dwelling density per quarter section of land (circle of 451-m radius around affected dwelling).

2.4 Vibration

There are no directly applicable regulations regarding vibration from mining facilities such as the Project. However, there are vibration regulations pertaining to the operation of the 2.5 km Rail Loop connected to the Canadian National Railway (CNR) rail line. As per Section 95.1 of the *Canada Transportation Act*, SC 1996, c. 10 (Government of Canada (GovCan) 1996), the operation of a railway shall cause only such vibration as is reasonable taking into account its location, operational requirements, and other obligations under the Act.

While specific vibration criteria have not been established but are determined on a case-by-case basis, the Federation of Canadian Municipalities and the Railway Association of Canada (FCM-RAC) have jointly developed a framework (FCM-RAC 2017) to address conflicts between railway operations and the development and use of land in proximity to railways.

The FCM-RAC Guidelines (FCM-RAC 2013) provide a recommended vibration influence area of 75 metres (m) from a railway corridor or rail yard. Within this vibration influence area, a vibration impact study should be conducted to determine the need for mitigation while beyond this distance no mitigations are required as vibration level increase due to the Project should not be measurable above current conditions.

3. SCOPE OF THE ASSESSMENT

The assessment of Project-related effects and cumulative effects was conducted according to the methods set out in **S3.0 Assessment Methodology** of the **EAC Application**. Methodologies specific to Atmospheric Environment VC are described in their relevant sections. The assessment boundaries specific to Atmospheric Environment VC are provided in**.2.4** and the characterisation criteria specific to this VC are provided at the start of **5.4**.

Assessment of effects on the Atmospheric Environment VC focuses on the Operation Phase of the Project as this phase is associated with the greatest effects on the Air Quality, GHG Emissions, and Noise subcomponents. Potential effects associated with the Construction, Decommissioning and Reclamation, and Post-closure phases are expected to be bounded by (i.e., less than) effects presented herein for the Operation Phase.

The assessment has been informed by the engagement and consultation process, including an air quality model plan submitted to and approved by the British Columbia Ministry of Environment and Climate Change Strategy (BC MECCS) (Orchard 2019-2020).

3.1 Issues Scoping

Telkwa Coal Limited (TCL) has undertaken an engagement and consultation process to support the scoping of issues for the Project. Refer to **S11.0 Wet'suwet'en Rights and Interests Assessment** and **S12.0 Public Consultation** of the **EAC Application** for details on the consultation program. This consultation and engagement process has included technical working groups established with Indigenous groups and government departments, community meetings, one-on-one and small group meetings, regarding key themes of interest and discussion of candidate VCs to represent the themes.

Key themes of interest identified through consultation, and reviews of other information, were dust generated from the Minesite (blasting) and associated haul and access roads, and potential noise effects from mining activities on wildlife.

3.2 Rationale for Selection of Atmospheric Environment Valued Component (VC)

3.2.1 Valued Component (VC)

The Atmospheric Environment VC and associated subcomponents were selected during the pre-Application phase of the Project following the VC selection process set out in **S3.0 Assessment Methodology** of the **EAC Application** and used the methodology provided in Guideline for Selection of Valued Components and Assessment of Potential Effects (BC EAO 2013).

The Project has the potential to influence the atmospheric environment including air quality, GHG emissions, and noise through emissions from Project activities. Atmospheric environment was identified as a VC because of its potential to interact with the Project, its importance to Indigenous groups and the public, as well as to government agencies.

The Atmospheric Environment VC supports (i.e., is input to) and/or is dependent on the assessment of several VCs (see **Table 3.2-1**).

- **Dependent on:**
  - **Terrain and Soils VC (S4.0-C2)** – Terrain and soil contribute to landscape form and function that affect dispersion and deposition of air contaminants.
- **Supporting:**
  - **Surface Water VC (S4.0-C3)** – Atmospheric environment contributes to dustfall deposition that affects water quality;
  - **Aquatic Resources VC (S4.0-C5)** – Atmospheric environment contributes to dustfall deposition that affects aquatic resources;
  - **Fish and Fish Habitat VC (S4.0-C6)** – Atmospheric environment contributes to dustfall deposition that affects fish and fish habitat;
  - **Vegetation VC (S4.0-C7)** – Atmospheric environment contributes to dustfall deposition that affects vegetation growth;
  - **Wildlife VC (S4.0-C8)** – Atmospheric environment contributes to air quality and noise that affect the suitability of habitat used by wildlife;
  - **Avian Species VC (S4.0-C9)** – Atmospheric environment contributes to air quality and noise that affect suitability of habitat used by Avian Species;
  - **Visual Resources VC (S6.0-C2)** – Atmospheric environment contributes to haze that affects visual quality;
  - **Land and Resource Use VC (S6.0-C4)** – Atmospheric environment contributes to air quality and noise that affect the quality of resources support land and resource use;
  - **Community Well-being VC (S6.0-C5)** – Atmospheric environment contributes to air quality and noise that affect health determinants indicative of community well-being; and
  - **Human Health VC (S8.0-C1)** – Atmospheric environment contributes to air quality and noise that affects human health.

3.2.2 Subcomponents

As summarized in **Table 3.2-1**, the Atmospheric Environment VC is comprised of three (3) subcomponents: Air Quality, GHG Emissions, and Noise. Air emissions of CACs can change air quality which is regulated in BC under the *EMA* and is on the effect pathway for human health, wildlife, and vegetation. GHG emissions can contribute to climate change which has been raised as a concern both provincially and federally. Changes in noise levels can cause disturbance to human and wildlife receptors.

Vibration was screened out as a subcomponent in the Valued Components Scoping Document (TCL 2019) as sources of vibration are far enough removed from permanent human receptors that there is not anticipated to be any interaction or adverse effects from the Project. However, a qualitative discussion on vibration is included in the EAC Application as a matter of community interest.

Table 3.2-1: Summary of Rationale for Selection of Atmospheric Environment Valued Component (VC) and Subcomponents and their Linkages

Subcomponent	Rationale for Inclusion	Source of Information	VC Linkages	
Air Quality	▪ Air quality is a pathway for contaminants to enter the terrestrial and aquatic food chains and is therefore an important factor for human health and safety. ▪ Air quality is a fundamental component of the natural ecosystem because of its biological importance to vegetation and wildlife. ▪ Air emissions are provincially regulated. ▪ Project activities have the potential to change ambient air quality.	▪ BC Ministry of Environment and Climate Change Strategy (BC MECCS) ▪ Environment and Climate Change Canada (ECCC) ▪ National Air Pollution Surveillance	**Dependent on:** ▪ Terrain and Soils	**Supporting:** ▪ Surface Water ▪ Aquatic Resources ▪ Fish and Fish Habitat ▪ Vegetation ▪ Wildlife ▪ Avian Species ▪ Visual Resources ▪ Land and Resource Use ▪ Community Well-being ▪ Human Health
GHG Emissions	▪ GHG emissions are linked to climate change, which has been raised as a concern provincially and federally. ▪ Project activities have the potential to change GHG emissions.	▪ BC MECCS ▪ ECCC ▪ BC Environmental Assessment Office (BC EAO)	**Dependent on:** None	**Supporting:** None
Noise	▪ Noise from equipment and mining activities can create sensory disturbance to human and wildlife receptors and is an effect pathway for wildlife, recreation, and human health. ▪ Project activities have the potential to change ambient noise levels.	▪ British Columbia Oil and Gas Commission (BC OGC) ▪ Health Canada	**Dependent on:** None	**Supporting:** ▪ Wildlife ▪ Land and Resource Use ▪ Community Well-being ▪ Human Health

Notes: *BC=British Columbia; GHG=greenhouse gas emissions; VC= Valued Component*

3.2.3 Indicators

Indicators are quantitative and/or qualitative measures used to describe existing VC or VC subcomponent conditions and trends, and to evaluate potential Project effects and cumulative effects on the VC. The indicators considered in the assessment of the Atmospheric Environment VC are shown in **Table 3.2-2.**

The indicators for the Air Quality subcomponent include changes in ambient concentrations of CACs in comparison to ambient air quality criteria, established by environment and health authorities based on scientific studies that consider the influence of the contaminant on humans, wildlife, vegetation, as well as aesthetic qualities such as visibility.

Indicators for GHG Emissions include changes in emissions of CO_2e[1] relative to provincial and national totals, as well as comparison to the industry profile in Canada.

Indicators for noise include changes in ambient noise levels at sensitive receptors. Daytime noise levels (L_d) and nighttime noise levels (L_n), expressed in dBA, are compared against the BC OGC (BC OGC 2018) PSLs, adopted for this assessment in the absence of regulations and guidelines directly applicable to the Project.

Table 3.2-2: Indicators for Atmospheric Environment Valued Component (VC) and Subcomponents

Indicator	Rationale for Selection
Air Quality	
Increase in ambient concentrations of CACs (total suspended particulate [TSP], inhalable particulate matter [PM10], fine particulate matter [PM2.5], nitrogen dioxide [NO2], sulphur dioxide [SO2])	This indicator considers potential effects on human health and vegetation. CAC concentrations are managed provincially.
GHG Emissions	
Increase in GHG emissions (carbon dioxide [CO2], methane [CH4], nitrous oxide [N2O])	This indicator considers potential incremental contributions to climate change.
Noise	
Increase in ambient noise levels (daytime noise levels [Ld], nighttime noise levels [Ln], low frequency noise, percent highly annoyed [%HA])	This indicator considers potential effects on public annoyance and human health.

Notes: *CACs=criteria air contaminants; GHG=greenhouse gas*

3.2.4 Assessment Boundaries

The spatial and temporal boundaries encompass the area within, and times during which, the Project is expected to interact with the Terrain and Soils VC. The administrative and technical boundaries represent any constraints that may be placed on the EA due to political, social, and economic realities (i.e., administrative boundaries), or limitations in predicting or measuring changes (i.e., technical boundaries).

[1] CO_2e represents an aggregate measure including all indicators listed in the AIR and **Table 3.2-2**.

This subsection identifies the spatial, temporal, and technical boundaries for the analysis of potential effects on the Atmospheric Environment VC.

3.2.4.1 Spatial Boundaries

The spatial boundaries for the assessment of Air Quality, GHG Emissions and Noise subcomponents are summarized in **Table 3.2-3.**

The Air Quality Local Study Area (LSA) is defined as the 25 km by 21 km area illustrated in **Figure 3.2-1.** This area, which encompasses a minimum 5-km buffer around the Project and extended northward to include the Village of Telkwa, represents the area in which Project-related effects on air quality may be expected. The Air Quality Regional Study Area (RSA), which provides regional context of the analysis of Project-related effects as well as cumulative effects associated with other reasonably foreseeable projects, is defined as the 35 km by 35 km square encompassing a minimum 10-km buffer around the Project and extended northward to include the populated area of Smithers. Since GHG emissions have a global effect that cannot easily be measured on a local or regional scale, the spatial boundary for GHG assessment considers the provincial and federal jurisdictional boundaries.

The Noise LSA is defined as the area encompassing a 3-km buffer around the Project as illustrated in **Figure 3.2-2.** This 3-km buffer distance is double the criteria boundary of 1.5 km defined by the BC OGC and thus is expected to capture the area in which there may be any possible Project-related effects on noise. The Noise RSA is defined as the area encompassing a 5-km buffer around the Project to assess potential regional effects.

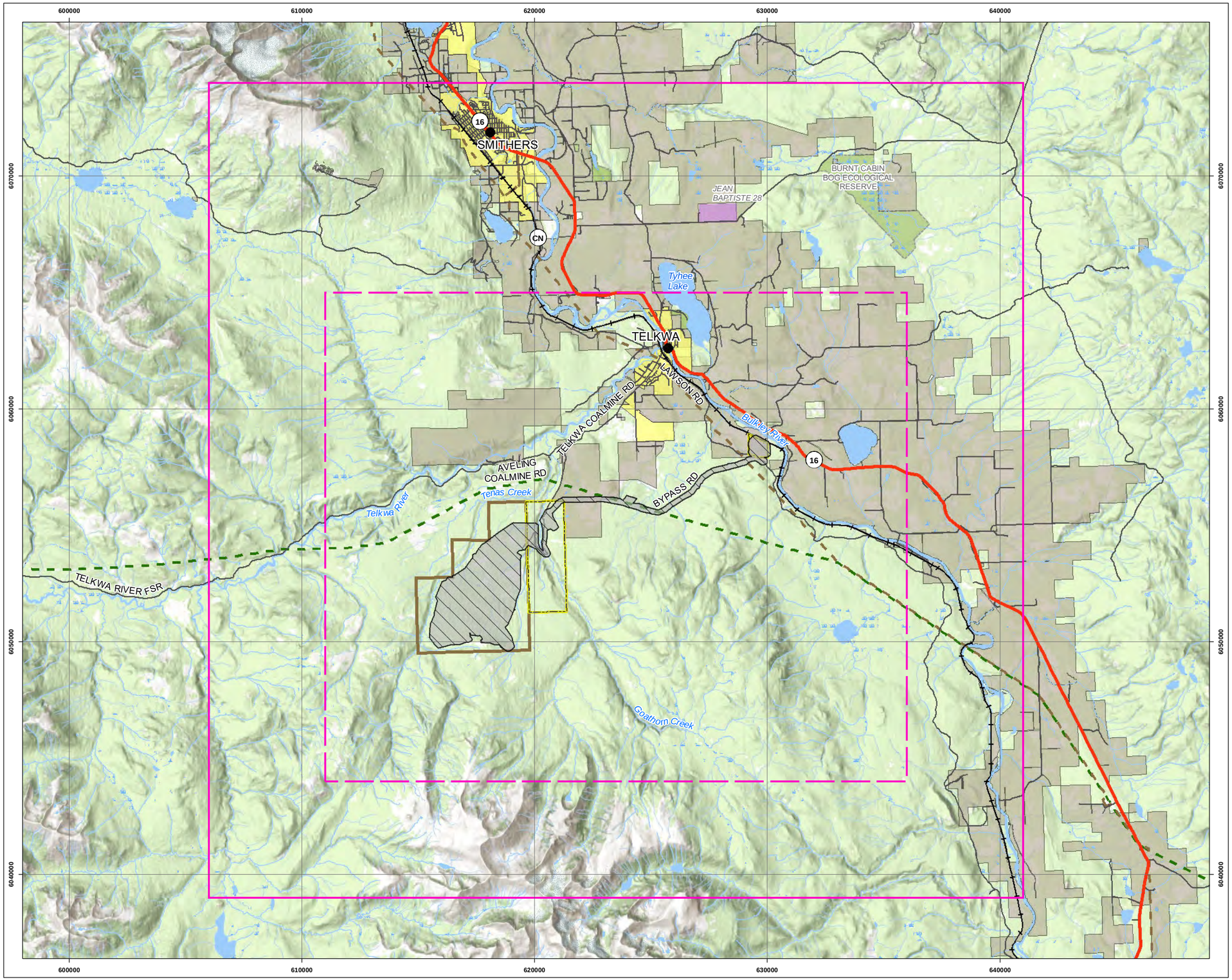
Table 3.2-3: Spatial Boundary Definitions for the Atmospheric Environment Valued Component (VC)

Subcomponent	Spatial Boundary	Description of Assessment Area
Air Quality	Local Study Area	25 km by 21 km area encompassing minimum 5 km buffer around the Project, extended north to include Village of Telkwa
	Regional Study Area	35 km by 35 km square encompassing minimum 10 km buffer around the Project, extended north to include the populated area of Smithers
GHG Emissions	Jurisdictional Boundary	BC and Canada
Noise	Local Study Area	Area encompassing 3 km buffer around the Project
	Regional Study Area	Area encompassing 5 km buffer around the Project

Notes: *BC=British Columbia; GHG=greenhouse gas emissions; km=kilometre; Project=Tenas Project*

Tenas Project

Air Quality Local and Regional Study Areas



Legend

- Air Quality Local Study Area
- Air Quality Regional Study Area
- City/Town
- Rail Line
- Highway
- Road
- 138 kV Transmission Line
- 500 kV Transmission Line
- Watercourse
- Wetland
- Waterbody
- Park or Protected Area
- First Nation Reserve
- Municipal Area
- General Private Property
- Tenas Coal Licenses
- Telkwa Coal Limited Private Property
- Project Area

Notes

1. All mapped features are approximate and should be used for discussion purposes only.
2. This map is not intended to be a “stand-alone” document, but a visual aid of the information contained within the referenced Report. It is intended to be used in conjunction with the scope of services and limitations described therein.

Sources

- Project Area: Allegiance Coal, April 21, 2021
- Basedata: Government of British Columbia
- Basemap: World Topo Base

N

1:160,000

0 2 4 6 8 10

Kilometres

NAD 1983 UTM Zone 9N

Page Size: 11" x 17"

989388-01	Production Date: May 26, 2021	Figure 3.2-1

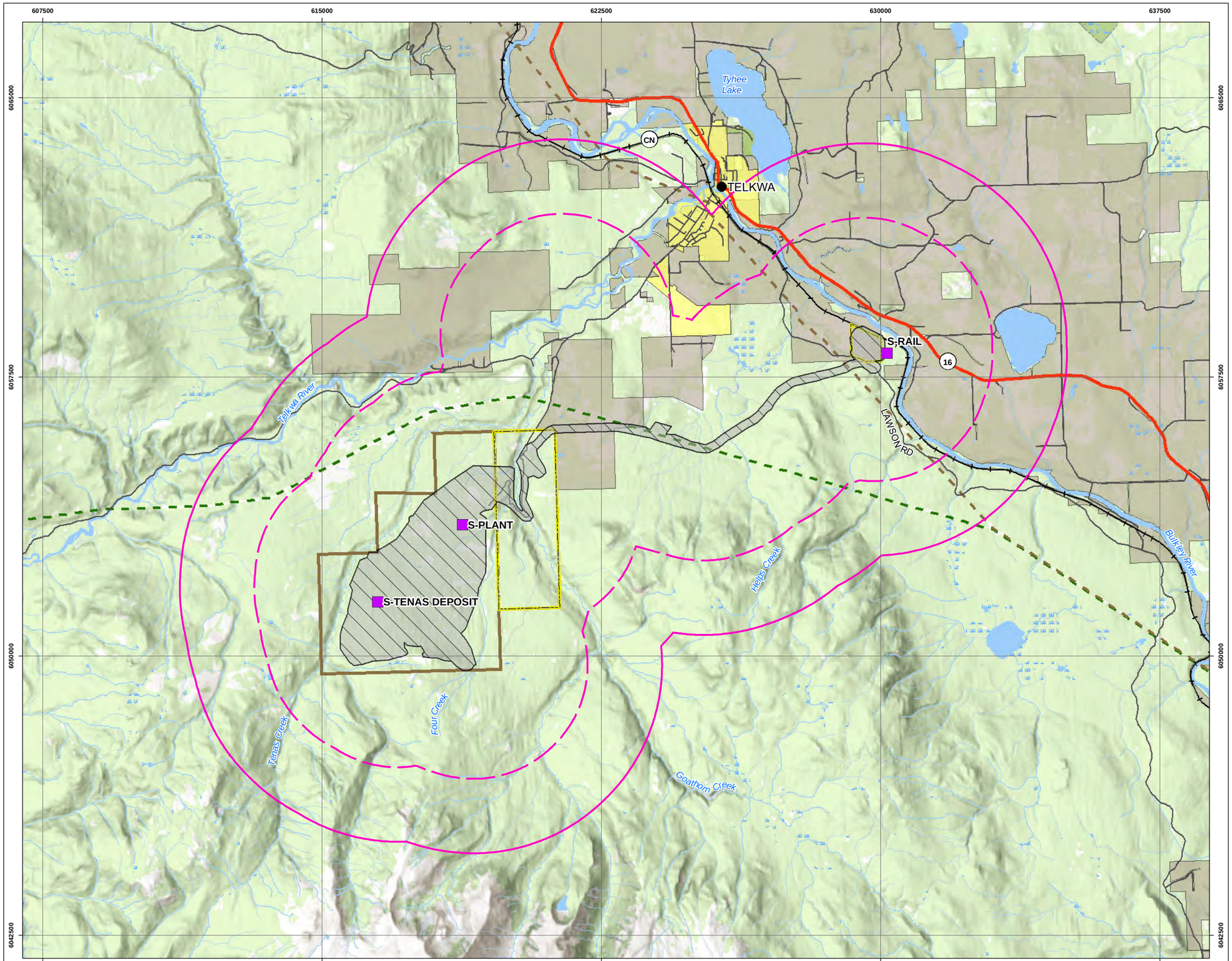
TELKWA COAL LIMITED

Hemmera An Ausenco Company

Path: S:\Kitimat\es\Projects\989388\01\mxd\ARI\Fig3_.._989388_01_AQ_StudyAreas_210526.mxd

Tenas Project

Noise Local and Regional Study Areas



Legend

- Noise Monitoring Location
- Noise Local Study Area
- Noise Regional Study Area
- City/Town
- Rail Line
- Highway
- Road
- 138 kV Transmission Line
- 500 kV Transmission Line
- Watercourse
- Wetland
- Waterbody
- Park or Protected Area
- Municipal Area
- General Private Property
- Tenas Coal Licenses
- Telkwa Coal Limited Private Property
- Project Area

Notes

1. All mapped features are approximate and should be used for discussion purposes only.
2. This map is not intended to be a "stand-alone" document, but a visual aid of the information contained within the referenced Report. It is intended to be used in conjunction with the scope of services and limitations described therein.

Sources

- Project Area: Allegiance Coal, April 21, 2021
- Basedata: Government of British Columbia
- Basemap: World Topo Map

N

1:100,000

0 1 2 3 4 5

Kilometres

NAD 1983 UTM Zone 9N

Page Size: 11" x 17"

989388-01	Production Date: May 26, 2021	Figure 3.2-2

TELKWA COAL LIMITED

Hemmera An Ausenco Company

Path: S:\Cartrefile\Projects\989388\01\mxd\ARI\Fig4_ 989388_01_Noise_Study_Areas_210526.mxd

3.2.4.2 Temporal Boundaries

Temporal boundaries for the assessment of effects on the Atmospheric Environment VC are defined by the Project's Construction, Operation, Decommissioning and Reclamation, and Post-closure phases. The Project phases are summarized in **Table 3.2-4** and described in detail in **S1.0 Overview of Project Proponent Description** of the **EAC Application**.

Table 3.2-4: Temporal Boundaries for the Tenas Project

Phase	Year	Duration (years)	Description of Activities
Construction	-0.5 to 0	1.5	Site clearing, soil salvage, open pit development, building construction, service and haul road development, Rail Infrastructure construction, bridge construction and development of onsite utilities and services. Development of mine rock, and overburden storage piles, stockpiling of reclamation material such as soil, overburden and other materials suitable for reclamation. Development of water management systems and management ponds for storage of potentially acid generating (PAG) materials.
Operation	1 to 21	21	Development of the open pit through drilling, blasting, loading, and hauling functions. Development of mine rock, and overburden storage piles, stockpiling of reclamation material such as soil, overburden and other materials suitable for reclamation. Development of water management systems and management ponds for PAG storage. Conducting coal processing, stockpiling of raw coal prior to processing, and stockpiling of processed coal prior to shipping. Progressive reclamation will be accomplished during operation including, where available, reclamation activities such as sloping, topsoil placement and revegetation.
Decommissioning and Reclamation	22 to 25	4	Tear-down of infrastructure onsite plus reclamation activities, including sloping of storage piles, backfill materials, and placement of reclamation materials including growth media, overburden and non-PAG rock for management pond covers and revegetating surfaces that are planned to be reclaimed.
Post-closure	26 to 50	10	Active: This involves the filling of the open pit with water, monitoring of vegetation growth and water quality for both groundwater and surface water and wildlife. Control and sedimentation ponds may still be needed for settling of total suspended solid levels. The management ponds are left as dry land reclamation except for portions that will be left as open water.
		15	Passive: This stage is when the control and sedimentation ponds are no longer required for settling of total suspended solid (TSS) levels and the management ponds are left as dry land reclamation except for portions that will be left as open water. Telkwa Coal Limited (TCL) is now simply monitoring the site.

This analysis for the Atmospheric Environment VC focuses on the Operation Phase of the Project as this phase is associated with the greatest potential effects on Air Quality, GHG Emissions and Noise. The temporal boundary for the assessment is focused on Year 5, as it represents a peak operating scenario when the most coal and overburden are expected to be mined, and active mining will be located towards the north end of the open pit extent, closest to any sensitive receptors.

3.2.4.3 Administrative Boundaries

No administrative boundaries were identified for the Atmospheric Environment VC.

3.2.4.4 Technical Boundaries

Limitations are inherent in the assessment of Project-related effects on the Atmospheric Environment VC. These include limitations in estimating air emissions and sound power levels of Project activities, and limitations in modelling of ambient concentrations and noise levels in the LSA and RSA.

Air emissions and sound power levels have been estimated based on Project-specific information where available, and default data from the public literature where site-specific information is not available. Such default data are based on the average of conditions observed at a limited number of project sites, mainly in the United States of America (USA), which may not be representative of the Project.

Air quality dispersion models and noise propagation models can only approximate atmospheric processes. Many assumptions and simplifications are required to describe real phenomena using mathematical equations. Model uncertainties can result from:

- simplifications and accuracy limitations related to source inputs to represent Project activities;
- extrapolation of meteorological data from selected locations to a larger region; and/or
- simplification of model physics to replicate the nature of atmospheric processes.

To overcome these limitations, conservative assumptions were made and are described in **Appendix 4.1-A Noise Modelling Report** and **4.1-B Air Quality Report**.

4. EXISTING CONDITIONS

The information in this subsection establishes the context for the assessment of effects on the Atmospheric Environment VC.

4.1 Background Information and Studies

4.1.1 Traditional Knowledge (TK)

The Atmospheric Environment LSA and RSA are situated within the Wet'suwet'en Traditional Territory. Traditional Knowledge (TK) for the Project was obtained through a review of publicly available information as well as the **Cultural Use Study (CUS)** (**Appendix 7.1-B** of **S7.0 Heritage Resources VC** of the **EAC Application**) which compiled a baseline inventory of cultural heritage resources pertaining to Wet'suwet'en communities by examining pre-existing cultural, social, historic, and economic data (Crossroads Cultural Resource Management [Crossroads] 2021). TK relevant to the Atmospheric VC and subcomponents (i.e., Air Quality, GHG Emissions, and Noise) was not reported. While the CUS reports the importance of subsistence foods, the potential Project-related effects associated with contaminants of potential concern in air on traditional subsistence foods is discussed in the Human Health VC (**S8.0** of the **EAC Application**).

4.1.2 Scientific and Other Information

This subsection presents a summary of existing scientific and other information reviewed to characterise existing conditions of climate, air quality, GHG emissions, noise, and vibration for the Atmospheric Environment VC. In addition to the information referenced therein, the following references were reviewed for applicability, but were determined to not contain the most recent/relevant information, so alternate references were used. See **Table 4.1-1**.

Table 4.1-1: Environmental Assessment Certificate (EAC) Application Alternate References

AIR Proposed Reference	EAC Application Alternate Reference
Air Quality Objectives and Standards (BC AQO) (British Columbia Ministry of Environment & Climate Change Strategy [BC MECCS] 2018a)	British Columbia Ambient Air Quality Objectives (BC MECCS 2020a)
Canadian Ambient Air Quality Standards (Canadian Council of Ministers of the Environment (CCME) 2020a)	**Appendix 4.1-C Tenas Project 2017 to 2019 Baseline** (page 3-2 and Table 3.2-1)
National Ambient Air Quality Objectives (CCME 1974)	National Ambient Air Quality Objectives Pollution Surveillance Program (NAPS) (ECCC 2019)
Night Noise Guidelines for Europe (World Health Organization [WHO] 1999)	**Appendix 4.1-C Tenas Project 2017 to 2019 Baseline** uses: Guidelines for Community Noise (World Health Organization 1999)
Useful Information for Environmental Assessments (Health Canada 2010c)	Guidance for Evaluating Human Health Impacts in Environmental Assessment: Noise (Health Canada 2017)
Guidance for Developing a Fugitive Dust Management Plan (British Columbia Ministry of Energy, Mines and Petroleum Resources [BC MEMPR] and BC MECCS 2020).	Referenced in the **Air Quality Management Plan (S13.0-C2) (AQMP)**

Notes: *AIR=draft Application Information Requirements; EAC=Environmental Assessment Certificate*

4.1.2.1 Climate

Climate is defined as the weather conditions that prevail in an area over a long period of time. Climate is characterised as part of existing conditions as it drives the transport, dispersion, and deposition of air contaminants, and thereby affects air quality in the Air Quality LSA and RSA. Parameters of interest include wind speed and direction, temperature, and precipitation.

Environment and Climate Change Canada (ECCC 2020a) compiles climate normal data at the end of each decade to represent average climatic conditions over the last 30 years. The most recent climate normal data (1981 to 2010) for Smithers Airport were reviewed for characterising existing climatic conditions in the air quality LSA and RSA. To better illustrate wind patterns in the area, which may vary depending on elevation, slope, aspect, and proximity to the Bulkley and Telkwa rivers, hourly wind speed and direction data for January to December 2015 from the following stations were obtained and presented as wind roses:

- Smithers St. Josephs, operated by BC MECCS (2020b);
- Village of Telkwa, operated by BC MECCS (2020b); and
- Pine Creek, operated by the British Columbia Ministry of Forests, Lands, Natural Resource Operations and Rural Development (BC MFLNRORD) and Pacific Climate Impacts Consortium (PCIC) 2020.

Wind roses are essentially bar charts in polar format, with the direction of the bar indicating the direction from which the wind is blowing, the colour indicating the wind speed class, and the length of the bar indicating the frequency of occurrence.

The 2015 weather data from Smithers, Telkwa, and Pine Creek were also entered into the CALMET meteorological model to provide a three-dimensional (3D) field of weather conditions in the Air Quality LSA.

4.1.2.2 Air Quality

The BC MECCS operates a network of air quality monitoring stations across the province in cooperation with industry, ECCC, and regional districts. Monitoring data in the region, summarized in **Table 4.1-2** were reviewed for characterising existing air quality conditions in the Air Quality LSA and RSA.

There are two (2) air quality monitoring stations in the Air Quality RSA located in Smithers and Telkwa, providing measurements of PM_{10}, $PM_{2.5}$, and NO_2. There are no air quality monitoring stations with SO_2 measurements in the Air Quality LSA or RSA. Therefore, baseline SO_2 concentrations were developed based on measurements from Terrace as recommended by the BC MECCS.

The following source was reviewed for further information pertaining to existing air quality conditions in the region:

- Air Quality Assessment for the Proposed Telkwa Mine. Prepared for Manalta Coal Ltd. (Connor Pacific Environmental Technologies Inc. 1999).

Manalta Coal Ltd., in conjunction with the BC MECCS, installed a PM monitoring station near the Telkwa firehall to characterise existing air quality conditions for the Project. This station remains operational as part of the BC MECCS air quality monitoring network described above. In addition, baseline dustfall monitoring was collected on the roof of the Telkwa municipal building. Dustfall measurements are available for the period from April 1983 to January 1986. Given the age of the data and expected changes in the air quality landscape over the last several decades, these baseline dust measurements were not considered for this assessment.

Table 4.1-2: Air Quality Monitoring Data

Contaminant	Station Name	Data Period
PM_{10}	Smithers St. Josephs	June 2014 to November 2018
$PM_{2.5}$	Smithers St. Josephs	January 2014 to November 2018
	Telkwa	January 2014 to April 2015
NO_2	Smithers St. Josephs	January 2014 to November 2018
SO_2	Terrace Skeena Middle School	January 2015 to December 2018

Source: *British Columbia Ministry of Environment and Climate Change Strategy (BC MECCS) 2020b*
Notes: *PM_{10}=particulate matter less than 10 micron in diameter; $PM_{2.5}$=particulate matter less than 2.5 micron in diameter; NO_2=nitrogen dioxide; SO_2=sulphur dioxide*

4.1.2.3 Greenhouse Gas (GHG) Emissions

Canada compiles a national inventory of GHG emission sources and sinks for annual reporting under the United Nations Framework Convention on Climate Change. The most recent submission for 2020 (ECCC 2020c) was reviewed to characterise existing GHG emissions in BC and Canada.

GHG emission intensities from other bituminous coal mining facilities in Canada were characterised using 2017 facility reporting data under the federal GHG Reporting Program (ECCC 2020c) in conjunction with 2017 production data from Mining Data Online (2020).

4.1.2.4 Noise

Information pertaining to existing noise conditions in the region from the following sources were reviewed:

- Noise Impact Assessment, Telkwa Coal Project, Final Report. Prepared for Manalta Coal Ltd. (Green Plan Ltd. 1998); and
- Davidson Project: Application for Environmental Assessment Certificate, Appendix D1 – Davidson Project Meteorology, Air Quality and Noise Baseline Study (Blue Pearl Mining Inc. 2008).

A baseline noise survey was conducted in February 1998 as part of the noise impact assessment for the Project. Continuous noise measurements were collected over a 24-hour period at nine (9) sites around the Project, including one (1) site within Telkwa, seven (7) sites within outlying residential subdivisions, and one (1) remote site.

A baseline noise monitoring program was conducted from November 2005 to September 2006 in support of the Davidson Project. Continuous measurements were collected over a two (2)-week period in each season (autumn, winter, spring, summer) at eight (8) sites representing a range of baseline conditions in the area. The noise monitoring sites are located outside the Noise LSA and RSA and insufficient information is available for characterising each of the eight (8) sites. Therefore, baseline noise measurements from the Davidson Project were not considered for this assessment.

4.1.3 Baseline Studies

Several baseline studies were conducted for the Project and described in **Appendix 4.1-C Tenas Project 2017 to 2019 Baseline Report.** A summary of the baseline studies of relevance to the Atmospheric Environment VC is shown **Table 4.1-3**.

Table 4.1-3: Summary of Desktop and Field Studies Related to Atmospheric Environment Valued Component (VC)

Study Name	Study Purpose	Duration	Spatial Boundaries
Air Quality-Dustfall	To collect local baseline dustfall measurements	Approximately one (1) year, September 2017 to November 2018	▪ DF-TenasDep: Within proposed open pit areas at the Tenas Deposit ▪ DF-Kerr: West side of Private Property Receptor 2 (PPR2), 14 m from Telkwa Coalmine Road ▪ DF-Telkwa: Intersection of Telkwa Coalmine Road and Birch Street ▪ DF-Rail: Within proposed Rail Loadout area
Air Quality-Particulate Matter	To collect local baseline PM10 and PM2.5 measurements to supplement publicly available monitoring data	November 2018 to January 2020	▪ PM-Kerr: West side of the PPR2, 90 m from Telkwa Coalmine Road
Climate/Meteorology	To collect meteorological data to support air quality assessment	September 2017 to December 2018	▪ One (1) station located at the Tenas Deposit
Noise	To measure existing noise levels in the vicinity of the Project	October 2017 (autumn), December 2017 (winter), March 2018 (spring)	▪ S-Plant: Within proposed area for Coal Processing Plant ▪ S-TenasDep: Adjacent to proposed open pit area at the Tenas Deposit ▪ S-Rail: Within proposed rail loadout area, 340 m from CN rail line

Notes: *DF=dustfall monitoring site; m=metre; PM=particulate matter monitoring site; $PM_{2.5}$=particulate matter less than 2.5 microns in diameter; PM_{10}=particulate matter less than 10 microns in diameter; S=noise monitoring site*
[a] = dustfall monitoring at DF-TenasDep station was discontinued after the February/March 2018 monitoring period.
[b] = Kerr is the name of the monitoring stations at the Kerr Farm as used in the baseline studies and report. In the EAC Application, Kerr Farm is referred to as Private Property Receptor (PPR) 2.

Dustfall monitoring was completed in accordance with sampling method American Society for Testing and Materials (ASTM) International D1739-98 (ASTM 2017). Dustfall canisters were installed at four (4) locations in the Air Quality LSA and sampled approximately every 30 days. Collected samples were sent for laboratory analysis. All laboratory reported dustfall deposition rates were then adjusted to account for periods of time when snow may have built up and blocked the opening of the dustfall canisters.

Ambient PM_{10} and $PM_{2.5}$ concentrations were monitored at one (1) location near the Kerr Farm[2] (Private Property Receptor 2 [PPR2]) using a Thermo Scientific Partisol 2025i-D dichotomous sequential air sampler. The air sampler was programmed to sample PM over a 24-hour period on a three (3)-day rotation following ECCC's National Air Pollution Surveillance (NAPS) program schedule.

One (1) automated meteorological station was installed at the Tenas Deposit near the proposed open pit area to collect continuous measurements of air temperature, relative humidity, precipitation, snow depth, wind speed and direction, solar radiation, and barometric pressure. The meteorological station was sited in a cutblock clearing according to siting guidelines from ECCC and BC MECCS.

[2] In the EAC Application, Kerr Farm is referred to as Private Property Receptor 2 (PPR2). In the baseline studies and report, Kerr Farm and DF-Kerr (the name of the monitoring station) are used.

The baseline noise monitoring program was developed in accordance with ASTM E1686-03 (ASTM 2003). A Bruel & Kjaer Type 2250 Class 1 sound level meter with datalogging capability was used to collect noise measurements at three (3) locations over a period of approximately 24 hours. Monitoring was repeated three (3) times to account for seasonal variability.

4.2 Description of Existing Conditions

This subsection provides a description of existing conditions related to the Air Quality, GHG Emissions, and Noise subcomponents based on publicly available information and baseline studies conducted for the Project.

4.2.1 Climate

The region has a borderline humid continental/subarctic climatic regime, with cold winters and cool to warm summers. Daily mean temperatures range from -7.2 degrees Celsius (°C) in January to 15.2°C in July, as illustrated in **Figure 4.2-1**. Cold continental arctic air masses dominate in the winter, although air flows are restricted by the Rocky Mountains to the east, thus moderating temperatures. Diurnal temperature ranges are generally greater in the summer, reflecting the seasonal variation in solar radiation. Located in the lee of the Coast Mountains, the region receives only 509 millimetres (mm) of precipitation annually. Little seasonality in precipitation is observed other than a somewhat drier spring, as shown in **Figure 4.2-2**.

Wind conditions in the Air Quality LSA and RSA vary as shown in the wind roses for Smithers, Telkwa, Pine Creek, and the Tenas Deposit (**Figures 4.2-3** through **4.2-6**). The predominant wind direction at Smithers is from the south and the predominant wind direction at Telkwa is from the east-southeast, following the orientation of the Bulkley River Valley. Winds at Pine Creek and the Tenas Deposit are predominantly from the west-southwest to southwest, following the orientation of the Telkwa River Valley.

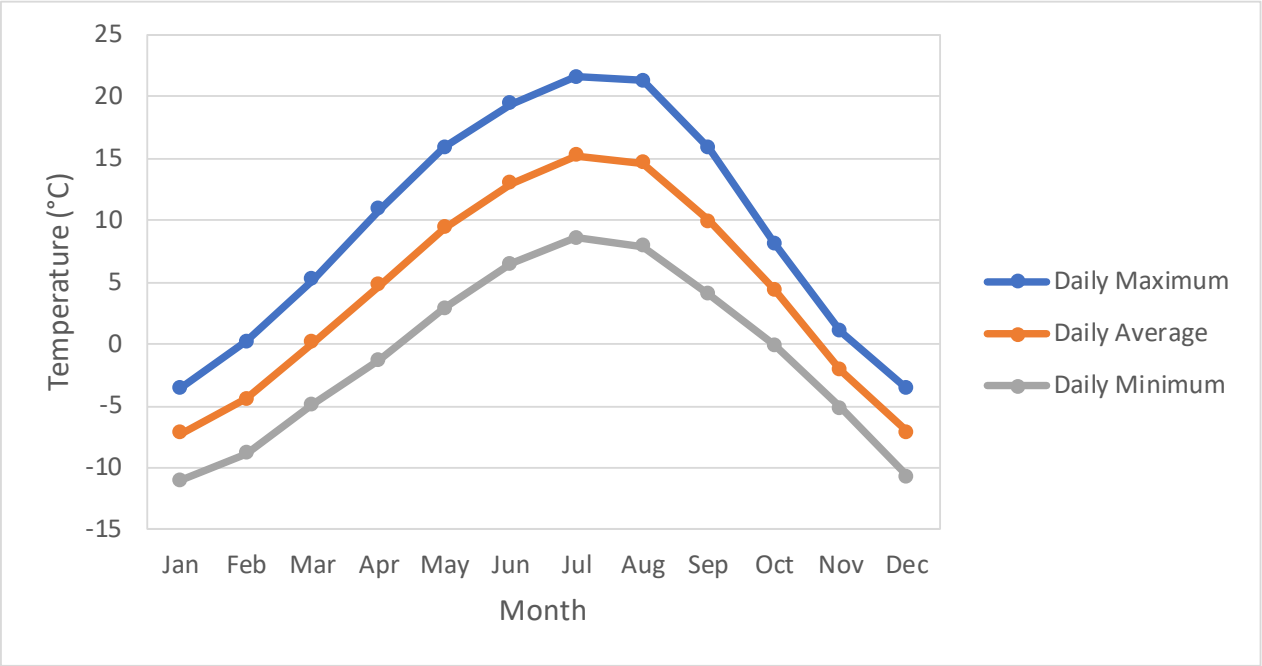


Figure 4.2-1: Temperature regime from Smithers Airport climate normals

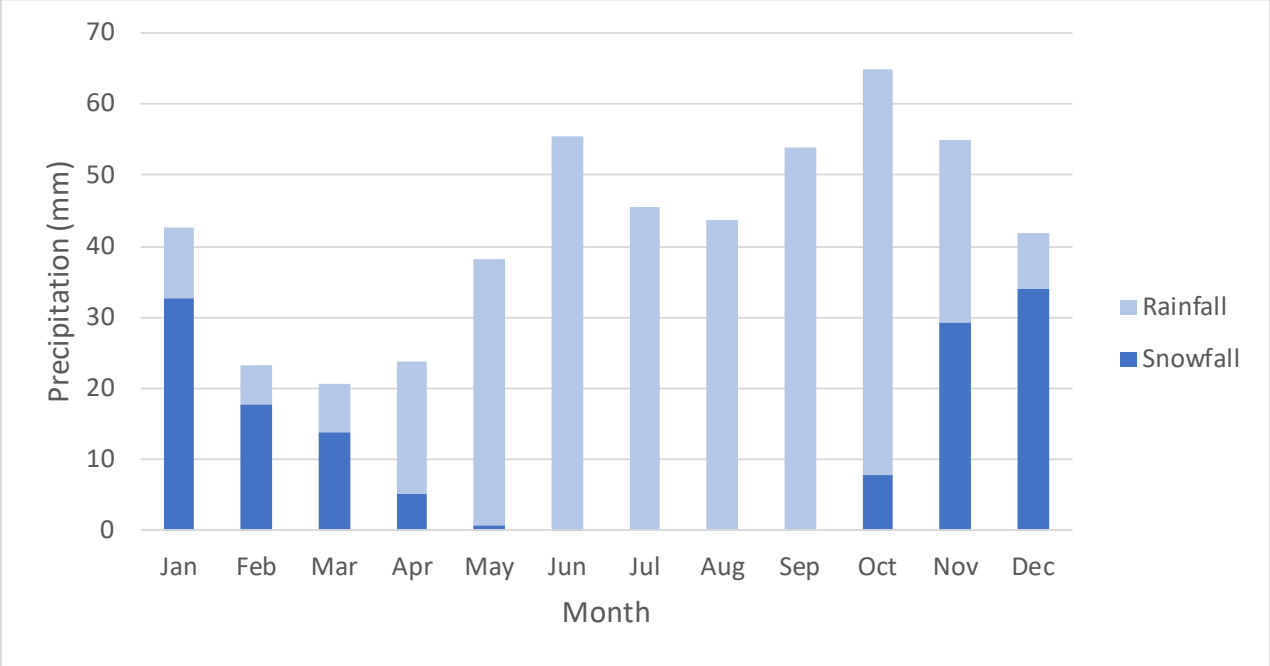


Figure 4.2-2: Precipitation regime from Smithers Airport climate normals

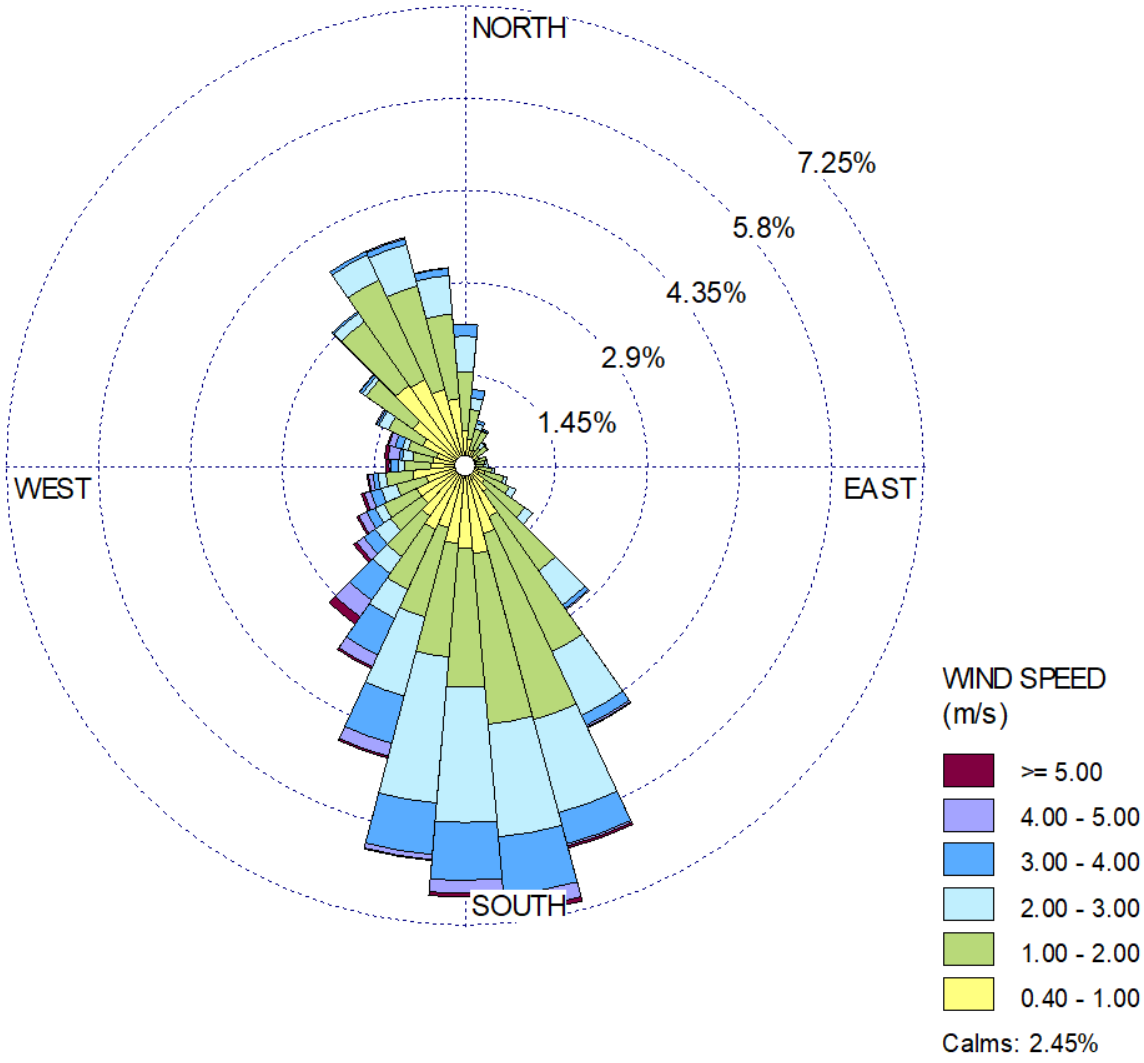


Figure 4.2-3: Wind roses for the Air Quality Regional Study Area (RSA) - Smithers St Josephs, 2015

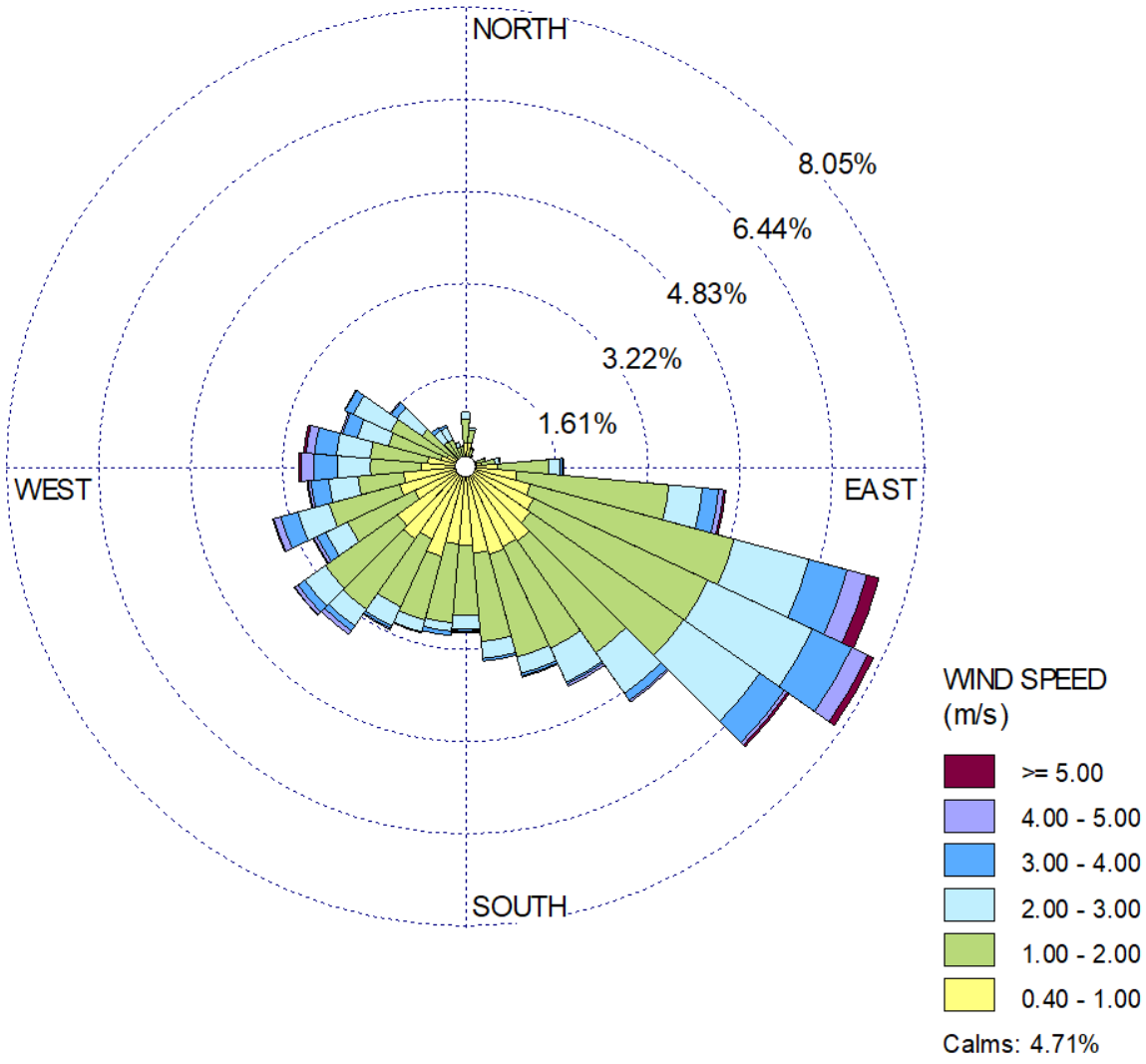


Figure 4.2-4: Wind roses for the Air Quality Regional Study Area (RSA) - Telkwa, 2015

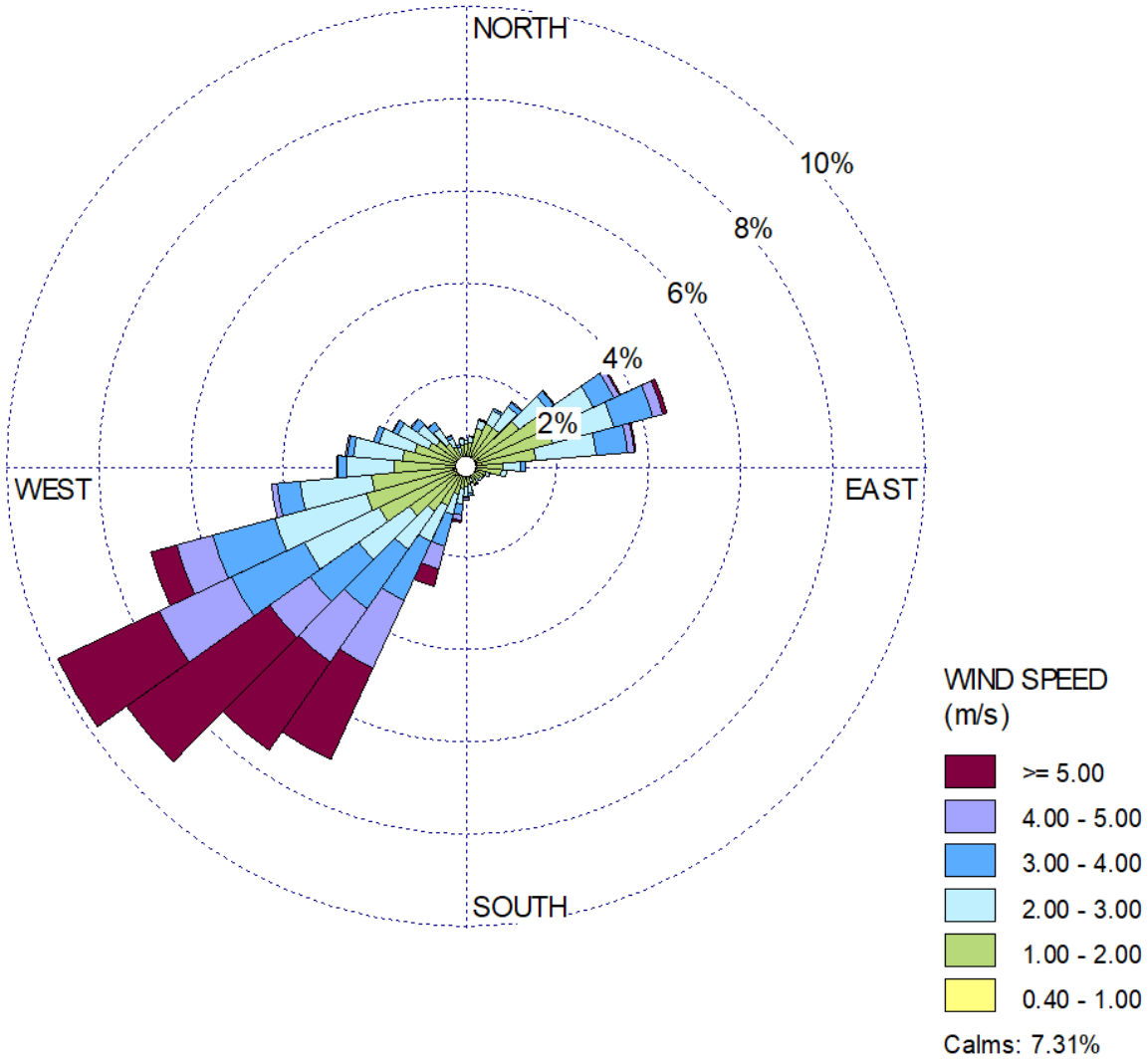


Figure 4.2-5: Wind roses for the Air Quality Regional Study Area (RSA) - Pine Creek, 2015

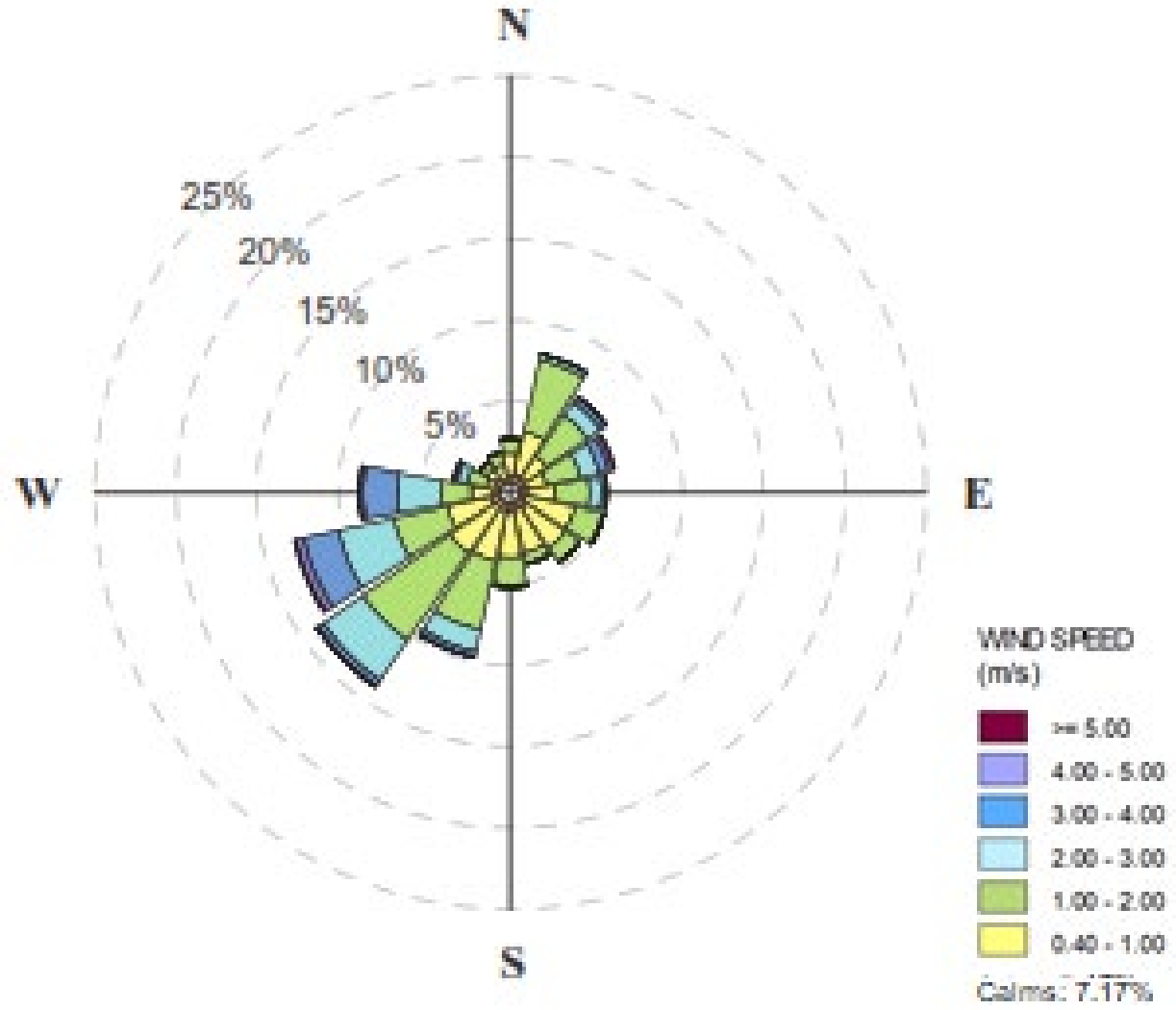


Figure 4.2-6: Wind roses for the Air Quality Regional Study Area (RSA) - Tenas Deposit, 2018

4.2.2 Air Quality

Existing air quality in the LSA and RSA is affected by natural air emissions (e.g., wind-blown dust), residential emissions (e.g., wood burning) in Telkwa and Smithers, forestry activity, vehicle traffic, and road dust. There are no major industrial facilities in the LSA; major industrial facilities in the RSA include the Pinnacle Renewable Holdings pellet plant and the Pacific Inland Resources sawmill in Smithers.

4.2.2.1 Particulate Matter

A summary of PM_{10} and $PM_{2.5}$ concentrations in the study area is provided in **Table 4.2-1.** As shown in the table, $PM_{2.5}$ measurements at Telkwa are available using two (2) different types of sensors. The tapered element oscillating microbalance (TEOM) method has been slowly phased out over recent years to be replaced by the synchronized hybrid real-time particulate (SHARP) monitor. $PM_{2.5}$ concentrations reported using the SHARP monitor tend to be higher than those reported using the TEOM, especially during cold winter conditions. $PM_{2.5}$ concentrations reported using the SHARP monitor were conservatively used to develop background concentrations for this assessment.

Overall, PM concentrations are considerably higher in the populated areas of Smithers and Telkwa compared to the remote setting of PPR2. PM concentrations in these populated areas exceeded the relevant ambient air quality criteria up to 8% of the time. Concentrations at the PPR2 remained well below the ambient air quality criteria.

Table 4.2-1: Summary of Particulate Matter less than 10 Micron in Diameter (PM_{10}) and Particulate Matter less than 2.5 Microns in Diameter ($PM_{2.5}$) Monitoring Data

Contaminant	Smithers (TEOM)	Telkwa (SHARP/TEOM)	PM-Kerr[a] (Partisol)	Criteria
Maximum 24-hour PM_{10} concentration ($\mu g/m^3$)	83.3	-	21.0	50
98th percentile 24-hour PM_{10} concentration ($\mu g/m^3$)	39.4	-	15.2	-
Average PM_{10} concentration ($\mu g/m^3$)	13.4	-	4.8	-
Frequency of exceedance of 50 $\mu g/m^3$ (%)	1.0	-	0.0	-
Maximum 24-hour $PM_{2.5}$ concentration ($\mu g/m^3$)	48.0	49.6 / 23.4	14.7	-
98th percentile 24-hour $PM_{2.5}$ concentration ($\mu g/m^3$)	27.0	34.0 / 16.6	10.2	25
Average $PM_{2.5}$ concentration ($\mu g/m^3$)	8.1	11.2 / 5.4	2.8	8
Frequency of exceedance of 25 $\mu g/m^3$ (%)	2.5	7.9 / 0.0	0.0	-

Notes: *$\mu g/m^3$=micrometre per cubic metre; - = not available; %=percent; PM_{10}=particulate matter less than 10 micron in diameter; $PM_{2.5}$=particulate matter less than 2.5 micron in diameter; SHARP= synchronized hybrid real-time particulate; TEOM= tapered element oscillating microbalance*
Days with exceedances of ambient air quality criteria corresponding to known wildfire activity have been removed: August 9-11, 2017, and August 20-21, 2018.
[a] = Kerr is the name of the monitoring station at the Kerr Farm as used in the baseline studies and report. In the EAC Application, Kerr Farm is referred to as Private Property Receptor (PPR) 2.

Seasonal variations in PM_{10} and $PM_{2.5}$ concentrations are illustrated in **Figure 4.2-7** and **Figure 4.2-8**, respectively. PM_{10} concentrations in Smithers tend to be highest in March and may be attributable to snowmelt and the accumulation of winter traction material on road surfaces, in conjunction with the lower amounts of precipitation during the spring. $PM_{2.5}$ concentrations in Smithers and Telkwa tend to be highest in the winter (November to February) and may be attributable to increased usage of wood stoves during this time (Levelton Engineering Ltd. 2002). Conversely, PM_{10} and $PM_{2.5}$ concentrations at PPR2 tend to be

highest in July. This location is less influenced by wood stoves and may be more influenced by agricultural and forestry activity in the surrounding area.

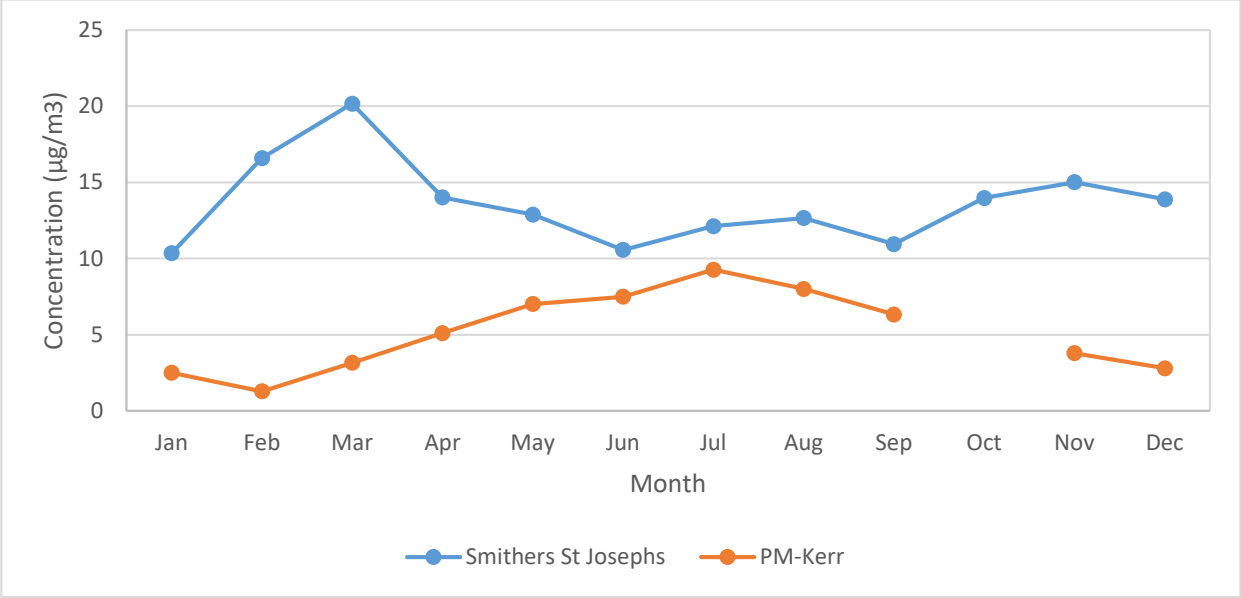


Figure 4.2-7: Seasonal variation in measured particulate matter less than 10 microns in diameter (PM_{10}) concentrations

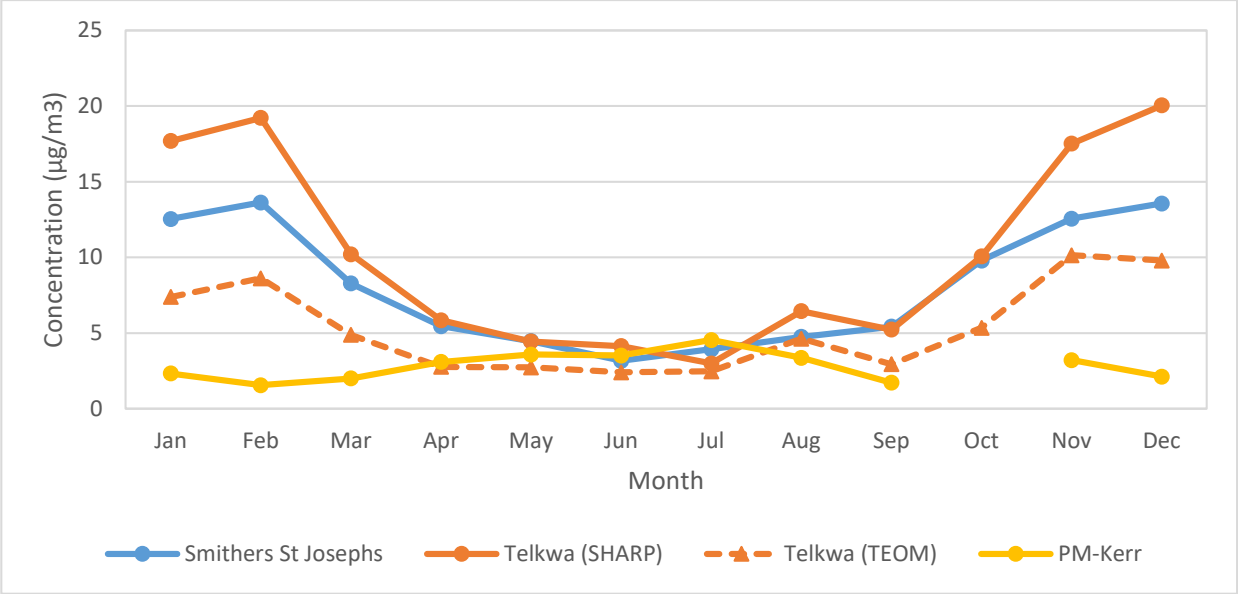


Figure 4.2-8: Seasonal variation in measured particulate matter less than 2.5 microns in diameter ($PM_{2.5}$) concentrations

4.2.2.2 Nitrogen Dioxide (NO_2) and Sulphur Dioxide (SO_2)

A summary of NO_2 and SO_2 concentrations is provided in **Table 4.2-2.** Overall, ambient concentrations of NO_2 and SO_2 in the region are low, remaining well below the relevant ambient air quality criteria. The air quality monitoring stations are in the populated areas of Smithers and Terrace and therefore, the NO_2 and SO_2 concentrations presented here are expected to be conservative of (i.e., higher than) baseline conditions in the more remote areas of the LSA and RSA.

Table 4.2-2: Summary of Nitrogen Dioxide (NO_2) and Sulphur Dioxide (SO_2) Monitoring Data

Contaminant	Smithers	Terrace	Criteria
Maximum 1-hour NO_2 concentration (µg/m^3)	77.1	-	-
98th percentile daily 1-hour maximum NO_2 concentration (µg/m^3)	53.6	-	113
Average NO_2 concentration (µg/m^3)	9.8	-	32
Maximum 1-hour SO_2 concentration (µg/m^3)	-	20.7	-
99th percentile daily 1-hour maximum SO_2 concentration (µg/m^3)	-	13.6	183
Average SO_2 concentration (µg/m^3)	-	1.0	13

Notes: *µg/m^3=microgram per cubic metre; - = not available; NO_2=nitrogen dioxide; SO_2=sulphur dioxide*

4.2.2.3 Dustfall

Dustfall criteria in BC have been rescinded since 2006[3]. A description of existing conditions is provided here for community interest. Dust is one of the top concerns of the local community and therefore we conducted dustfall sample monitoring to provide information on potential nuisance concerns only.

Dustfall measurements in the study area are illustrated in **Figure 4.2-9.** Deposition rates exceeded the upper dustfall objective of 2.9 mg/dm^2/d once at PPR2 in August/October 2018. Deposition rates exceeded the lower objective of 1.7 mg/dm^2/d six (6) times at PPR2 and twice at the proposed Rail Loadout. However, the lower objective is typically applied to residential areas and are not directly applicable to the locations of the dustfall monitoring stations.

Overall, dustfall deposition rates tend to be highest at PPR2 and is likely due to the influence of road dust from Telkwa Coalmine Road, located only 14 m away from the monitoring station. Dustfall deposition rates tend to be lower at the proposed Rail Loadout, in an undeveloped area away from sources of fugitive dust.

[3] The BC dustfall objectives were developed under Pollution Control Objectives in 1979 as a 'soiling index' or method of assessing the "dustiness" of an area from an aesthetic or nuisance perspective. The objectives were rescinded in 2006 and their effectiveness for determining impacts is limited. The dustfall objectives were retained on the BC air quality website for reference purposes (BC MECCS 2020c).

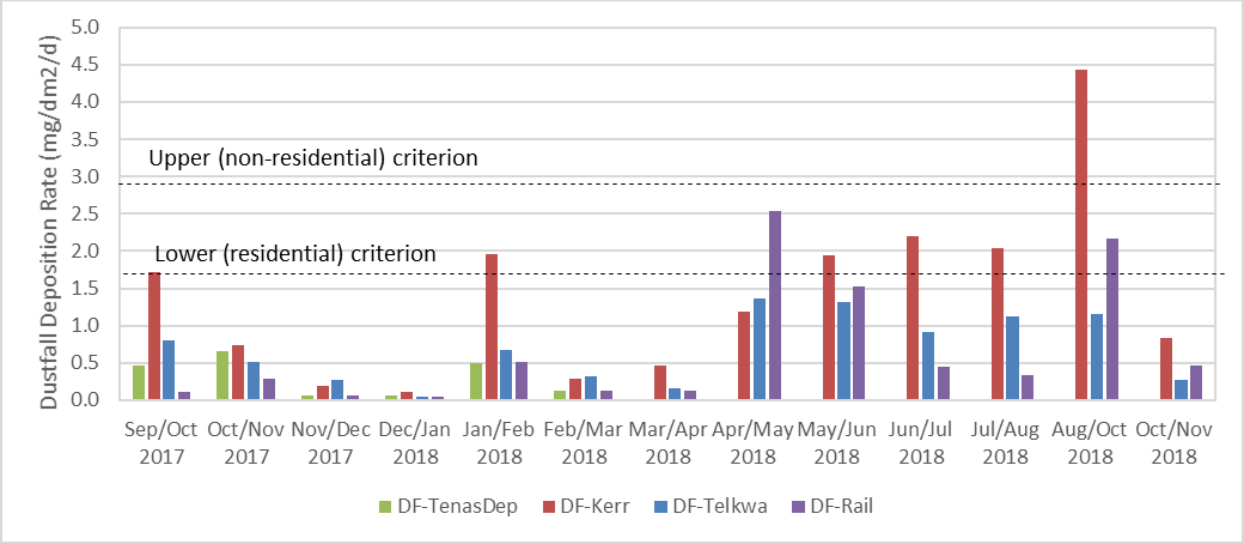


Figure 4.2-9: Summary of measured dustfall deposition rates

4.2.2.4 Summary

PM represents the main air quality concern in the LSA and RSA, with PM_{10} and $PM_{2.5}$ concentrations within populated areas exceeding the relevant air quality criteria up to 8% of the time. Dustfall deposition rates near unpaved roads also tend to be high, occasionally exceeding the rescinded provincial objectives. PM concentrations and dustfall deposition rates in more remote areas of the LSA and RSA tend to be lower. Concentrations of NO_2 and SO_2, both in populated and remote areas, are generally low and remain well below the relevant ambient air quality criteria.

Background concentrations for this assessment were selected in accordance with the British Columbia Air Quality Dispersion Modelling Guideline (British Columbia Ministry of Environment [BC MOE] 2015):

- Background 1-hour average NO_2 concentrations are based on the 98th percentile of the daily maximum 1-hour values in the screened dataset;
- Background 1-hour average SO_2 concentrations are based on the 99th percentile of the daily maximum 1-hour values in the screened dataset;
- Background 24-hour average PM_{10} and $PM_{2.5}$ concentrations are based on the 98th percentile of the daily values in the screened dataset;
- Background dustfall deposition rates are based on the average of the (approximately) monthly dustfall measurements;
- Background annual average concentrations for all contaminants are based on the mean of the screened dataset; and
- If there is more than one (1) monitoring site, the background value is based on the average of the values from all sites.

Due to the measurably different PM concentrations in populated areas versus more remote areas, two (2) different sets of background concentrations are developed. Monitoring data from Telkwa are used to develop the background PM concentrations for the populated area of the LSA. Monitoring data from PPR2 are used to develop the background PM concentrations for the remainder of the LSA.

Since no TSP monitoring data are available in the region, background TSP concentrations were estimated to be 3.3 times the background $PM_{2.5}$ concentrations (Lall et al 2004). This ratio of total suspended particulate to particulate matter less than 2.5 microns ($TSP/PM_{2.5}$) ratio is based on historical monitoring data from over 100 metropolitan statistical areas across the US and may not be representative of $TSP/PM_{2.5}$ ratios in the LSA. Within populated areas where wood burning is one (1) of the largest contributors to PM concentrations, the use of this $TSP/PM_{2.5}$ ratio is expected to provide a conservative estimate of baseline TSP concentrations. Conversely, in more remote areas where PM concentrations are more influenced by fugitive dust rather than combustion sources, this $TSP/PM_{2.5}$ ratio may underestimate baseline TSP concentrations. A $PM_{10}/PM_{2.5}$ ratio of 1.7, based on the ratio of average concentrations observed at Smithers, is applied to estimate background PM_{10} concentrations for Telkwa.

The background concentrations used for this assessment are summarized in **Table 4.2-3.**

Table 4.2-3: Summary of Background Air Quality Concentrations

Contaminant	Averaging Period	Background for Populated Areas (µg/m^3)	Background for Other Areas (µg/m^3)
TSP	24-hour	113.2	33.9
	Annual	37.4	9.5
PM_{10}	24-hour	56.3	15.2
$PM_{2.5}$	24-hour	34.0	10.2
	Annual	11.2	2.8
Contaminant	**Averaging Period**	**Background (µg/m3)[b]**	
NO_2[a]	1-hour	53.6	
	Annual	9.8	
NO_X	1-hour	172.0	
	Annual	18.9	
SO_2	1-hour	13.6	
	Annual	1.0	
Dustfall	1-month	0.8 mg/dm^2-d	

Notes: *µg/m^3=microgram per cubic metre; mg/dm^2-d=milligram per square decimeter per day; NO_2=nitrogen dioxide; NO_X=oxides of nitrogen; PM_{10}=particulate matter less than 10 micron in diameter; $PM_{2.5}$=particulate matter less than 2.5 micron in diameter; SO_2=sulphur dioxide; TSP=total suspended particulate;*

*[a] Background NO_X concentrations are added to predicted NO_X concentrations from dispersion modelling prior to NO_2 conversion (see **S3.3.7.3 in Appendix 4.1-B**). Background NO_2 concentrations are presented for reference purposes only.*

[b] Due to the lack of representative data, only one value is provided for both populated and other areas for the other NO_2, NO_x, SO_2 and dustfall.

4.2.3 Greenhouse Gas (GHG) Emissions

Total GHG emissions in Canada in 2018 were estimated to be 729 million tonnes (Mt) CO_2e, with transportation (i.e., road, rail, air, marine traffic), and the oil and gas industry representing the largest contributors. Total GHG emissions in BC were estimated to be 65.5 Mt CO_2e, 9% of the national total.

In the absence of a GHG emission intensity benchmark, the GHG emission intensities for other bituminous coal mining facilities in Canada, as estimated during their individual EA processes, are presented in **Table 4.2-4.** The industry profile ranges from 49 to 95 tonnes CO_2e per kilotonne (t CO_2e/kt) of processed coal.

Table 4.2-4: Greenhouse Gas (GHG) Emission Intensities from Bituminous Coal Mining Facilities

Facility	GHG Emissions (t CO_2e)	Coal Production (Mt)	GHG Emission Intensity (t CO_2e/kt coal)	Source
Fording River Operations	912,713	10.0	91.3	Teck Coal Ltd. 2014
Line Creek Operations	301,525	3.5	86.2	Teck Coal Ltd. 2011
Elkview Operations	654,000	7.9	82.8	Teck Coal Ltd. 2015
Wolverine Coal Mine	78,691	1.6	49.2a	Western Canadian Coal Corp. 2004
Brule Mine	101,760	2.0	50.9	Western Canadian Coal Corp. 2005
Roman Coal Mine	181,392	2.1	86.4	Peace River Coal Inc. 2010
Grassy Mountain Coal Mine	362,000	3.8	95.3	Benga Mining Ltd. 2016
Vista Coal Mine	358,000	5.0	71.6	Coalspur Mines Ltd. 2012

Notes: *GHG=greenhouse gas; t CO_2e= tonnes of carbon dioxide equivalent; Mt= million tonnes; t CO_2e/kt=tonnes of carbon dioxide equivalent per kilotonne*
[a] *Does not appear to include potential emissions from equipment and vehicles*

4.2.4 Noise

A summary of baseline noise measurements in the LSA and RSA is summarized in **Table 4.2-5** to **4.2-6**.

As expected, noise levels are highest in the populated area of Telkwa and lowest in remote locations. The primary sources contributing to the measured noise levels at Telkwa is vehicle traffic along Highway 16 and rail traffic along the CNR rail line. The primary sources contributing to the measured noise levels at the outlying residential subdivisions are livestock and local vehicle traffic including logging trucks. Measured noise levels at the remote site is dominated by wildlife with some local vehicle traffic.

Noise levels near the proposed mine and Coal Processing Plant (CPP) are generally consistent with remote areas away from anthropogenic noise sources. The primary sources contributing to the measured noise levels are wildlife, bird calls, rainfall, and wind. Noise levels in the fall and spring tend to be higher than noise levels in the winter. This is attributed to a lower level of audible wind gusts during the winter.

Noise levels near the proposed Rail Loadout are dominated by vehicle traffic along Highway 16 and rail traffic along the CNR rail line.

Table 4.2-5: Summary of Baseline Noise Measurements, 1998

Site Type	L_d (dBA)	L_n (dBA)	L_{dn} (dBA)
Populated Area (Telkwa)	61.4	59.0	65.8
Rural Residence	45.6	42.1	49.2
Remote	26.4	19.3	27.7

Notes*: L_d= daytime noise, L_n=nighttime noise, L_{dn}= day-night noise; dBA=a-weighted decibel*

Table 4.2-6: Summary of Baseline Noise Measurements, 2017 - 2018

Site	Season	L_d (dBA)	L_n (dBA)	L_{dn} (dBA)
S-Plant	Fall	37.7	26.1	37.2
	Winter	21.3	21.4	27.8
	Spring	37.1	17.8	35.4
	Average	35.7	23.1	34.9
S-TenasDep	Fall	28.6	22.9	30.7
	Winter	20.5	19.1	25.7
	Spring	37.8	33.1	40.6
	Average	33.6	28.9	36.4
S-Rail	Winter	41.7	40.2	46.8
	Spring	40.9	33.5	42.1
	Average	41.3	38.0	45.1

***Notes**: L_d= daytime noise level; L_n=nighttime noise level; L_{dn}=day-night noise level; dBA=A-weighted decibel; S=noise monitoring site*

4.2.5 Vibration

The only source of existing ground-borne vibration is rail traffic along the CNR rail line. With the exception of one (1) potential TCL employee residence (private property owned by TCL located within the Project Area, all residences are located over 500 m from the rail line. Therefore, existing vibration levels are expected to be low.

5. ASSESSMENT OF PROJECT-RELATED EFFECTS

The assessment of Project-related effects includes potential Project-related interactions with the Atmospheric Environment VC, potential Project-related effects on the Atmospheric Environment VC, mitigation measures, residual effects, and significance determination.

5.1 Potential Project-related Interactions with the Atmospheric Environment Valued Component (VC)

Potential interactions between Project activities and the Atmospheric Environment VC are identified in this subsection. Each potential interaction is rated using the terms provided in **Table 5.1-1** and described in **Table 5.1-2.** Where there are no interactions between the Project and the Atmospheric Environment VC, the activity is not considered further in the assessment. All activities for which there are potential interactions with the Atmospheric Environment VC are carried forward and described in **5.2**.

Table 5.1-1: Potential for an Interaction between the Atmospheric Environment Valued Component (VC) and the Tenas Project

Term	Definition
No Interaction	Tenas Project (Project) activity will not interact with the Atmospheric Environment Valued Component (VC), no adverse effect is expected; no further consideration is warranted.
Interaction	Interaction between the Project activity and the Atmospheric Environment VC may have a substantive influence on the short- or long-term integrity of the VC (i.e., measurable, or detectable using the identified indicator). The potential effect(s) of the interaction is considered further in the effects assessment.

As discussed in **3.2.4.2**, this assessment on the Atmospheric Environment VC focuses on the Operation Phase as this phase is associated with the greatest potential effects on the Air Quality, GHG Emissions, and Noise subcomponents. Effects during the Construction, Decommissioning and Reclamation, and Post-closure phases are expected to be encompassed by effects during the Operation Phase and are effectively captured through the assessment of the Operation Phase. While vibration is considered as a matter of community interest, it is not a subject carried through the full assessment.

During the Construction Phase, the primary effects on Atmospheric Environment VC are expected to be associated with earthworks and operation of equipment required for construction activities. The total amount of material handled during the Construction Phase (1.5 million cubic metres [m^3]) is expected to be less than 20% of total overburden and waste rock material handled during the peak year (Year 5) of the Operation Phase (over 8.9 million m^3). Similarly, the total equipment usage during the Construction Phase is estimated to be approximately 20% of the total equipment usage during the peak year of the Operation Phase (refer to equipment list in Section 2.4 of **Appendix 4.1-B**). Even accounting for the duration of the Construction Phase (i.e., half a year), emission rates associated with the Construction Phase are anticipated to be less than 50% of emission rates associated with the Operation Phase. The only exception to this is the western quarry, which may encounter higher amounts of material movement as it supplies the bulk of the aggregate required for the Construction Phase. As detailed in **Appendix 4.1-B**, emissions associated with the quarry are expected to represent a very small fraction of overall emissions associated with the Project. Therefore, effects during the Construction Phase are not carried forward to the assessment.

During the Operation Phase, the primary effects on the Atmospheric Environment VC are expected to be associated with activities at the Minesite, Coal Processing Plant (CPP), and Rail Infrastructure, as well as

associated equipment, vehicles, and locomotives. The operation of two (2) gravel quarries for maintenance of the Tenas Access Corridor (TAC) is also included in the assessment. Effects associated with other activities such as infrastructure maintenance are expected to be minor compared to overall effects associated with the Operation Phase and are therefore not carried forward to the assessment.

During the Decommissioning and Reclamation, and Post-closure phases, effects on the Atmospheric Environment VC are expected to be minimal, arising from some equipment used for dismantling of infrastructure, and transportation of equipment, materials, and personnel. Effects during these two (2) phases are expected to be less than those from the Construction, or Operation phases and are not carried forward to the assessment.

Table 5.1-2: Interactions between Atmospheric Environment Subcomponents and the Tenas Project

Project Activity	Atmospheric Environment Subcomponent		
	Air Quality	GHG Emissions	Noise
Construction			
Transportation of equipment, materials, and personnel	X	X	X
Site clearing (surveying, clearing, grubbing, soil salvaging)	X	X	X
Construction of Surface Water Management Infrastructure, including channels and ponds (sedimentation, control, management, storage)	X	X	X
Construction of Bypass Road and quarries from the Minesite to the Rail Infrastructure	X	X	X
Improvements to existing private road and Forest Service Roads	X	X	X
Construction of haul roads and service roads within the Minesite	X	X	X
Construction of the permanent Goathorn Bridge Crossing over Goathorn Creek	X	X	X
Construction of the Coal Processing Plant	X	X	X
Construction of fuel and lubricant storage facilities and distribution network	X	X	X
Construction of administration buildings (first aid, maintenance, mine dry, warehouse, laboratory, parking, and vehicle wash facilities)	X	X	X
Construction of a 25 kilovolt (kV) powerline and a 600 volt (V) substation adjacent to the Coal Processing Plant	X	X	X
Construction of Rail Infrastructure including Rail Loop and Loadout connecting to the existing main Canadian National Railway line	X	X	X
Installation of water supply wells, storage, and distribution system	X	X	X
Construction of the water discharge infrastructure	X	X	X
Construction of storage piles for overburden, rock separated from coal in Coal Processing Plant, and stockpiles for topsoil and vegetation management	X	X	X
Construction of material handling systems for Minesite, including run-of-mine coal, processed coal, process rock conveyors, and stockpiles	X	X	X
Construction of solid waste management systems including recycling and composting facilities	X	X	X

Project Activity	Atmospheric Environment Subcomponent		
	Air Quality	GHG Emissions	Noise
Construction of Explosives Magazine (storage building)	X	X	X
Employment and labour			
Operation			
Mining the open pit (soil salvage, drilling and blasting, excavation of material, dewatering, loading, hauling, unloading)	X	X	X
Operate Surface Water Management Infrastructure including channels and ponds (sedimentation, control, management, storage)			
Maintain and use Bypass Road and quarries from the Minesite to the Rail Infrastructure	X	X	X
Maintain improved private and Forest Service Roads	X	X	X
Maintain haul roads within the Minesite, including service roads	X	X	X
Maintain permanent bridge over Goathorn Creek			
Operate Coal Processing Plant	X	X	X
Maintain fuel and lubricant storage facilities			
Maintain administration buildings (first aid, maintenance, mine dry, warehouse, laboratory, and vehicle wash facilities)			
Maintain 25 kV power line and a 600 V substation adjacent to the Coal Processing Plant			
Transportation of equipment, materials, and personnel	X	X	X
Maintain and use Rail Infrastructure including Rail Loop and Loadout connecting to the existing main Canadian National Railway line	X	X	X
Operate water supply wells, storage, and distribution system			
Operate the water discharge infrastructure			
Maintain storage piles for overburden, rock separated from coal in Coal Processing Plant, and stockpiles for topsoil and vegetation management	X	X	X
Operate material handling systems for Minesite, including run-of-mine coal, processed coal, process rock conveyors, and stockpiles	X	X	X
Operate solid waste management systems including recycling and composting facilities			

Project Activity	Atmospheric Environment Subcomponent		
	Air Quality	GHG Emissions	Noise
Maintain Explosives Magazine (storage building)			
Progressive reclamation	X	X	X
Employment and labour			
Decommissioning and Reclamation			
Dismantle and remove mining equipment and facilities (including powerline, Rail Infrastructure)	X	X	X
Transportation of equipment, materials, and personnel	X	X	X
Reclamation and closure activities at Minesite	X	X	X
Reclamation and closure of Bypass Road and haul roads, including quarries	X	X	X
Reclamation and closure of permanent bridge over Goathorn Creek	X	X	X
Reclamation and closure of powerlines	X	X	X
Reclamation and closure of Rail Infrastructure	X	X	X
Implement post-mining systems and monitoring	X	X	X
Employment and labour	X	X	X
Post-closure			
Maintain post-mining systems and ongoing monitoring			
Transportation of equipment, materials, and personnel	X	X	X
Employment and labour			

Notes:
Interaction (X): Interaction between the Project activity and the VC may have a substantive influence on the short- or long-term integrity of the VC (i.e., measurable, or detectable using the identified indicator). The potential effect(s) of the interaction is considered further in the effects assessment.
No interaction (blank cell): Project activity will not interact with the VC; no adverse effect is expected; no further consideration is warranted.

5.2 Potential Project-related Effects

Three (3) potential environmental effects have been identified for the Atmospheric Environment VC:

1. increase in ambient CAC concentrations;
2. increase in GHG emissions; and
3. increase in ambient noise levels.

These potential adverse effects of the Project on the Atmospheric Environment VC arising from potential interactions, as identified in **Table 5.2-1** and in relation to indicators listed in **Table 3.2-2**, are identified and described in this subsection.

5.2.1 Air Quality Subcomponent

5.2.1.1 Operation Phase

The Air Quality modelling methodology, including the selection of sensitive receptors, follows the British Columbia Air Quality Dispersion Modelling Guideline (BC MECCS 2015) as well as a model plan submitted to and approved by the BC MECCS. Sensitive receptors were defined at locations where sensitive individuals may be present and exposed to ambient concentrations. These include private residences outside of Telkwa, cabins, schools, and childcare facilities. The TCRC located within Project Area, just off the TAC, was also included for community interest and due diligence.

Emissions of CACs were estimated for all Project activities during Year 5 of the Operation Phase to represent effects associated with the peak operating scenario. The estimated emissions were then input into the CALPUFF dispersion modelling system to estimate maximum ambient concentrations and dustfall deposition rates in the air quality LSA associated with Project operations, as summarized in **Table 5.2-1** Isopleths of the maximum predicted ambient concentrations and dustfall deposition rates (without background) are illustrated in to **Figure 5.2-10**. Detailed information on the emission estimation and dispersion modelling methodology is provided in **Appendix 4.1-B**.

Project contribution to maximum predicted concentrations of PM and NO_2, as well as maximum predicted 30-day dustfall deposition, may exceed the relevant ambient air quality criteria in a small area surrounding the Minesite and CPP, out to approximately 3 km southeast of the Project Area. Maximum predicted concentrations for all contaminants and all averaging periods are expected to remain below the relevant ambient air quality criteria at sensitive receptors including the TCRC and nearby residences. In the populated area of Telkwa, maximum predicted concentrations of PM_{10} and $PM_{2.5}$ may exceed the ambient air quality criteria due to high background concentrations (**4.2.2**); however, the Project contribution is very low, less than 3% of background PM_{10} and $PM_{2.5}$ concentrations.

Table 5.2-1: Maximum Predicted Concentrations and Deposition Rates

Contaminant	Averaging Period	Maximum in LSA ($\mu g/m^3$)	Maximum in Telkwa ($\mu g/m^3$)	Maximum at TCRC ($\mu g/m^3$)	Maximum at Residence ($\mu g/m^3$)	Ambient Air Quality Criteria ($\mu g/m^3$)
Project Contribution						
TSP	24-hour	**863**	2.2	39.0	21.0	120
	Annual	**154**	0.4	5.2	4.4	60 (a)
PM_{10}	24-hour	**424**	1.5	25.0	10.9	50
$PM_{2.5}$	24-hour	**53.5**	0.4	4.3	2.2	25 (b)
	Annual	**8.4**	0.06	0.5	0.4	8 (c)
NO_2	1-hour	**1,481**	64.1	97.3	85.2	113 (d)
	Annual	**149**	0.4	5.2	7.9	32
SO_2	1-hour	4.4	0.05	0.5	1.0	183 (e)
	Annual	0.4	0.002	0.02	0.03	13
Dustfall	30-day	**8.9**	0.007	0.1	0.06	1.7 mg/dm^2-d (residential); 2.9 mg/dm^2-d (other)
Project Plus Background						
TSP	24-hour	**896**	115	72.9	54.9	120
	Annual	**163**	37.8	14.7	13.9	60 (a)
PM_{10}	24-hour	**439**	**57.8**	40.2	26.1	50
$PM_{2.5}$	24-hour	**63.7**	**34.4**	14.5	12.4	25 (b)
	Annual	**11.2**	**11.3**	3.3	3.2	8 (c)
NO_2	1-hour	**1,499**	76.9	103	91.8	113 (d)
	Annual	**161**	12.3	17.1	19.8	32
SO_2	1-hour	18.0	13.7	14.1	14.6	183 (e)
	Annual	1.4	1.0	1.0	1.0	13
Dustfall	30-day	**9.7**	0.8	0.9	0.9	1.7 mg/dm^2-d (residential); 2.9 mg/dm^2-d (other)

Notes: *$\mu g/m^3$=microgram per cubic metre; mg/dm^2-d=milligram per square decimeter per day; NO_2=nitrogen dioxide; PM_{10}=particulate matter less than 10 micron in diameter; $PM_{2.5}$=particulate matter less than 2.5 micron in diameter; SO_2=sulphur dioxide; TCRC=Telkwa Coalmine Recreation Camp; TSP=total suspended particulate*

*Values in **bold** font exceed the ambient air quality criteria.*

(a) Based on geometric mean.

(b) Based on 98th percentile of daily average.

(c) There is also a longer term aspirational target of 6 $\mu g/m^3$ to support continuous improvement.

(d) Based on annual 98th percentile of daily 1-hour maximum, averaged over three consecutive years.

(e) Based on annual 99th percentile of daily 1-hour maximum, averaged over three consecutive years.

Tenas Project

Maximum Predicted 24-hour TSP Concentrations (µg/m^3)

615000 620000 625000 630000

6060000 6055000 6050000

TELKWA
TELKWA COALMINE RD
AVELING COALMINE RD
Telkwa River
TELKWA RIVER FSR
Tenas Creek
Helps Creek
RAIL LOADOUT
BYPASS ROAD
LAWSON RD
Bulkley River
Four Creek
Goathorn Creek
16
CN

20 40 60 120 160

Legend

- Sensitive Receptor
- Maximum Predicted 24-hour TSP Concentration (µg/m^3)
- Rail Line
- Highway
- Road
- Watercourse
- Wetland
- Waterbody
- Municipal Area
- General Private Property
- 138 kV Transmission Line
- 500 kV Transmission Line

Project Features

- Existing 25 kV Power Line
- 25 kV Power Line
- Haul Road
- Rail Loop
- Discharge Path
- Tenas Access Corridor
- Backfill Area
- Control and Plant Sedimentation Pond
- Explosive Infrastructure
- Management Pond
- Mine Infrastructure Complex
- Open Pit
- Pit Lake
- Quarry
- Rail Infrastructure
- Topsoil Stockpile
- Tenas Coal Licenses
- Telkwa Coal Limited Private Property
- Project Area

Notes

1. All mapped features are approximate and should be used for discussion purposes only.
2. This map is not intended to be a “stand-alone” document, but a visual aid of the information contained within the referenced Report. It is intended to be used in conjunction with the scope of services and limitations described therein.
3. Project line features are for display only.

Sources

- Project Features: Allegiance Coal, April 21, 2021.
- Basedata: Government of British Columbia
- Basemap: World Topo Base

N

1:60,000

0 0.5 1 1.5 2 2.5

Kilometers

NAD 1983 UTM Zone 9N

Page Size: 11" x 17"

989388-01	Production Date: May 26, 2021	Figure 5.2-1

TELKWA COAL LIMITED

Hemmera An Ausenco Company

Path: S:\Graphics\Projects\989388\01\mxd\AQ_Fig5.2-1_989388_01_Nov_24th_TSP_210526.mxd

Tenas Project

Predicted Annual TSP Concentrations (µg/m^3)

615000 620000 625000 630000

6060000 6055000 6050000

TELKWA
TELKWA COALMINE RD
AVELING COALMINE RD
Telkwa River
TELKWA RIVER FSR
Tenas Creek
Helps Creek
RAIL LOADOUT
BYPASS ROAD
LAWSON RD
Bulkley River
Four Creek
Coalhorn Creek
16
CN

Legend

- Sensitive Receptor
- Predicted Annual TSP Concentrations (µg/m^3)
- Rail Line
- Highway
- Road
- Watercourse
- Wetland
- Waterbody
- Municipal Area
- General Private Property
- 138 kV Transmission Line
- 500 kV Transmission Line

Project Features

- Existing 25 kV Power Line
- 25 kV Power Line
- Haul Road
- Rail Loop
- Discharge Path
- Tenas Access Corridor
- Backfill Area
- Control and Plant Sedimentation Pond
- Explosive Infrastructure
- Management Pond
- Mine Infrastructure Complex
- Open Pit
- Pit Lake
- Quarry
- Rail Infrastructure
- Topsoil Stockpile
- Tenas Coal Licenses
- Telkwa Coal Limited Private Property
- Project Area

Notes

1. All mapped features are approximate and should be used for discussion purposes only.
2. This map is not intended to be a "stand-alone" document, but a visual aid of the information contained within the referenced Report. It is intended to be used in conjunction with the scope of services and limitations described therein.
3. Project line features are for display only.

Sources

- Project Features: Allegiance Coal, April 21, 2021.
- Basedata: Government of British Columbia
- Basemap: World Topo Base

N

1:60,000

0 0.5 1 1.5 2 2.5

Kilometers

NAD 1983 UTM Zone 9N

Page Size: 11" x 17"

989388-01	Production Date: May 26, 2021	Figure 5.2-2

TELKWA COAL LIMITED

Hemmera An Ausenco Company

Path: S:\Geomatics\Projects\989388\001\mxd\AQ_Fig5.2-2_989388_01_Annual_TSP_210526.mxd

Tenas Project

Maximum Predicted 24-hour PM_{10} Concentrations ($\mu g/m^3$)

615000 620000 625000 630000

6060000 6055000 6050000

TELKWA

TELKWA COALMINE RD

AVELING COALMINE RD

TELKWA RIVER FSR

Telkwa River

Tenas Creek

Helps Creek

Four Creek

Goathorn Creek

Bulkley River

16

CN

25

BYPASS ROAD

LAWSON RD

RAIL LOADOUT

25 50 100

Legend

- Sensitive Receptor
- Maximum Predicted 24-hour PM_{10} Concentration ($\mu g/m^3$)
- Rail Line
- Highway
- Road
- Watercourse
- Wetland
- Waterbody
- Municipal Area
- General Private Property
- 138 kV Transmission Line
- 500 kV Transmission Line

Project Features

- Existing 25 kV Power Line
- 25 kV Power Line
- Haul Road
- Rail Loop
- Discharge Path
- Tenas Access Corridor
- Backfill Area
- Control and Plant Sedimentation Pond
- Explosive Infrastructure
- Management Pond
- Mine Infrastructure Complex
- Open Pit
- Pit Lake
- Quarry
- Rail Infrastructure
- Topsoil Stockpile
- Tenas Coal Licenses
- Telkwa Coal Limited Private Property
- Project Area

Notes

1. All mapped features are approximate and should be used for discussion purposes only.
2. This map is not intended to be a "stand-alone" document, but a visual aid of the information contained within the referenced Report. It is intended to be used in conjunction with the scope of services and limitations described therein.
3. Project line features are for display only.

Sources

- Project Features: Allegiance Coal, April 21, 2021.
- Basedata: Government of British Columbia
- Basemap: World Topo Base

N

1:60,000

0 0.5 1 1.5 2 2.5

Kilometers

NAD 1983 UTM Zone 9N

Page Size: 11" x 17"

989388-01	Production Date: May 26, 2021	Figure 5.2-3

TELKWA COAL LIMITED

Hemmera An Ausenco Company

Path: S:\Geomatics\Projects\989388\001\mxd\AQ_Fig5.2-3_989388_01_Max_24h_PM10_210528.mxd

Tenas Project

Maximum Predicted 24-Hour $PM_{2.5}$ Concentrations ($\mu g/m^3$)

615000 620000 625000 630000

6060000 6055000 6050000

TELKWA

TELKWA COALMINE RD

AVELING COALMINE RD

16

CN

RAIL LOADOUT

BYPASS ROAD

LAWSON RD

Telkwa River

Tenas Creek

Helps Creek

Bulkley River

Four Creek

Coalhorn Creek

TELKWA RIVER FSR

5

25

50

Legend

- Sensitive Receptor
- Maximum Predicted 24-hour $PM_{2.5}$ Concentration ($\mu g/m^3$)
- Rail Line
- Highway
- Road
- Watercourse
- Wetland
- Waterbody
- Municipal Area
- General Private Property
- 138 kV Transmission Line
- 500 kV Transmission Line

Project Features

- Existing 25 kV Power Line
- 25 kV Power Line
- Haul Road
- Rail Loop
- Discharge Path
- Tenas Access Corridor
- Backfill Area
- Control and Plant Sedimentation Pond
- Explosive Infrastructure
- Management Pond
- Mine Infrastructure Complex
- Open Pit
- Pit Lake
- Quarry
- Rail Infrastructure
- Topsoil Stockpile
- Tenas Coal Licenses
- Telkwa Coal Limited Private Property
- Project Area

Notes

1. All mapped features are approximate and should be used for discussion purposes only.
2. This map is not intended to be a "stand-alone" document, but a visual aid of the information contained within the referenced Report. It is intended to be used in conjunction with the scope of services and limitations described therein.
3. Project line features are for display only.

Sources

- Project Features: Allegiance Coal, April 21, 2021.
- Basedata: Government of British Columbia
- Basemap: World Topo Base

N

1:60,000

0 0.5 1 1.5 2 2.5

Kilometers

NAD 1983 UTM Zone 9N

Page Size: 11" x 17"

989388-01	Production Date: May 26, 2021	Figure 5.2-4

TELKWA COAL LIMITED

Hemmera An Ausenco Company

Path: S:\Geomatics\Projects\989388\001\mxd\AQ_Fig5.2-4_989388_01_Max_24h_PM2.5_210528.mxd

Tenas Project

Predicted Annual $PM_{2.5}$ Concentrations ($\mu g/m^3$)

615000 620000 625000 630000

6060000 6055000 6050000

TELKWA

TELKWA COALMINE RD

AVELING COALMINE RD

Telkwa River

TELKWA RIVER FSR

Tenas Creek

Helps Creek

Fourt Creek

Goathorn Creek

BYPASS ROAD

RAIL LOADOUT

LAWSON RD

Bulkley River

16

CN

1 2 3 4

Legend

- Sensitive Receptor
- Predicted Annual $PM_{2.5}$ Concentration ($\mu g/m^3$)
- Rail Line
- Highway
- Road
- Watercourse
- Wetland
- Waterbody
- Municipal Area
- General Private Property
- 138 kV Transmission Line
- 500 kV Transmission Line

Project Features

- Existing 25 kV Power Line
- 25 kV Power Line
- Haul Road
- Rail Loop
- Discharge Path
- Tenas Access Corridor
- Backfill Area
- Control and Plant Sedimentation Pond
- Explosive Infrastructure
- Management Pond
- Mine Infrastructure Complex
- Open Pit
- Pit Lake
- Quarry
- Rail Infrastructure
- Topsoil Stockpile
- Tenas Coal Licenses
- Telkwa Coal Limited Private Property
- Project Area

Notes

1. All mapped features are approximate and should be used for discussion purposes only.
2. This map is not intended to be a "stand-alone" document, but a visual aid of the information contained within the referenced Report. It is intended to be used in conjunction with the scope of services and limitations described therein.
3. Project line features are for display only.

Sources

- Project Features: Allegiance Coal, April 21, 2021.
- Basedata: Government of British Columbia
- Basemap: World Topo Base

N

1:60,000

0 0.5 1 1.5 2 2.5

Kilometers

NAD 1983 UTM Zone 9N

Page Size: 11" x 17"

989388-01	Production Date: May 26, 2021	Figure 5.2-5

TELKWA COAL LIMITED

Hemmera An Ausenco Company

Path: S:\Geomatics\Projects\989388\01\mxd\AQ_Fig\5.2-5_989388_01_Annual_PM2.5_210526.mxd

Tenas Project

Maximum Predicted 1-Hour NO_2 Concentrations ($\mu g/m^3$)

615000 620000 625000 630000

6060000 6055000 6050000

TELKWA
LAWSON RD
TELKWA COALMINE RD
AVELING COALMINE RD
BYPASS ROAD
RAIL LOADOUT
TELKWA RIVER FSR
Tyhee Lake
Telkwa River
Tenas Creek
Goathorn Creek
Four Creek
Helps Creek
Bulkley River
16
CN

20 60 100 113 140

Legend

- Sensitive Receptor
- Rail Line
- Highway
- Road
- Watercourse
- Wetland
- Waterbody
- Municipal Area
- General Private Property
- 138 kV Transmission Line
- 500 kV Transmission Line

Project Features

- Existing 25 kV Power Line
- 25 kV Power Line
- Haul Road
- Rail Loop
- Discharge Path
- Tenas Access Corridor
- Backfill Area
- Control and Plant Sedimentation Pond
- Explosive Infrastructure
- Management Pond
- Mine Infrastructure Complex
- Open Pit
- Pit Lake
- Quarry
- Rail Infrastructure
- Topsoil Stockpile
- Tenas Coal Licenses
- Telkwa Coal Limited Private Property
- Project Area

Notes

1. All mapped features are approximate and should be used for discussion purposes only.
2. This map is not intended to be a “stand-alone” document, but a visual aid of the information contained within the referenced Report. It is intended to be used in conjunction with the scope of services and limitations described therein.
3. Project line features are for display only.

Sources

- Project Features: Allegiance Coal, April 21, 2021.
- Basedata: Government of British Columbia
- Basemap: World Topo Base

N

1:70,000

0 0.5 1 1.5 2 2.5

Kilometers

NAD 1983 UTM Zone 9N

Page Size: 11" x 17"

989388-01	Production Date: May 26, 2021	Figure 5.2-6

TELKWA COAL LIMITED

Hemmera An Ausenco Company

Path: S:\Geomatics\Projects\989388\01\mxd\AQ_Fig5.2-6_989388_01_Max_1h_NO2_210526.mxd

Tenas Project

Predicted Annual NO_2 Concentrations($\mu g/m^3$)

615000 620000 625000 630000

6060000 6055000 6050000

TELKWA
Tyhee Lake
TELKWA COALMINE RD
AVELING COALMINE RD
Telkwa River
TELKWA RIVER FSR
Tenas Creek
Four Creek
Goathorn Creek
Helps Creek
RAIL LOADOUT
BYPASS ROAD
LAWSON RD
Bulkley River
16
CN

Legend

- Sensitive Receptor
- Predicted Annual NO_2 Concentration ($\mu g/m^3$)
- Rail Line
- Highway
- Road
- Watercourse
- Wetland
- Waterbody
- Municipal Area
- General Private Property
- 138 kV Transmission Line
- 500 kV Transmission Line

Project Features

- Existing 25 kV Power Line
- 25 kV Power Line
- Haul Road
- Rail Loop
- Discharge Path
- Tenas Access Corridor
- Backfill Area
- Control and Plant Sedimentation Pond
- Explosive Infrastructure
- Management Pond
- Mine Infrastructure Complex
- Open Pit
- Pit Lake
- Quarry
- Rail Infrastructure
- Topsoil Stockpile
- Tenas Coal Licenses
- Telkwa Coal Limited Private Property
- Project Area

Notes

1. All mapped features are approximate and should be used for discussion purposes only.
2. This map is not intended to be a "stand-alone" document, but a visual aid of the information contained within the referenced Report. It is intended to be used in conjunction with the scope of services and limitations described therein.
3. Project line features are for display only.

Sources

- Project Features: Allegiance Coal, April 21, 2021.
- Basedata: Government of British Columbia
- Basemap: World Topo Base

N

1:60,000

0 0.5 1 1.5 2 2.5

Kilometers

NAD 1983 UTM Zone 9N

Page Size: 11" x 17"

989388-01	Production Date: May 26, 2021	Figure 5.2-7

TELKWA COAL LIMITED

Hemmera An Ausenco Company

Path: S:\Geomatics\Projects\989388\01\mxd\AQ_Fig\5.2-7_989388_01_Annual_NO2_210526.mxd

Tenas Project

Maximum Predicted 1-Hour SO_2 Concentrations ($\mu g/m^3$)

615000 620000 625000 630000

6060000 6055000 6050000

TELKWA
Tyhee Lake
TELKWA COALMINE RD
AVELING COALMINE RD
Telkwa River
TELKWA RIVER FSR
Tenas Creek
Helps Creek
RAIL LOADOUT
BYPASS ROAD
LAWSON RD
Bulkley River
Four Creek
Goathorn Creek
16
CN

0.25
0.5
1
1.5
2

Legend

- Sensitive Receptor
- Maximum Predicted 1-Hour SO_2 Concentration ($\mu g/m^3$)
- Rail Line
- Highway
- Road
- Watercourse
- Wetland
- Waterbody
- Municipal Area
- General Private Property
- 138 kV Transmission Line
- 500 kV Transmission Line

Project Features

- Existing 25 kV Power Line
- 25 kV Power Line
- Haul Road
- Rail Loop
- Discharge Path
- Tenas Access Corridor
- Backfill Area
- Control and Plant Sedimentation Pond
- Explosive Infrastructure
- Management Pond
- Mine Infrastructure Complex
- Open Pit
- Pit Lake
- Quarry
- Rail Infrastructure
- Topsoil Stockpile
- Tenas Coal Licenses
- Telkwa Coal Limited Private Property
- Project Area

Notes

1. All mapped features are approximate and should be used for discussion purposes only.
2. This map is not intended to be a "stand-alone" document, but a visual aid of the information contained within the referenced Report. It is intended to be used in conjunction with the scope of services and limitations described therein.
3. Project line features are for display only.

Sources

- Project Features: Allegiance Coal, April 21, 2021.
- Basedata: Government of British Columbia
- Basemap: World Topo Base

N

1:60,000

0 0.5 1 1.5 2 2.5

Kilometers

NAD 1983 UTM Zone 9N

Page Size: 11" x 17"

989388-01	Production Date: May 26, 2021	Figure 5.2-8

TELKWA COAL LIMITED

Hemmera An Ausenco Company

Path: S:\Geomatics\Projects\989388\001\mxd\AQ_Fig5.2-8_989388_01_Max_1h_SO2_210526.mxd

Tenas Project

Predicted Annual SO_2 Concentrations µg/m^3)

615000 620000 625000 630000

6060000 6055000 6050000

TELKWA
Tyhee Lake
TELKWA COALMINE RD
AVELING COALMINE RD
Telkwa River
TELKWA RIVER FSR
Tenas Creek
Helps Creek
RAIL LOADOUT
BYPASS ROAD
LAWSON RD
Bulkley River
Four Creek
Goathorn Creek
16
CN
0.1
0.2
0.3
0.4

Legend

- Sensitive Receptor
- Predicted Annual SO_2 Concentration (µg/m^3)
- Rail Line
- Highway
- Road
- Watercourse
- Wetland
- Waterbody
- Municipal Area
- General Private Property
- 138 kV Transmission Line
- 500 kV Transmission Line

Project Features

- Existing 25 kV Power Line
- 25 kV Power Line
- Haul Road
- Rail Loop
- Discharge Path
- Tenas Access Corridor
- Backfill Area
- Control and Plant Sedimentation Pond
- Explosive Infrastructure
- Management Pond
- Mine Infrastructure Complex
- Open Pit
- Pit Lake
- Quarry
- Rail Infrastructure
- Topsoil Stockpile
- Tenas Coal Licenses
- Telkwa Coal Limited Private Property
- Project Area

Notes

1. All mapped features are approximate and should be used for discussion purposes only.
2. This map is not intended to be a "stand-alone" document, but a visual aid of the information contained within the referenced Report. It is intended to be used in conjunction with the scope of services and limitations described therein.
3. Project line features are for display only.

Sources

- Project Features: Allegiance Coal, April 21, 2021.
- Basedata: Government of British Columbia
- Basemap: World Topo Base

N

1:60,000

0 0.5 1 1.5 2 2.5

Kilometers

NAD 1983 UTM Zone 9N

Page Size: 11" x 17"

989388-01	Production Date: May 26, 2021	Figure 5.2-9

TELKWA COAL LIMITED

Hemmera An Ausenco Company

Path: S:\Geomatics\Projects\989388\01\mxd\AQ_Fig\5.2-9_989388_01_Annual_SO2_210526.mxd

Tenas Project

Maximum Predicted 30-Day Dustfall Deposition (mg/dm^2-d)

615000 620000 625000 630000

6060000 6055000 6050000

TELKWA
Tyhee Lake
TELKWA COALMINE RD
AVELING COALMINE RD
Telkwa River
TELKWA RIVER FSR
Tenas Creek
Helps Creek
RAIL LOADOUT
BYPASS ROAD
LAWSON RD
Bulkley River
Four Creek
Coalhorn Creek
16
CN
0.25
0.50
1.00
2.90

Legend

- Sensitive Receptor
- Maximum Predicted 30-Day Dustfall Deposition (mg/dm^2-d)
- Rail Line
- Highway
- Road
- Watercourse
- Wetland
- Waterbody
- Municipal Area
- General Private Property
- 138 kV Transmission Line
- 500 kV Transmission Line

Project Features

- Existing 25 kV Power Line
- 25 kV Power Line
- Haul Road
- Rail Loop
- Discharge Path
- Tenas Access Corridor
- Backfill Area
- Control and Plant Sedimentation Pond
- Explosive Infrastructure
- Management Pond
- Mine Infrastructure Complex
- Open Pit
- Pit Lake
- Quarry
- Rail Infrastructure
- Topsoil Stockpile
- Tenas Coal Licenses
- Telkwa Coal Limited Private Property
- Project Area

Notes

1. All mapped features are approximate and should be used for discussion purposes only.
2. This map is not intended to be a "stand-alone" document, but a visual aid of the information contained within the referenced Report. It is intended to be used in conjunction with the scope of services and limitations described therein.
3. Project line features are for display only.

Sources

- Project Features: Allegiance Coal, April 21, 2021.
- Basedata: Government of British Columbia
- Basemap: World Topo Base

N

1:60,000

0 0.5 1 1.5 2 2.5

Kilometers

NAD 1983 UTM Zone 9N

Page Size: 11" x 17"

989388-01	Production Date: May 26, 2021	Figure 5.2-10

TELKWA COAL LIMITED

Hemmera An Ausenco Company

Path: S:\Geomatics\Projects\989388\001\mxd\A2_Fig5.2-10_989388_01_Max_30d_Dust_210528.mxd

5.2.2 Greenhouse Gas (GHG) Emissions Subcomponent

5.2.2.1 Operation Phase

Emissions of GHGs were estimated for all Project activities during Year 5 of the Operation Phase and summarized in **Table 5.2-2.** Total annual GHG emissions associated with the Project are estimated to be 68,973 tonnes. The largest sources of GHG emissions are fuel combustion in mobile mine equipment and fugitive releases of coalbed methane.

Total Project-related GHG emissions are 0.10% of existing GHG emissions in BC and 0.010% of existing GHG emissions in Canada. The GHG emission intensity associated with the Project is 83.9 t CO_2e/kt processed coal[4], which is in the range of the industry profile.

Table 5.2-2: Estimated Greenhouse Gas (GHG) Emissions

Emission Source	CO_2 (t)	CH_4 (t)	N_2O (t)	CO_2e (t)
Mine equipment	44,156	1.2	3.7	45,300
Locomotives	101	0.006	0.04	113
Haul trucks and service vehicles	388	0.01	0.02	395
Space heating	156	0.006	0.003	157
Quarry equipment	575	0.02	0.05	590
Coalbed methane	-	897	-	22,418
Total	**45,377**	**898**	**3.8**	**68,973**

Notes: *t=tonnes; CO_2=carbon dioxide; CH_4=methane; N_2O=nitrous oxide; CO_2e=carbon dioxide equivalent*

5.2.3 Noise Subcomponent

5.2.3.1 Operation Phase

Project-related effects on continuous noise were considered by estimating sound power levels associated with all equipment and activities associated with the Operation Phase. The CadnaA noise propagation modelling software was used to estimate potential changes in daytime and nighttime noise levels in the LSA and RSA. Results are provided in **Appendix 4.1-A**. Select results for the nearest, most affected, sensitive receptors are summarized in **Table 5.2-3**. Sensitive receptor points include permanently, or seasonally occupied structures used for habitation purposes, including private residences, cabins, and the TCRC where noise limits (i.e., BC OGC PSL) apply. Schools and childcare facilities were also included for consistency with air quality modelling and to consider exposure to potentially sensitive individuals.

Maximum daytime and nighttime noise levels are expected to remain below the PSLs at the nearest residences and at the TCRC. Nighttime noise levels may exceed the nighttime PSL of 40 dBA at several residences within the surrounding residential subdivisions; however, these exceedances are related to background noise levels rather than the Project. The change in %HA is expected to remain well below the threshold of 6.5% at all sensitive receptors in the LSA and RSA. Furthermore, the Project-related dBC value

[4] Emission intensity = 68,973 t CO_2e / 822 kt processed coal in Year 5 = 83.9 t CO_2e/kt

minus the Project-related dBA value is well below 20 dB at all sensitive receptors. Therefore, the Project is not expected to result in any low frequency noise concerns.

Table 5.2-3: Maximum Predicted Noise Levels

Receptor	Project Contribution		Project plus Background		PSL	
	L_d (dBA)	L_n (dBA)	L_d (dBA)	L_n (dBA)	L_d (dBA)	L_n (dBA)
Residence near Minesite and Coal Processing Plant	42.1	24.1	43.0	26.6	50	40
Residence near Rail Loadout	41.8	41.8	44.6	43.3	55	45
Residential Subdivision	30.5	2.2	45.7	42.1	50	40
Telkwa Coal Recreation Camp	47.2	30.5	47.5	31.2	50	40

Notes: *dBA=A-weighted decibel; L_d= daytime noise level; L_n=nighttime noise level; L_{dn}=day-night noise level; PSL= permissible sound level*
Values in bold font exceed the PSL.

Project-related blasting noise was assessed separately and provided in **Appendix 4.1-A** for use by the Wildlife VC discipline. This type of noise is short-term and generally has minimal effect on overall daytime and nighttime noise levels. Engineering formulae from Linehan and Wiss (1980) were used to estimate the peak air overpressure at various distances from the blasting site.

5.2.4 Vibration

5.2.4.1 Operation Phase

Ground-borne vibration from the Project may be transmitted by blasting or by rail operations at the Rail Loop.

TCL will follow BMPs to limit vibration from blasting (see **5.3.1 Limit Project Footprint and Project Area**). Blasting will primarily occur at the open pit and to a lesser extent at the eastern quarry. The nearest residences are over 4 km away from the open pit and over 1.5 km from the eastern quarry. Given the BMPs and the far distances between source and receiver, Project-related vibration effects from blasting are expected to be limited, well below perception thresholds and potential for building damage.

Vibration from railway operations is strongly dependent on factors such as train speed, the smoothness of the wheel/rail interface, distance between the source and the receiver, as well as geological conditions. Train speeds at the Rail Infrastructure will be low; 10 km/h within the Rail Loop, and up to 20 km/h when entering and exiting the Rail Infrastructure. The Project is expected to result in a total of 66 trains per year (approximately one (1) train every five (5) days), which represents less than 1.0% of existing rail activity on the CNR rail line. With the exception of one (1) potential TCL employee residence (private property owned by TCL) located within the Project Area, the nearest residences to the Rail Loop are over 500 m away. This is well beyond the recommended vibration influence area from the FCM-RAC Guidelines. Therefore, Project-related vibration effects from rail operations are expected to be limited, well below perception thresholds.

5.3 Mitigation Measures

This subsection describes the mitigation measures to address the potential adverse effects of the Project on the Atmospheric Environment VC. The mitigation measures are consistent with the mitigation definition

provided by BC EAO (BC EAO 2013). Mitigations are practical means or measures taken to avoid, minimize, rehabilitate onsite, and if required, compensate, or offset the potential adverse effects of a project. Mitigation measures may include Project design measures or other mitigation measures developed based on applicable standards, guidelines, and BMPs.

TCL has incorporated several mitigation measures in the Project's design and/or operational procedures to reduce the magnitude, duration, and extent of effects due to the Project. These Project mitigation measures are outlined in **S1.0 Overview of Project Proponent Description** of the **EAC Application** and include Project design aspects such as site selection, selection of best available technologies to-date for Project infrastructure and mining equipment, and a commitment to progressive reclamation. Project mitigation measures that are relevant to minimizing potential Project-related effects on the Atmospheric Environment VC are described in **5.3.1** to **5.3.5** below.

Additional mitigation measures specific to the Atmospheric Environment VC are provided in **5.3.6** to **5.3-9** and were developed based on BMPs. These additional mitigation measures are expected to be feasible and effective in a timely manner following implementation. No uncertainties with the feasibility or effectiveness of these mitigation measures have been identified as this time.

Mitigation measures developed to mitigate potential adverse effects on the Atmospheric Environment VC will be incorporated into the various Project management plans such as the:

- **Air Quality Management Plan (S13.0-C2) (AQMP)**; and
- **Explosives Management Plan (S13.0-C6) (EMP)**.

The management plans provide further direction on sequencing, monitoring and adaptive management and the mitigation measures outlined in each plan are expected to be timely and effective following implementation.

Mitigation measures are commitments that TCL has applied through mine design and to the operating principles through the life cycle of the Project. All mitigation measures for the Atmospheric Environment VC are described in detail below and then summarized in **Table 5.3-1**.

5.3.1 Limit Project Footprint and Project Area

To limit the Project footprint and Project Area, the Project has been designed to:

- Cluster Project components, including the open pit, stockpiles for run-of-mine (ROM) coal, processed coal and processed rock, CPP, management ponds, and ancillary facilities, such as the Maintenance Facility and Administrative Building;
- Align linear Project features (such as powerlines, roads, water distribution) into a common right-of-way (ROW) ;
- Place Project features within existing or planned Project component footprints to limit the clearing of vegetation and the salvage of reclamation materials (surface soil, woody debris, and overburden). For example, the Minesite buildings will be built in areas previously cleared by forestry activity; and
- Minimize the length of haul roads, access roads, and rail line where possible. Use or improve existing roads where practical.

5.3.2 Reclamation Measures

The following reclamation measures have been incorporated into the mine design:

- Use progressive reclamation techniques including to limit the amount of disturbance at any given time by sequencing the open pit and stockpiles to the extent feasible, backfilling of open pit, and where possible, directly placing reclamation materials, and placing excavated materials on previously disturbed areas;
- Vegetate all temporary surface soil and overburden stockpiles to minimize the potential for erosion and sediment generation; and
- Implement progressive reclamation on embankments, buttresses, backfills, cut and fill slopes, and other Project components where possible to minimize fugitive dust emissions and reduce erosion and sediment generation.

5.3.3 Transport Measures

The following mitigation measures refer to transport measures:

- Build, maintain, and use the TAC for hauling processed coal to the Rail Infrastructure for the duration of all Project phases after the Construction phase to minimize traffic on existing, residential roads;
- Use buses and/or vans for employees and contractors as much as practical to reduce the risk of traffic incidents, and to reduce noise and fugitive dust emissions generated by the Project. Bussing options to Witset and/or Houston to be provided (if requested and based on sufficient employees in these locations) to facilitate potential employees accessing employment opportunities with the Project;
- Use dust suppression agents on the rail cars to reduce fugitive dust emissions;
- Cover super B-train trucks when hauling processed coal from CPP to Rail Infrastructure to reduce fugitive emissions from trucks;
- Use water and chemical agents on the TAC to reduce fugitive dust emissions, where and when appropriate;
- Use water and chemical agents on, as required, on processed coal and ROM coal stockpiles to reduce fugitive dust emissions resulting from storage and handling;
- Use privately controlled Rail Infrastructure so that there are no train whistles generated from Rail Infrastructure;
- Utilize low train speeds (10 kilometres/hour [km/hr] within the Rail Infrastructure, and up to 20 km/hr while entering and exiting the Rail Infrastructure) to mitigate vibration and noise;
- Post a speed limit of 50 km/hr on the TAC, 70 km/hr on Minesite haul roads, and 30 km/hr on Project service roads. Mine haul trucks within the Minesite portion of the Project Footprint will have a maximum operating speed of approximately 35 km/hr, given their large size and weight; and
- Investigate implementing a no train whistle requirement at the existing level rail crossing in the Village of Telkwa based on consultation with and approval of the Canadian National Railway (CNR).

5.3.4 Blasting Measures

The following mitigation measures apply to blasting:

- Use best management stemming techniques (e.g., type of material, size consistency, loading method, and thickness) that will minimize effects of noise and fugitive dust from blast patterns and assist in the complete detonation of drill holes to reduce the introduction of nitrogen species into the surrounding rock per the **EMP**;
- Correctly time blasts to minimize effects of noise, vibration, and fugitive dust from blast patterns;
- Keep blast patterns small to minimize effects of noise, vibration, and fugitive dust and to reduce the time that patterns need to sleep or wait until they are blasted which reduces the introduction of nitrogen species into the surrounding rock;
- Monitor actual blast results and implement improvements as required as per the adaptive management process to reduce effects of noise, vibration, fugitive dust and reduce the introduction of nitrogen species into the surrounding rock;
- Use electronic detonators to minimize effects of noise, vibration, and fugitive dust from blast patterns, and manage misfires to reduce the introduction of nitrogen species into the surrounding environment; and
- Use noiseless lead lines on the surface to minimize the effects of noise from blasts.

Refer to the **EMP** for further details about blasting and explosives.

5.3.5 Coal Processing Measures

The following mitigation measures apply to process design:

- Use centrifuges for processed coal dewatering versus coal and/or natural gas fuelled coal dryers to minimize GHG and dust emissions.

5.3.6 Load Management for Processed Coal Trucks

Super B-train trucks will be loaded in a manner to minimize fugitive dust during transportation along the TAC. Overfilling will be avoided and where feasible, adequate freeboard will be maintained in accordance with TCL and governmental BMPs. Loaded trucks will be covered with a removable tarp when travelling along the TAC. This mitigation measure is intended to minimize changes to ambient CAC concentrations (i.e., TSP, PM_{10}, $PM_{2.5}$).

5.3.7 Drop Height Reduction

Drop heights will be minimized when dropping materials onto open stockpiles and haul trucks. This reduces the speed at which material hits the pile or truck surface and bounces off, as well as the potential for wind to pick up materials at the transfer point and carry it downwind. This mitigation measure is intended to minimize changes to ambient CAC concentrations (i.e., TSP, PM_{10}, $PM_{2.5}$).

5.3.8 Vehicle and Equipment Fleet Selection and Maintenance

Vehicles and equipment will be purchased that meet regulatory air emission standards. A fleet maintenance program will be implemented to support optimal operation of vehicles and equipment. Deficiencies will be corrected and worn parts replaced as soon as practicable.

TCL will investigate the use of electric powered vehicles for transport vans, light vehicles, and coal haul vehicles. TCL intends to provide funding to assist employees to purchase electric vehicles or related charging equipment.

This mitigation is intended to minimize emissions of CACs and GHGs but is also expected to minimize noise.

5.3.9 Wood or Oil Stove Replacement Program

To partially offset any potential regional air quality effects associated with the Project, TCL intends to provide a funding program to assist personnel to replace their wood or oil burning stoves with alternative lower emission or higher efficiency heating systems. This mitigation measure aligns with the BLVD Airshed Management Plan: A Community Action Plan for Clean Air (Bulkley Valley Lakes District [BLVD] 2012).

5.3.10 Summary of Mitigation Measures

A summary of the mitigation measures to avoid or reduce potential Project-related adverse effects on the Atmospheric Environment VC, organized by potential effect and contributing activities within the Project phases, is provided in **Table 5.3-1.**

An indication of whether a residual effect is anticipated for each potential effect following implementation of the listed mitigation measures is provided in the table.

Table 5.3-1: Summary of Potential Effects and Mitigation Measures for the Atmospheric Environment Valued Component (VC)

Potential Effect	Contributing Activities within the Project Phases (C, O, D, P)	Proposed Mitigation Measure	Applicable VC Subcomponent	Residual Effect (Yes/No)
Increase In Ambient Criteria Air Contaminant (CAC) Concentrations	All activities (O)	▪ Limit Project footprint and Project Area ▪ Reclamation measures ▪ Transport measures ▪ Blasting measures. Refer to **Explosives Management Plan (S13.0-C6) (EMP)** ▪ Load management for processed coal trucks ▪ Drop height reduction See **Air Quality Management Plan (S13.0-C2) (AQMP)** ▪ Vehicle and equipment fleet selection and maintenance (**AQMP**) ▪ Wood or oil stove replacement program	▪ Air Quality	Yes
Increase In Greenhouse Gas (GHG) Emissions	All activities (O)	▪ Transport measures ▪ Coal processing measures ▪ Vehicle and equipment fleet selection and maintenance (**AQMP**)	▪ GHG Emissions	Yes
Increase In Ambient Noise Levels	All activities (O)	▪ Limit Project footprint and Project Area ▪ Blasting measures (**EMP**)	▪ Noise	Yes

Potential Effect	Contributing Activities within the Project Phases (C, O, D, P)	Proposed Mitigation Measure	Applicable VC Subcomponent	Residual Effect (Yes/No)
		▪ Vehicle and equipment fleet selection and maintenance (**AQMP**)		

Notes: *C, O, D, P represent Project Phases: (C)onstruction, (O)peration, (D)ecomissioning and Reclamation, (P)ost-closure. VC=Valued Component*
*See **Table 5.1-2** for list of applicable activities for each listed Project phase, unless otherwise noted in this table.*

5.4 Residual Effects and Significance of Residual Effects

This subsection describes the potential residual effects of the Project on the Atmospheric Environment VC. Residual effects are effects anticipated to remain after the application of all mitigation measures. The approach to assessing residual Project effects on the Atmospheric Environment VC follows the methodology outlined in **S3.0 Assessment Methodology** of the **EAC Application**.

As described in **3.2.4.2**, the assessment of residual effects for Atmospheric Environment VC focuses on the Operation Phase as this phase is associated with the greatest potential effects on the Air Quality, GHG Emissions, and Noise subcomponents. Residual effects associated with the other phases are expected to be encompassed by (i.e., less than) the effects associated with the Operation Phase presented here, and will be managed using BMPs. Residual effects are then characterised based on the combined predicted residual effect for these phases. The assessment includes a determination of Likelihood, Significance and the Level of Confidence associated with the prediction.

5.4.1 Description of Evaluation Criteria

5.4.1.1 Residual Effects Characteristics

Residual effects to the measurement indicators for the Air Quality, GHG Emissions, and Noise subcomponents (**Table 3.2-2**) were characterised using the criteria and definitions outlined in **Table 5.4-1**. Magnitude is determined based on the change in a measurement indicator from a Project interaction. Geographic Extent refers to the area affected, and Duration is defined as the amount of time for a residual effect to be reversed. Other criteria (e.g., Frequency and Context) are used as modifiers where applicable.

Table 5.4-1: Effect Characteristics Considered When Determining the Significance of Residual Effects on the Atmospheric Environment Valued Component (VC)

Residual Effect Characteristic	Definition	Rating
Magnitude	Size or severity of the residual effect relative to existing conditions and applicable criteria.	**Low:** Subcomponent - Air Quality ▪ Change in ambient CAC concentrations is less than 50% of baseline and Project results in no new exceedances of ambient air quality criteria. Subcomponent - GHG ▪ Project GHG emissions are less than 1.0% of provincial totals, less than 0.10% of national totals, and less than the industry profile.

Residual Effect Characteristic	Definition	Rating
		Subcomponent - Noise ▪ Project noise levels barely perceptible, less than baseline noise levels. **Moderate:** Subcomponent - Air Quality ▪ Change in ambient CAC concentrations is more than 50% of baseline and Project results in no new exceedances of ambient air quality criteria. Subcomponent - GHG ▪ Project GHG emissions are less than 1.0% of provincial totals, less than 0.10% of national totals, and within the range of the industry profile. Subcomponent - Noise ▪ Project noise levels are equal to or higher than baseline and are less than applicable criteria. **High:** Subcomponent - Air Quality ▪ Project results in new exceedances of the ambient air quality criteria. Subcomponent - GHG ▪ Project GHG emissions are greater than 1.0% of provincial totals, greater than 0.10% of national totals, or greater than the industry profile. Subcomponent - Noise ▪ Project noise levels result in exceedances of applicable criteria.
Geographic Extent	Spatial scale over which the residual effect is expected to occur.	**Local**: Limited to the LSA. **Regional**: Limited to the RSA. **Beyond Regional:** Beyond the RSA.
Duration	Length of time over which the residual effect is expected to persist.	**Short-term:** Effects are not evident beyond the Construction Phase. **Medium-term:** Effects are not evident beyond the life of the Project. **Long-term:** Effects will persist beyond the life of the Project.
Frequency	How often the residual effect is expected to occur.	**Infrequent:** Effects are sporadic, occurring at irregular intervals. **Frequent:** Effects occur on a regular basis, at regular intervals. **Continuous:** Effects occur near-continuously or continuously.
Reversibility	Whether or not the residual effect can be reversed once the activity causing the residual effect ceases. Irreversible effects are considered to be permanent.	**Fully Reversible:** Effects will diminish to baseline conditions. **Partially Reversible:** Effects will partially diminish to baseline conditions. **Irreversible:** Effects are permanent and will not diminish to baseline conditions.

Residual Effect Characteristic	Definition	Rating
Context	The extent to which the Atmospheric Environment VC has been affected by past and present environmental and socio-economic processes and conditions, its potential sensitivity to the Project-related residual effect, and its ability to recover from that effect (i.e., resilience).	**Low:** Effects occur in a viable ecosystem or undisturbed area. **Moderate:** Effects occur in a stable ecosystem of moderately disturbed area. **High:** Effects occur in a fragile ecosystem or highly disturbed area.

Notes: *%=percent; CAC=criteria air contaminant; GHG=greenhouse gas; LSA=Local Study Area; RSA=Regional Study Area; VC=Valued Component*

5.4.1.2 Likelihood

Likelihood is the probability that the predicted residual effect will occur including consideration of the likelihood that the mitigation will be successful. Likelihood is defined as Likely or Unlikely:

- **Likely:** Moderate-to-High probability of an effect; or
- **Unlikely:** Low probability of an effect.

5.4.1.3 Significance Determination

The residual effects classification and associated prediction in changes to the measurement indicators provide the foundation for the determination of Significance. Magnitude is the primary criterion used to determine the Significance of effects to the Air Quality, GHG emissions, and Noise subcomponents and is established based on applicable guidelines and thresholds. These guidelines and thresholds were developed by environmental and health authorities for the protection of human and environmental health. If an effect is High in Magnitude, there is potential for an adverse human or environmental health effect, and it is rated as **Significant**. Otherwise, an effect is considered **Not Significant**. While other characteristics help to further characterise the effect, they are not used in the determination of Significance.

The Level of Confidence is used as a qualifier for the prediction of Significance. Confidence estimates allow the decision-maker to evaluate risk associated with the residual effects of the Project. The Level of Confidence is a measure of how well residual effects are understood based on the quality of the input data (i.e., taking into account the reliability of data inputs and analytical methods used to predict Project effects, the confidence in the effectiveness of mitigation measures and certainty of the predicted outcome). The Level of Confidence is rated as Low, Moderate or High:

- **Low Confidence:** Cause-effect relationships between the Project and VC are not fully understood and/or necessary data are not entirely available to support the assessment. For example, there are a number of unknown external variables and/or data for the Project is incomplete, the effectiveness of the mitigation measures is not yet be proven, and the modelling results hold a high degree of variance given the data inputs. Consequently, there is generally a high degree of uncertainty in the conclusions of the assessment;
- **Moderate Confidence:** Cause-effect relationships between the Project and the VC are not fully understood, but most of the necessary data are available to support the assessment. For example, there are several unknown external variables and/or data for the Project is incomplete. However, the effectiveness of the mitigation measures is moderately-well or highly proven and the modelling

results hold a moderate or low degree of variance given the data inputs. Consequently, there is generally a moderate degree of uncertainty in the conclusions of the assessment; or

- **High Confidence:** Cause-effect relationships between the Project and the VC are fully understood and all the necessary data are available to support the assessment. For example, external variables and/or data for the Project is both complete and comprehensive, the effectiveness of the mitigation measures is highly proven, and the modelling results hold a low degree of variance given the data inputs. Consequently, there is generally a high degree of uncertainty in the conclusions of the assessment.

Based on these criteria, it was determined that an additional risk analysis was not required.

5.4.2 Air Quality Subcomponent

Residual effects for the Air Quality subcomponent are described in this subsection. The assessment considered changes in ambient concentrations of CACs during the Operation Phase in comparison to ambient air quality criteria.

5.4.3 Residual Effect Characteristics

The effects characteristics ratings for the Air Quality subcomponent are summarized in **Table 5.4-2**. The Project is expected to result in CAC emissions and an increase in ambient CAC concentrations. Magnitude is Moderate as Project contribution to ambient CAC concentrations are measurable, above 50% of baseline at the TCRC and the nearest residences but are anticipated to remain below relevant ambient air quality criteria for all contaminants and all averaging periods. The change in ambient CAC concentrations is predicted to be limited to the LSA (i.e., Local Geographic Extent), which is currently moderately disturbed by existing agricultural and logging activity (i.e., Moderate Context). Project-related CAC emissions are Continuous and are expected to last for the life of the Project, upon which effects are expected to be Fully Reversible.

Table 5.4-2: Summary of Effect Characteristics Ratings for the Air Quality Subcomponent

Residual Effects Characteristic	Rating	Rationale for Rating
Magnitude	Moderate	Change in ambient CAC concentrations is greater than 50% of baseline but does not result in any new exceedances of ambient air quality criteria.
Geographic Extent	Local	Change in ambient CAC concentrations are expected to occur only within the LSA.
Duration	Medium-term	Effects are anticipated for the duration of the Project and cease after the Post-closure Phase.
Frequency	Continuous	Mining activities contributing to CAC emissions are anticipated to be continuous or near-continuous.
Reversibility	Fully Reversible	Change in ambient CAC concentrations are anticipated to be fully reversible after the Post-closure Phase.
Context	Moderate	LSA is moderately disturbed by existing agricultural and logging activity.

Notes: *%=percent; CAC=criteria air contaminant; LSA=Local Study Area; Project=Tenas Project*

5.4.3.1 Likelihood

Residual effects on the Air Quality VC are considered Likely. The Project will result in CAC emissions and an increase in ambient CAC concentrations despite the implementation of mitigation measures.

5.4.3.2 Significance Determination

Due to the Moderate Magnitude, Project-related effects on the Air Quality subcomponent is **Not Significant**. The Level of Confidence is High as a quantitative assessment was completed using Project-specific information where possible.

5.4.4 Greenhouse Gas (GHG) Emissions Subcomponent

Residual effects for the GHG Emissions subcomponent are described in this subsection. The assessment considered Project-related GHG emissions during the Operation Phase in comparison to provincial and national totals as well as to the industry profile in Canada.

5.4.4.1 Residual Effect Characteristics

The effects characteristics ratings for GHG emissions are summarized in **Table 5.4-3.** The Project will result in GHG emissions. The Magnitude of the residual effect is Moderate as the Project-related GHG emissions are expected to be less than 1.0% of existing provincial totals, less than 0.10% of existing national totals, and within the range of the industry profile. GHG emissions and associated climate effects are global in nature; therefore, the Geographic Extent is Beyond Regional. Project-related GHG emissions are Continuous and will last for the life of the Project (i.e., Long-term Duration). Upon closure, Project-related GHG emissions will cease. However, because GHGs in the atmosphere can persist for hundreds of years with the exception of CH_4, which is short-lived, effects are Partially Reversible.

Table 5.4-3: Summary of Effect Characteristics Ratings for the Greenhouse Gas (GHG) Emissions Subcomponent

Residual Effects Characteristic	Rating	Rationale for Rating
Magnitude	Moderate	GHG emissions are expected to be less than 1.0% of provincial totals, less than 0.10% of national totals, and within the range of the industry profile.
Geographic Extent	Beyond Regional	GHG emissions contribute to global climate effects.
Duration	Long-term	GHGs and associated climate effects will persist beyond the life of the Project.
Frequency	Continuous	Mining activities contributing to GHG emissions are continuous or near-continuous.
Reversibility	Partially Reversible	GHGs can persist for hundreds of years in the atmosphere but effects are reversible thereafter.
Context	High	Existing GHG emissions are high and resulting climate effects are evident.

Notes: *%=percent; GHG=greenhouse gas*

5.4.4.2 Likelihood

Residual effects on GHG emissions are considered Likely. The Project will result in GHG emissions despite the implementation of mitigation measures.

5.4.4.3 Significance Determination

Due to the Moderate Magnitude, Project-related effects on the GHG Emissions subcomponent are rated **Not Significant**. The Level of Confidence is rated High as a quantitative assessment was completed using Project-specific information where possible.

5.4.5 Noise Subcomponent

Residual effects for the Noise subcomponent are described in this subsection. The assessment considered changes in ambient noise levels at sensitive receptors in comparison to PSLs established by the BC OGC.

5.4.5.1 Residual Effect Characteristics

The effects characteristics ratings for the Noise subcomponent are summarized in **Table 5.4-4**. The Project will result in noise emissions and an increase in ambient noise levels. The Magnitude of the residual effect is Moderate as Project contribution to ambient noise levels are measurable, above baseline levels at the TCRC and the nearest residences but will remain below the BC OGC PSLs as well as Health Canada's threshold for %HA. The change in ambient noise levels will be limited to the LSA (i.e., Local Geographic Extent), which is currently moderately disturbed by existing agricultural and logging activity (i.e., Moderate Context). Project-related noise emissions are Continuous and will last for the life of the Project, upon which effects will be Fully Reversible.

Table 5.4-4: Summary of Effect Characteristics Ratings for the Noise Subcomponent

Residual Effects Characteristic	Rating	Rationale for Rating
Magnitude	Moderate	Project-related noise levels may exceed baseline at nearby residences but will remain below PSLs and threshold for %HA.
Geographic Extent	Local	Change in ambient noise levels will occur within the LSA.
Duration	Medium-term	Effects will last for the duration of the Project and cease upon closure.
Frequency	Continuous	Mining activities contributing to noise emissions are continuous or near-continuous.
Reversibility	Fully Reversible	Change in noise levels are fully reversible after closure.
Context	Moderate	LSA is moderately disturbed by existing agricultural and logging activity.

Notes: *%HA=percent of high annoyance; PSL=permissible sound level; LSA=Local Study Area*

5.4.5.2 Likelihood

Residual effects on the Noise subcomponent are Likely. The Project will result in noise emissions and an increase in ambient noise levels despite the implementation of mitigation measures.

5.4.5.3 Significance Determination

Due to the Moderate Magnitude, Project-related effects on the Noise subcomponent are **Not Significant**. The Level of Confidence is High as a quantitative assessment was completed using Project-specific information where possible.

5.5 Summary of Project-related Residual Adverse Effects and Significance

The results of the residual effects characterisations for the Atmospheric Environment subcomponents are presented in **Table 5.5-1.** Residual effects on the Air Quality, GHG Emissions, and Noise subcomponents are **Not Significant** due to the Moderate Magnitude. The Likelihood of effects is Likely. The Level of Confidence is High as the determination is based on a quantitative assessment using Project-specific information where possible. Based on the determination of **Not Significant** for all residual effects**,** it is concluded that there is no potential for a Significant residual effect on the Atmospheric Environment VC.

All residual effects are carried forward into the CEA.

Table 5.5-1: Summary of Residual Adverse Effects for the Atmospheric Environment Valued Component (VC) Subcomponents

Residual Adverse Effects	Contributing Activities within the Project Phases (C, O, D, P)	Proposed Mitigation Measures	Subcomponent	Residual Effects Characterisation								
				Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Context	Significance	Likelihood	Level of Confidence
Increase in Ambient Criteria Air Contaminant (CAC) Concentrations	All activities (O)	▪ Limit Project footprint and Project Area ▪ Reclamation measures ▪ Transport measures ▪ Blasting measures. See **Explosives Management Plan (S13.0-C6) (EMP)** ▪ Load management for processed coal trucks ▪ Drop height reduction. See **Air Quality Management Plan (S13.0-C2) (AQMP)** ▪ Vehicle and equipment fleet selection and maintenance (**AQMP**) ▪ Wood or oil stove replacement program	Air Quality	M	LSA	MT	CF	FR	M	NS	L	H
Increase in Greenhouse Gas (GHG) Emissions	All activities (O)	▪ Transport measures ▪ Coal processing measures ▪ Vehicle and equipment fleet selection and maintenance (**AQMP**)	GHG Emissions	M	BR	LT	CF	PR	H	NS	L	H
Increase in Ambient Noise Levels	All activities (O)	▪ Limit Project footprint and Project Area ▪ Blasting measures (**EMP**) ▪ Vehicle and equipment fleet selection and maintenance (**AQMP**)	Noise	M	LSA	MT	CF	FR	M	NS	L	H

Notes: *C, O, D, P represent Project Phases: (C)onstruction, (O)peration, (D)ecomissioning and Reclamation, (P)ost-closure*
Magnitude: Low (L), Moderate (M), High (H)
Geographic Extent: Local (LSA), Regional (RSA), Beyond Regional (BR)
Duration: Short-term (ST), Medium-term (MT), Long-term (LT)
Frequency: Infrequent (IF), Frequent (FF), Continuous (CF)
Reversibility: Fully reversible (FR), Partially reversible (PR), Irreversible (IR)
Context: High (H), Moderate (M), Low (L)
Significance: Not-Significant (NS), Significant (S)
Likelihood: Likely (L), Unlikely (UL)
Level of Confidence: High (H), Moderate (M), or Low (L).
*See **Table 5.1-2** for list of applicable activities for each listed Project phase, unless otherwise noted in this table.*

6. CUMULATIVE EFFECTS ASSESSMENT (CEA)

Cumulative effects are the overall effects on a VC due to the Project's residual effects overlapping both spatially and temporally with those of other projects and activities. This subsection presents an assessment of cumulative effects on the Atmospheric Environment VC.

All major past, present, and reasonably foreseeable future projects and activities identified in the Project and Activity Inclusion List (**S3.0 Assessment Methodology** of the **EAC Application**) were considered. The spatial boundaries of the CEA for the Air Quality and Noise subcomponents is their respective RSAs described in **3.2.4.1 Spatial Boundaries.** Due to the global nature of GHG emissions and associated climate effects, it is not feasible to identify all projects and activities with spatial overlap; therefore, the CEA for this subcomponent is approached differently. Projects and activities located within these spatial boundaries are shown in **Table 6-1** and **Figure 6-1**. Other projects and activities listed in the Project and Activity Inclusion List are not anticipated to overlap spatially with Project-related residual effects on the Atmospheric Environment VC and are not included.

The temporal boundaries within which cumulative effects were considered include past, present, and reasonably foreseeable future activities inclusive of the life of the Project including Construction, Operation, Decommissioning and Reclamation, and Post-closure phases.

As outlined in **5.2 Potential Project-related Effects,** the following Project-related residual effects to the Atmospheric VC subcomponents were considered for their potential to interact cumulatively with the residual effects of past, present, and reasonably foreseeable future projects and activities:

- Air Quality: increase in ambient CAC concentrations;
- GHG Emissions: increase in GHG emissions; and
- Noise: increase in ambient noise levels.

Potential cumulative effects are discussed in the following subsections.

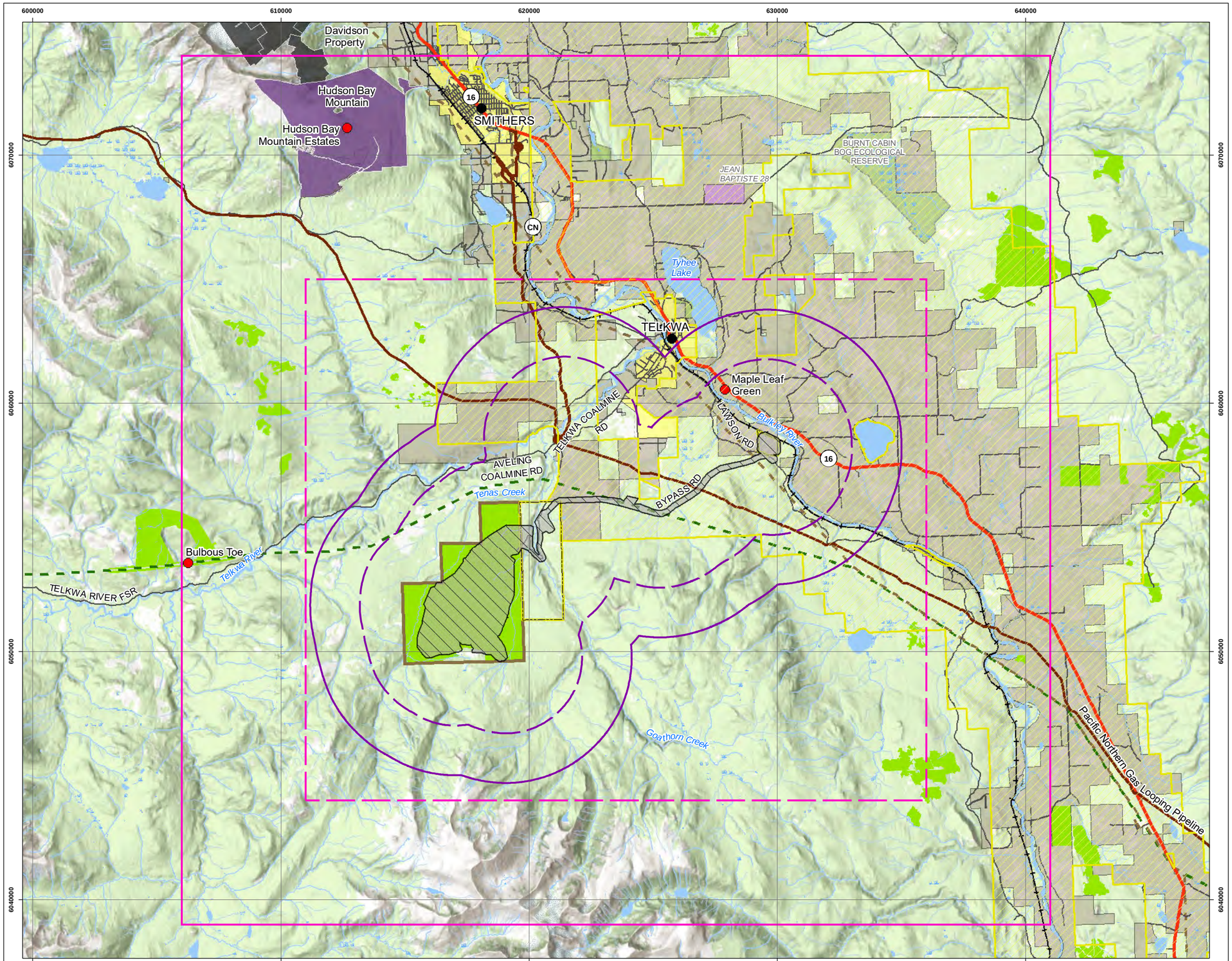
Table 6-1: Projects Included in the Assessment of Atmospheric Environment Valued Component (VC) Based on Spatial and Temporal Interaction

Project/Activity Name	Interacts with Project-related Effects on the VC as a Past, Present, or Future Project/Activity	
	Past and Present	Future
Bulbous Toe	No	No
Maple Leaf Cannabis Production Facility	No	No
Pacific Northern Gas Looping Pipeline	Yes	Yes
Telkwa to Smithers Bike Trail	No	Yes
Community Development	Yes	Yes
Agricultural Activities	Yes	Yes
Forestry Activities	Yes	Yes
Harvesting Activities	Yes	Yes
Recreation Activities	No	No
Utilities Activities	No	No

Notes: *Project=Tenas Project; VC=Valued Component*

Tenas Project

Map of Projects and Activities for Cumulative Effects Assessment



Legend

- Project
- City/Town
- Rail Line
- Highway
- Road
- 138 kV Transmission Line
- 500 kV Transmission Line
- Watercourse
- Wetland
- Waterbody
- Park or Protected Area
- First Nation Reserve
- Municipal Area
- General Private Property
- Tenas Coal Licenses
- Telkwa Coal Limited Private Property
- Project Area
- Air Quality Local Study Area
- Air Quality Regional Study Area
- Noise Local Study Area
- Noise Regional Study Area
- Coastal GasLink Pipeline Ltd.
- Pacific Northern Gas Ltd.
- Pacific Trail Pipelines Management Inc.
- Telkwa to Smithers Bike Trail
- Hudson Bay Mountain Resort Tenure
- Mining Leases
- Agricultural Land Reserve (ALR)
- Forest Cutblock (Active or Pending)

Notes

1. All mapped features are approximate and should be used for discussion purposes only.
2. This map is not intended to be a “stand-alone” document, but a visual aid of the information contained within the referenced Report. It is intended to be used in conjunction with the scope of services and limitations described therein.

Sources

- Project Area: Allegiance Coal, April 21, 2021
- Basedata: Government of British Columbia
- Basemap: World Topo Base

N

1:150,000

0 2 4 6 8 10

Kilometres

NAD 1983 UTM Zone 9N

Page Size: 11" x 17"

103260-04	Production Date: Jun 29, 2021	Figure 6-1

TELKWA COAL LIMITED

Hemmera An Ausenco Company

Path: G:\Geomatics\Projects\103260\04\mxd\Fig6-1_103260-04_AQ_CEA_210629.mxd

6.1 Cumulative Effects Assessment (CEA) – Air Quality Subcomponent

6.1.1 Potential Cumulative Effects

Potential cumulative effects on the Air Quality subcomponent associated with each of the projects and activities previously identified in **Table 6-1** are discussed below.

- Bulbous Toe: Bulbous Toe refers to a large landslide that underwent rapid movement during prehistoric times near the western boundary of the Air Quality RSA. The landslide continues to advance as a slow-moving earth flow at approximately 30 cm per year. This slow-moving earth flow is not expected to result in air emissions that can overlap with Project effects;
- Maple Leaf Cannabis Production Facility: Maple Leaf Green World Inc. is developing a cannabis production facility at the Woodmere Nursery site, located southeast of Telkwa approximately 2 km from the Rail Loop. The cultivation of cannabis plants is associated with emissions of volatile organic compounds (VOCs). The key VOCs are natural substances including pinenes, linalool, myrcene, limonene, and isoprene. These substances are expected to be different from those that may be emitted by the Project and therefore, effects will not overlap;
- Pacific Northern Gas Looping Pipeline: Pacific Northern Gas is proposing to upgrade its transmission pipeline capacity by looping or twinning its existing natural gas transmission system between Summit Lake and Kitimat. A portion of this 525 km pipeline corridor traverses through the Air Quality LSA and RSA, including a compressor station located approximately 2 km north of the Bypass Road that will need to be upgraded. Stationary combustion sources at the compressor station may result in emissions of CACs, primarily oxides of nitrogen (NO_X)[5] and small amounts of SO_2 and $PM_{2.5}$. Overlapping effects with past and present operations of the compressor station are expected to be included in the background concentrations developed for the assessment of Project effects. Future operations may increase ambient concentrations of NO_2 in the immediate vicinity of the compressor station. Cumulative effects are expected to remain below ambient air quality criteria;
- Telkwa to Smithers Bike Trail: The Cycle 16 Trail Society is intending to develop a paved cycling path that runs along Highway 16 between Telkwa and Smithers. The construction of this path (e.g., paving activities) may result in short-term emissions of CACs that can overlap temporally with Project effects. Spatial overlap is minimal as the contribution of the Project in Telkwa and beyond is small. All overlapping effects from construction of the path are Reversible upon completion;
- Community Development: Future community development in Telkwa, Smithers, as well as the Hudson's Bay Mountain Estates may result in additional emissions of CACs associated with residential heating, vehicle traffic, etc. Effects associated with future community development is expected to be small compared to existing development included in the baseline concentrations. Contribution of the Project to cumulative effects is small in the locations of potential future community development; and
- Agricultural, Forestry, Harvesting, Recreation, and Utilities: These activities are ongoing and potential overlapping effects are expected to be included in the baseline concentrations.

[5] Emissions are comprised of nitric oxide (NO) and nitrogen dioxide (NO_2), collectively known as oxides of nitrogen (NO_X), with reactions in the atmosphere resulting in the conversion of NO to NO_2. Effects and indicators are based on ambient concentrations of NO_2.

6.1.2 Additional Mitigation Measures

As potential cumulative effects associated with other projects and activities are expected to be minimal, additional mitigation is not considered to be required to minimize cumulative effects on the Air Quality subcomponent.

6.1.3 Cumulative Effects and Characterisation of Significance

As potential effects associated with other projects and activities are expected to be minimal, the characterisation of cumulative effects for Air Quality is similar to the characterisation of Project-related residual effects.

Magnitude is Moderate as cumulative effects on ambient concentrations of CACs are anticipated to remain below relevant ambient air quality criteria. The Geographic Extent is Regional to reflect the spatial boundaries of the CEA. The Air Quality RSA is moderately disturbed by existing agricultural, logging, and industrial activity (i.e., Moderate Context). Cumulative effects are Likely, Continuous and are expected to last for the life of the Project, upon which effects are expected to be Fully Reversible. Due to the Moderate Magnitude, cumulative effects on the Air Quality subcomponent is **Not Significant**. A summary is provided in **Table 6.1-1**.

Table 6.1-1: Summary of Cumulative Effects for the Air Quality Subcomponent

Cumulative Effects	Contributing Activities within the Project Phases (C, O, D, P)	Cumulative Effects Characterisation								
		Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Context	Significance	Likelihood	Level of Confidence
Increase In Ambient Criteria Air Contaminant (CAC) Concentrations	All activities (O)	M	RSA	MT	CF	FR	M	NS	L	H

Notes: *C, O, D, P represent Project Phases: (C)onstruction, (O)peration, (D)ecomissioning and Reclamation, (P)ost-closure*

Magnitude: Low (L), Moderate (M), High (H)
Geographic Extent: Local (LSA), Regional (RSA), Beyond Regional (BR)
Duration: Short-term (ST), Medium-term (MT), Long-term (LT)
Frequency: Infrequent (IF), Frequent (FF), Continuous (CF)
Reversibility: Fully reversible (FR), Partially reversible (PR), Irreversible (IR)
Context: High (H), Moderate (M), Low (L)
Significance: Significant (S), Not-Significant (NS)
Likelihood: Likely (L), Unlikely (UL)
Level of Confidence: High (H), Moderate (M), Low (L)

*See **Table 5.1-2** for list of applicable activities for each listed Project phase, unless otherwise noted in this table. Includes all existing and reasonably foreseeable projects as outlined in **Table 6-1.***

6.2 Cumulative Effects Assessment (CEA) – Greenhouse Gas (GHG) Emissions Subcomponent

6.2.1 Potential Cumulative Effects

GHG emissions by their nature represent a global concern and cumulative effects cannot be considered at a microscale based on each major project or activity. Rather, cumulative effects are considered at a provincial and federal level based on projections that account for potential future development.

Despite increases in population and gross domestic product, total GHG emissions in BC and Canada are expected to decrease going forward, as shown in **Table 6.2-1.** This reflects climate actions outlined in the Pan-Canadian Framework on Clean Growth and Climate Change adopted in 2016 (ECCC 2016). Project-related GHG emissions remain less than 1.0% of provincial totals and less than 0.10% of federal totals in 2030.

Table 6.2-1: Projected Greenhouse Gas (GHG) Emissions in British Columbia (BC) and Canada

Jurisdiction	Historical Emissions (Mt CO2e)				Projected Emissions (Mt CO2e)		Project Contribution to Projected 2030 Emissions (%)
	2005	2010	2015	2018	2020	2030	
BC	62	57	59	66	58	58	0.10
Canada	730	691	720	729	637	674	0.010

Source: *Environment and Climate Change Canada (ECCC) 2020b*
Notes: *%=percent; BC=British Columbia; Mt CO_2e= million tonnes carbon dioxide equivalent*

6.2.2 Additional Mitigation Measures

As cumulative effects on the GHG Emissions subcomponent are projected to decrease in the future, additional mitigation is not required to reduce cumulative effects. As technologies improve and more fuel efficient and/or lower-emission vehicles are in commercial production; in use at other mines; and shown to have a lower or equal overall operating cost to available hydrocarbon powered equipment; purchasing decisions related to vehicle replacement will consider options that reduce Project-related GHG emissions.

6.2.3 Cumulative Effects and Characterisation of Significance

The cumulative effects characteristics ratings for the GHG Emissions subcomponent are summarized in **Table 6.2-2.**

Magnitude is Low as cumulative effects on GHG emissions are projected to decrease in the future. All other ratings are developed based on the nature of GHG emissions and remain the same as the characterisation of Project-related residual effects (i.e., Beyond Regional, Long-term, Continuous, and Partially Reversible). Cumulative effects are **Not Significant** due to the Low Magnitude. The Level of Confidence is Moderate as uncertainties are inherent to any projections into the future.

Future development in technologies, demographics and industrial resources cannot be foreseen with certainty and the presented cumulative effects on the GHG Emissions subcomponent represent the most likely scenario in a range of plausible outcomes.

Table 6.2-2: Summary of Cumulative Effects for the Greenhouse Gas (GHG) Emissions Subcomponent

Cumulative Effects	Contributing Activities within the Project Phases (C, O, D, P)	Cumulative Effects Characterisation (see Notes for details)								
		Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Context	Significance	Likelihood	Level of Confidence
Increase In Greenhouse Gas (GHG) Emissions	All activities (O)	L	BR	LT	CF	PR	H	NS	L	M

Notes: *C, O, D, P represent Project Phases: (C)onstruction, (O)peration, (D)ecomissioning and Reclamation, (P)ost-closure*
Magnitude: Low (L), Moderate (M), High (H)
Geographic Extent: Local (LSA), Regional (RSA), Beyond Regional (BR)
Duration: Short-term (ST), Medium-term (MT), Long-term (LT)
Frequency: Infrequent (IF), Frequent (FF), Continuous (CF)
Reversibility: Fully reversible (FR), Partially reversible (PR), Irreversible (IR)
Context: High (H), Moderate (M), Low (L)
Significance: Significant (S), Not-Significant (NS)
Likelihood: Likely (L), Unlikely (UL)
Level of Confidence: High (H), Moderate (M), Low (L)
*See **Table 5.1-2** for list of applicable activities for each listed Project phase, unless otherwise noted in this table. Includes all existing and reasonably foreseeable projects as outlined in **Table 6-1.***

6.3 Cumulative Effects Assessment (CEA) - Noise Subcomponent

6.3.1 Potential Cumulative Effects

Potential cumulative effects with the Noise subcomponent are discussed below. Only projects and activities located within the Noise RSA are included.

- Maple Leaf Cannabis Production Facility: Equipment required to maintain environmental conditions (e.g., temperature, light, humidity) for cannabis cultivation may be a source of noise. The facility is located southeast of Telkwa approximately 2 km from the Rail Loop and over 150 m away from the nearest residence; thus, cumulative effects at residences are expected to remain below the BC OGC PSLs;
- Pacific Northern Gas Looping Pipeline: Equipment at the Telkwa compressor station may be a source of noise. Overlapping effects associated with past and present operations of the compressor station are expected to be included in the baseline noise levels developed for assessment of Project effects. Future operations of the compressor station may increase ambient noise levels in the immediate vicinity of the compressor station. Cumulative effects at the nearest residences are expected to remain below the BC OGC PSLs;
- Community Development: Future community development in Telkwa may result in additional noise associated with human activity, vehicle traffic, etc. Overlapping effects associated with future community development is expected to be small compared to existing development included in the baseline noise levels; and
- Agricultural, Forestry, Harvesting, Recreation, and Utilities: These activities are ongoing and potential overlapping effects are expected to be included in the baseline noise levels.

6.3.2 Additional Mitigation Measures

As potential cumulative effects associated with other projects and activities are expected to be minimal, additional mitigation is not expected to be required to minimize cumulative effects on the Noise subcomponent.

6.3.3 Cumulative Effects and Characterisation of Significance

As potential effects associated with other projects and activities are expected to be minimal, the characterisation of cumulative effects for the Noise subcomponent is similar to the characterisation of Project-related residual effects. Magnitude is Moderate as cumulative effects on ambient noise levels are anticipated to remain below the BC OGC PSLs. The Geographic Extent is Regional to reflect the spatial boundaries of the CEA. The Noise RSA is moderately disturbed by existing agricultural and logging activity (i.e., Moderate Context). Cumulative effects are Likely, Continuous and are expected to last for the life of the Project, upon which effects are expected to be Fully Reversible. Due to the Moderate Magnitude, cumulative effects on the Noise subcomponent is **Not Significant**. A summary is provided in **Table 6.3-1.**

Table 6.3-1: Summary of Cumulative Effects for the Noise Subcomponent

Cumulative Effects	Contributing Activities within the Project Phases (C, O, D, P)	Cumulative Effects Characterisation (see Notes for details)								
		Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Context	Significance	Likelihood	Level of Confidence
Increase In Ambient Noise Levels	All activities (O)	M	RSA	MT	CF	FR	M	NS	L	H

Notes: *C, O, D, P represent Project Phases: (C)onstruction, (O)peration, (D)ecomissioning and Reclamation, (P)ost-closure*
Magnitude: Low (L), Moderate (M), High (H)
Geographic Extent: Local (LSA), Regional (RSA), Beyond Regional (BR)
Duration: Short-term (ST), Medium-term (MT), Long-term (LT)
Frequency: Infrequent (IF), Frequent (FF), Continuous (CF)
Reversibility: Fully reversible (FR), Partially reversible (PR), Irreversible (IR)
Context: High (H), Moderate (M), Low (L)
Significance: Significant (S), Not-Significant (NS)
Likelihood: Likely (L), Unlikely (UL)
Level of Confidence: High (H), Moderate (M), Low (L)
*See **Table 5.1-2** for list of applicable activities for each listed Project phase, unless otherwise noted in this table. Includes all existing and reasonably foreseeable projects as outlined in **Table 6-1**.*

6.4 Summary of Cumulative Effects Assessment (CEA)

The following residual effects of the Project on the Atmospheric Environment VC subcomponents were carried forward to the CEA:

- Air Quality: increase in ambient CAC concentrations;
- GHG Emissions: increase in GHG emissions; and
- Noise: increase in ambient noise levels.

There are cumulative effects on the Atmospheric Environment VC Air Quality, GHG Emissions, and Noise subcomponents as noted in **Table 6.4-1.** The Significance of the cumulative effects are determined to be **Not Significant**.

Table 6.4-1: Summary of Cumulative Effects for the Atmospheric Environment Valued Component (VC)

VC Subcomponent	Potential Cumulative Effect	Contributing Activities within the Project Phases (C, O, D, P)	Cumulative Effect (Yes/No)	Significant (Yes/No)
Air Quality	Increase in ambient Criteria Air Contaminant (CAC) concentrations	All activities (O)	Yes	No
Greenhouse Gas (GHG) Emissions	Increase in greenhouse gas (GHG) emissions	All activities (O)	Yes	No
Noise	Increase in ambient noise levels	All activities (O)	Yes	No

Notes: *C, O, D, P represent Project Phases: (C)onstruction, (O)peration, (D)ecomissioning and Reclamation, (P)ost-closure*
VC=Valued Component
*See **Table 5.1-2** for list of applicable activities for each listed Project phase, unless otherwise noted in this table. Includes all existing and reasonably foreseeable projects as outlined in **Table 6-1**.*

7. SUMMARY OF EFFECTS ASSESSMENT ON THE ATMOSPHERIC ENVIRONMENT VALUED COMPONENT (VC)

The Project has the potential to result in the following potential effects to the Atmospheric Environment VC subcomponents:

- Air Quality: Increase in ambient CAC concentrations;
- GHG Emissions: Increase in GHG emissions; and
- Noise: Increase in ambient noise levels.

While all phases of the Project have the potential to result in effects to Air Quality, GHG Emissions, and Noise subcomponents, the Operation Phase is expected to result in the greatest effects. The effects assessment considers a peak operating scenario based on Year 5.

The Project will be designed with a number of Project mitigation measures. Other mitigation measures to be implemented during the Operation Phase are based on BMPs and proven/accepted mitigation used on other similar projects.

With mitigation measures in place, ambient CAC concentrations and ambient noise levels are predicted to remain below relevant guidelines and thresholds at the nearest residences and other sensitive receptors. Changes in GHG emissions are predicted to be small relative to provincial and federal totals and within the industrial profile. Therefore, potential residual effects of the Project on the Atmospheric Environment VC are determined to be **Not Significant**.

Reasonably foreseeable projects in the area may have overlapping effects on the Air Quality and Noise subcomponents. However, based on the location of these projects and the type of projects, overlapping effects are expected to be minimal. All measurement indicators are expected to remain below relevant guidelines and thresholds at the nearest residences and no additional mitigation measures are required. Cumulative effects on the GHG Emissions subcomponent were assessed based on projected provincial and federal totals which incorporate reasonably foreseeable future development. GHG emissions are projected to decrease in the future. Therefore, cumulative effects of the Project on the Atmospheric Environment VC are **Not Significant.**

8. FOLLOW-UP STRATEGY

To verify the accuracy of anticipated residual effects and the efficacy of mitigation measures, it is recommended that the baseline air quality monitoring station located at PPR2 be maintained to collect continuous measurements of PM_{10} and $PM_{2.5}$ concentrations associated with the Project. A Thermo Scientific Partisol 2025i-D dichotomous sequential air sampler will be operated and maintained in accordance with manufacturer specifications and the most recent edition of the British Columbia Field Sampling Manual (GovBC 2014a) for the duration of the Project and ceases to be in force at the final closure of the Project as approved by regulatory authorities. If ambient concentrations more than 40% above the predicted concentrations from dispersion modelling are observed, an investigation should be conducted to determine the need for additional mitigation. Details are provided in the **AQMP**.

Air quality monitoring will be supported by a meteorological weather station that will be installed at the Mine Infrastructure Complex (MIC) or Explosive Facility to measure temperature, precipitation, snow amounts, wind speed, and direction. The meteorological station will consist of an instrument such as a RM Young 05305 wind sensor, installed at a height of 10 m above the ground, and programmed to automatically log data at hourly intervals. This will be supported by obtaining data from government weather stations in Smithers and Telkwa.

As described in the **AQMP**, a philosophy of adaptive management will be adopted to meet or exceed ambient air quality criteria and verify that proposed mitigation measures are effective. TCL will work towards continual improvement at the Project by reviewing the **AQMP** on an annual basis. This process will include a review of the air quality monitoring data, as well as any input received from Indigenous groups and other community members.

9. REFERENCES

American Society for Testing and Materials (ASTM). 2003. ASTM E1686-03, Standard Guide for Selection of Environmental Noise Measurements and Criteria, ASTM International, West Conshohocken, PA, 2003, www.astm.org.

American Society for Testing and Materials (ASTM). 2017. ASTM D1739-98 (2017), Standard Test Method for Collection and Measurement of Dustfall (Settleable Particulate Matter), ASTM International, West Conshohocken, PA, 2017, www.astm.org.

Benga Mining Ltd. 2016. Air Quality Assessment – Grassy Mountain Coal Project. Prepared by Millennium EMS Solutions Ltd. File #14-00201-01.

Blue Pearl Mining Inc. 2008. Davidson Project: Application for Environmental Assessment Certificate, Appendix D1 – Davidson Project Meteorology, Air Quality and Noise Baseline Study.

British Columbia Environmental Assessment Office (BC EAO). 2013. Guideline for the Selection of Valued Components and Assessment of Potential Effects. Available at: https://www2.gov.bc.ca/assets/gov/environment/natural-resource-stewardship/environmental-assessments/guidance-documents/eao-guidance-selection-of-valued-components.pdf. Accessed March 2020.

British Columbia Environmental Assessment Office (BC EAO). 2022. Tenas Project Application Information Requirements. Prepared by Telkwa Coal for the British Columbia Environmental Assessment Office. Vancouver, BC.

British Columbia Ministry of Environment (BC MOE). 2015. British Columbia Air Quality Dispersion Modelling Guideline. Available at: https://www2.gov.bc.ca/assets/gov/environment/air-land-water/air/reports-pub/bc-dispersion-modelling-guideline-2015.pdf. Accessed August 2021.

British Columbia Ministry of Environment and Climate Change Strategy (BC MECCS). 2015. British Columbia Air Quality Dispersion Modelling Guideline. Available at: https://www2.gov.bc.ca/assets/gov/environment/air-land-water/air/reports-pub/bc-dispersion-modelling-guideline-2015.pdf. Accessed September 2021.

British Columbia Ministry of Environment and Climate Change Strategy (BC MECCS). 2020a. British Columbia Ambient Air Quality Objectives. Updated February 28, 2020. Available at: https://www2.gov.bc.ca/assets/gov/environment/air-land-water/air/reports-pub/prov_aqo_fact_sheet.pdf. Accessed September 2021.

British Columbia Ministry of Environment and Climate Change Strategy (BC MECCS). 2020b. BC Air Data Archive Website. Available at: https://envistaweb.env.gov.bc.ca/. Accessed March 2020.

British Columbia Ministry of Environment and Climate Change Strategy (BC MECCS). 2020c. Dustfall Monitoring and Pollution Control Objectives. Available at: https://www2.gov.bc.ca/assets/gov/environment/waste-management/waste-discharge-authorization/guides/templates/gui-tec-041_dustfall_monitoring.pdf. Accessed November 2021.

British Columbia Oil and Gas Commission (BC OGC). 2018. British Columbia Noise Control Best Practices Guideline. Version 2.1. December 2018

Bulkley Valley Lakes District (BLVD). 2012. BLVD Airshed Management Plan: A Community Action Plan for Clean Air. Available at: https://cleanairplan.ca/old/cleanairplan2012.pdf. Accessed June 2021.

Coalspur Mines Ltd. 2012. Air Quality Assessment in Support of the EIA for Coalspur Mines Ltd. Vista Coal Mine Project. Prepared by Millennium EMS Solution Ltd. File #10-036.

Connor Pacific Environmental Technologies Inc. 1999. Air Quality Assessment for the Proposed Telkwa Mine. Prepared for Manalta Coal Ltd. Inc, March 1999.

Crossroads Cultural Resource Management (Crossroads). 2021. Tenas Project Cultural Use Study. Prepared for Telkwa Coal Ltd.

Environment and Climate Change Canada (ECCC). 2005. Best Practices for the Reduction of Air Emissions from Construction and Demolition Activities. Prepared by Cheminfo Services Inc.

Environment and Climate Change Canada (ECCC). 2020a. 1981-2010 Climate Normals & Averages. Available at https://climate.weather.gc.ca/climate_normals/index_e.html. Accessed June 2020.

Environment and Climate Change Canada (ECCC). 2020b. National Inventory Report 1990-2018: Greenhouse Gas Sources and Sinks in Canada. Canada's Submission to the United Nations Framework Convention on Climate Change. Available at: https://publications.gc.ca/collections/collection_2020/eccc/En81-4-2018-3-eng.pdf. Accessed September 2021.

Environment and Climate Change Canada (ECCC). 2020c. Greenhouse Gas Reporting Program (GHGRP) – Facility Greenhouse Gas (GHG) Data. Available at: https://open.canada.ca/data/en/dataset/a8ba14b7-7f23-462a-bdbb-83b0ef629823. Accessed April 2020.

Federation of Canadian Municipalities and Railway Association of Canada (FCM-RAC). 2013. Guidelines for New Development in Proximity to Railway Operations. Prepared by Dialog and J.E. Coulter Associates Ltd. Available at: http://proximityissue.wpengine.com/wp-content/uploads/2017/09/2013_05_29_Guidelines_NewDevelopment_E.pdf. Accessed June 2021.

Federation of Canadian Municipalities and Railway Association of Canada (FCM-RAC). 2017. Land Use Planning, Rail Proximity and Public Safety. Prepared by CPCS. Available at: https://tc.canada.ca/sites/default/files/migrated/appendix_f.pdf. Accessed June 2021.

Green Plan Ltd. 1998. Noise Impact Assessment, Telkwa Coal Project, Final Report. May 1998. Prepared for Manalta Coal Ltd. Prepared by Green Plan Ltd. Edmonton, Alberta.

Government of British Columbia (GovBC). 2002. *Environmental Assessment Act*, SBC 2002, c 43. Available at: https://www.bclaws.ca/civix/document/id/consol14/consol14/00_02043_01. Accessed November 2020.

Government of British Columbia (GovBC). 2003. *Environmental Management Act*, SBC 2003, c. 53. Available at: https://www.bclaws.gov.bc.ca/civix/document/id/complete/statreg/03053_00. Accessed April 2021.

Government of British Columbia (GovBC). 2007a. *Climate Change Accountability Act*, SBC 2007, c. 42. Available at: https://www.bclaws.gov.bc.ca/civix/document/id/lc/statreg/07042_01. Accessed April 2021.

Government of British Columbia (GovBC). 2007b. *Greenhouse Gas Reduction Targets Act*, SBC 2007, c. 42. Available at: https://www.bclaws.gov.bc.ca/civix/document/id/consol22/consol22/00_07042_01. Accessed April 2021.

Government of British Columbia (GovBC). 2014a. British Columbia Field Sampling Manual. Available at: https://www2.gov.bc.ca/gov/content/environment/research-monitoring-reporting/monitoring/laboratory-standards-quality-assurance/bc-field-sampling-manual. Accessed September 2021

Government of British Columbia (GovBC). 2014b. *Greenhouse Gas Industrial Reporting and Control Act*, SBC 2014, c. 29. Available at: https://www.bclaws.gov.bc.ca/civix/document/id/complete/statreg/14029_01. Accessed April 2021.

Government of Canada (GovCan). 1996. *Canada Transportation Act*, SC 1996, c. 10. Available at: https://laws-lois.justice.gc.ca/eng/acts/c-10.4/index.html. Accessed June 2021.

Health Canada. 2017. Guidance for Evaluating Human Health Impacts in Environmental Assessment: Noise. Available at: https://www.ceaa.gc.ca/050/documents/p80054/119378E.pdf. Accessed September 2021.

Lall, R., M. Kendall, K. Ito, and G.D. Thurston. 2004. Estimation of historical annual $PM_{2.5}$ exposures for health effects assessment. Atmospheric Environment, Volume 38, pp. 5217-5226.

Levelton Engineering Ltd. 2002. Air Quality Summary and Assessment, Bulkley Valley – Lakes District. Prepared for the Ministry of Water, Land and Air Protection, Skeena Region. Available at: https://www2.gov.bc.ca/assets/gov/environment/air-land-water/air/reports-pub/bvld_aqassess.pdf. Accessed April 2020.

Linehan, P and J. Wiss. 1980. Vibration and air blast noise from surface coal mine blasting. Conference: SME-AIME fall meeting and exhibition, Minneapolis, MN, USA, 22 Oct 1980.

Mining Data Online (MDO). 2020. Mining Data Solutions. Available at: https://miningdataonline.com/. Accessed April 2020.

Orchard, T. 2019-2020. Personal communication. Air Quality Meteorologist, British Columbia Ministry of Environment and Climate Chance Strategy. E-Mail. December 2019 to June 2020.

Pacific Climate Impacts Consortium (PCIC). 2020. BC Station Data. Available at https://www.pacificclimate.org/data/bc-station-data. Accessed March 2020.

Peace River Coal Inc. 2010. Roman Coal Mine Project Environmental Assessment Report. Available at: https://projects.eao.gov.bc.ca/p/58851142aaecd9001b81d310/project-details. Accessed September 2021.

Telkwa Coal Limited (TCL). 2019. Valued Component Scoping Document. Submitted to BC EAO. September 2019. Available at: https://projects.eao.gov.bc.ca/p/5b905af23965330024d5b706/project-details. Accessed September 2021.

Teck Coal Ltd. 2011. Line Creek Operations Phase II Project Environmental Assessment Certificate Application. Available at: https://projects.eao.gov.bc.ca/p/58851185aaecd9001b821677/project-details. Accessed September 2021.

Teck Coal Ltd. 2014. Fording River Operations Swift Project Environmental Assessment Certificate Application. Available at: https://projects.eao.gov.bc.ca/p/588511a6aaecd9001b823734/project-details. Accessed September 2021.

Teck Coal Ltd. 2015. Elkview Operations Baldy Ridge Extension Project. Available at: https://projects.eao.gov.bc.ca/p/588511e8aaecd9001b827a9b/project-details. Accessed September 2021.

Western Canadian Coal Corp. 2004. Wolverine Coal Project Environmental Assessment Additional Information Report. Available at: https://projects.eao.gov.bc.ca/p/58851085aaecd9001b811843/project-details. Accessed September 2021.

Western Canadian Coal Corp. 2005. Brule Mine Project – Brule Mine EA Certificate Application. Available at: https://projects.eao.gov.bc.ca/p/588510deaaecd9001b816eec/project-details. Accessed September 2021.