



BC EAO EAC Application – Tenas Project

Section 4.0 Environmental Effects Assessment

Chapter 9 Avian Species Valued Component

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Tenas Project

Section 4.0 Environmental Effects Assessment Chapter 9 Avian Species Valued Component

TABLE OF CONTENTS

Table of Contents	i
List of Figures.....	iv
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	2
2.1 Federal Legislation and Regulations.....	2
2.2 Provincial Legislation and Regulations	3
2.3 Strategies, Guidelines, Plans, and Best Management Practices (BMPs)	4
2.4 Land Use Plans.....	6
3. Scope of the Assessment	7
3.1 Issues Scoping.....	7
3.2 Rationale for Selection of the Avian Species Valued Component (VC)	7
3.2.1 Valued Component (VC).....	7
3.2.2 Subcomponents	8
3.2.2.1 Migratory Breeding Birds	8
3.2.2.2 Listed Bird Species	9
3.2.2.3 Raptors	9
3.2.3 Indicators.....	11
3.2.4 Assessment Boundaries	12
3.2.4.1 Spatial Boundaries.....	12
3.2.4.2 Temporal Boundaries	14
3.2.4.3 Administrative Boundaries	14
3.2.4.4 Technical Boundaries	15
4. Existing Conditions.....	16
4.1 Background Information and Studies.....	16
4.1.1 Traditional Knowledge (TK)	16
4.1.2 Scientific and Other Information.....	16

4.1.3	Baseline Studies	17
4.2	Description of Existing Conditions	19
4.2.1	Avian Species Habitat Overview	19
4.2.2	Migratory Breeding Birds Subcomponent	20
4.2.2.1	Landbird Species	20
4.2.2.2	Waterbird Species	24
4.2.3	Listed Bird Species Subcomponent	24
4.2.4	Raptors Subcomponent	29
5.	Assessment of Project-related Effects	31
5.1	Potential Project-related Interactions with the Avian Species Valued Component (VC)	31
5.2	Potential Project-related Effects.....	35
5.2.1	Alteration and/or Loss of Habitat.....	36
5.2.1.1	Construction Phase	36
5.2.1.2	Operation Phase	38
5.2.1.3	Decommissioning and Reclamation Phase	38
5.2.1.4	Post-closure Phase.....	38
5.2.2	Change in Mortality	39
5.2.2.1	Construction Phase	39
5.2.2.2	Operation Phase	41
5.2.2.3	Decommissioning and Reclamation Phase	42
5.2.2.4	Post-closure Phase.....	42
5.2.3	Change in Movement Patterns	42
5.2.3.1	Construction Phase	42
5.2.3.2	Operation Phase	43
5.2.3.3	Decommissioning and Reclamation Phase	43
5.2.3.4	Post-closure Phase.....	43
5.3	Mitigation Measures	44
5.3.1	Avoid Sensitive Environments	45
5.3.2	Limit Project Footprint and Project Area	45
5.3.3	Reclamation Measures	45
5.3.4	Project Footprint Boundaries	46
5.3.5	Transport Measures	46
5.3.6	Project Component Design	47
5.3.7	Blasting Measures	47
5.3.8	Coal Processing Measures	48
5.3.9	Seepage Management Measures.....	48
5.3.10	Water Capture Measures.....	48
5.3.11	Management of Metal Leaching/Acid Rock Drainage (ML/ARD)	49
5.3.12	People, Employees, Contractors, and Onsite Policy	50
5.3.13	Powerline Design and Siting	50

5.3.14	Timing Considerations	50
5.3.15	Establish “No Activity” Buffers Around Nests.....	51
5.3.16	Wildlife Education Program.....	51
5.3.17	Wildlife Protection Protocols	52
5.3.18	Manage Chemical Hazards.....	52
5.3.19	Manage Potential Attractants.....	52
5.3.20	Summary of Mitigation Measures	52
5.4	Residual Effects and Significance of Residual Effects	56
5.4.1	Description of Evaluation Criteria.....	56
5.4.1.1	Residual Effects Characteristics	56
5.4.1.2	Likelihood.....	58
5.4.1.3	Significance Determination	58
5.4.2	Migratory Breeding Birds Subcomponent	59
5.4.2.1	Alteration and/or Loss of Habitat	59
5.4.2.2	Change in Mortality.....	67
5.4.2.3	Change in Movement Patterns	71
5.4.3	Listed Bird Species Subcomponent.....	78
5.4.3.1	Alteration and/or Loss of Habitat	78
5.4.3.2	Change in Mortality.....	88
5.4.3.3	Change in Movement Patterns	94
5.4.4	Raptors Subcomponent	102
5.4.4.1	Alteration and/or Loss of Habitat	102
5.4.4.2	Change in Mortality.....	107
5.4.4.3	Change in Movement Patterns	111
5.5	Summary of Project-related Residual Adverse Effects and Significance	118
6.	Cumulative Effects Assessment (CEA).....	124
6.1	Potential Cumulative Effects	124
6.2	Additional Mitigation Measures	128
6.3	Cumulative Effects Characterisation of Significance	128
6.3.1	Alteration and/or Loss of Habitat.....	129
6.3.1.1	Cumulative Effect Characteristics.....	130
6.3.2	Change in Mortality	133
6.3.2.1	Cumulative Effect Characteristics.....	133
6.3.3	Change in Movement Patterns	137
6.3.3.1	Cumulative Effect Characteristics.....	137
6.4	Summary of Cumulative Effects Assessment (CEA)	141
7.	Summary of Effects Assessment For the Avian Species Valued Component (VC)	144
8.	Follow-up Strategy	145
9.	References.....	147

LIST OF FIGURES

Figure 3.2-1:	Spatial assessment boundaries for the Avian Species Valued Component.....	13
Figure 4.2-1:	Old/mature forest habitat suitability within the Avian Species Regional Study Area	21
Figure 4.2-2:	Early seral habitat suitability within the Avian Species Regional Study Area	22
Figure 4.2-3:	Wetland habitat suitability within the Avian Species Regional Study Area.....	23
Figure 4.2-4:	Common nighthawk habitat suitability within the Avian Species Regional Study Area.....	26
Figure 4.2-5:	Olive-sided flycatcher habitat suitability within the Avian Species Regional Study Area.....	27
Figure 4.2-6:	Short-eared owl habitat suitability within the Avian Species Regional Study Area	28
Figure 4.2-7:	Northern goshawk habitat suitability within the Avian Species Regional Study Area.....	30
Figure 5.4-1:	Overlap of the Project with suitable nesting habitat for Migratory Breeding Birds – wetlands	62
Figure 5.4-2:	Overlap of the Project with suitable nesting habitat for Migratory Breeding Birds – early seral.....	63
Figure 5.4-3:	Overlap of the Project with suitable nesting habitat for Migratory Breeding Birds – old/mature forest	64
Figure 5.4-4:	Overlap of the Project with suitable nesting habitat for common nighthawk	81
Figure 5.4-5:	Overlap of the Project with suitable nesting habitat for olive-sided flycatcher.....	82
Figure 5.4-6:	Overlap of the Project with suitable nesting habitat for short-eared owl.....	83
Figure 5.4-7:	Overlap of the Project with suitable nesting habitat for northern goshawk.....	104
Figure 6.1-1:	Projects and activities included in the Cumulative Effects Assessment for the Avian Species Valued Component	127

LIST OF TABLES

Table 2.1-1:	Summary of Federal Legislation and Regulations Applicable to the Avian Species Valued Component (VC)	2
Table 2.2-1:	Summary of Provincial Legislation and Regulations Applicable to the Avian Species Valued Component (VC)	3
Table 2.3-1:	Summary of Strategies, Guidelines, Plans, and Best Management Practices (BMPs) Applicable to the Avian Species Valued Component (VC)	4
Table 2.4-1:	Management Goals and Objectives Established in Land Use Plans Applicable to the Avian Species Valued Component (VC).....	6
Table 3.2-1:	Summary of Rationale for Selection of the Avian Species Valued Component (VC) Subcomponents and Their Linkages	10

Table 3.2-2:	Provincial and Federal Listings for Representative Species Selected to Inform the Assessment of the Avian Species Valued Component (VC)	11
Table 3.2-3:	Indicators for the Avian Species Valued Component (VC)	11
Table 3.2-4:	Spatial Boundary Definitions for the Avian Species Valued Component (VC)	12
Table 3.2-5:	Temporal Boundaries for the Tenas Project	14
Table 4.1-1:	Summary of Data Sources Reviewed as Part of Baseline Reporting for the Avian Species Valued Component (VC)	16
Table 4.1-2:	Summary of Baseline Studies and Habitat Suitability Models Completed for the Avian Species Valued Component (VC)	17
Table 5.1-1:	Potential for an Interaction between the Avian Species Valued Component (VC) and the Tenas Project (Project)	31
Table 5.1-2:	Interactions between the Avian Species Valued Component (VC) and the Tenas Project	32
Table 5.2-1:	Ecological Receptor Benchmarks for the Water Ingestion Exposure Route	40
Table 5.2-2:	Screening of Water Quality Parameters Against Aquatic Life, Wildlife, Livestock Guidelines, and Site Performance Objectives	41
Table 5.3-1:	Summary of Potential Effects and Mitigation Measures for the Avian Species Valued Component (VC)	53
Table 5.4-1:	Effect Characteristics Considered when Determining the Significance of Residual Effects on the Avian Species Valued Component (VC)	56
Table 5.4-2:	Summary of Change in Suitable Nesting Habitat for Migratory Breeding Birds	61
Table 5.4-3:	Summary of Residual Effect Characteristics for Alteration and/or Loss of Habitat on Migratory Breeding Birds Subcomponent	66
Table 5.4-4:	Summary of Residual Effect Characteristics for Change in Mortality on Migratory Breeding Birds Subcomponent	70
Table 5.4-5:	Summary of Residual Effect Characteristics for Change in Movement Patterns on Migratory Breeding Birds Subcomponent	76
Table 5.4-6:	Summary of Change in Suitable Nesting Habitat for Listed Bird Species Subcomponent	80
Table 5.4-7:	Summary of Residual Effect Characteristics for Alteration and/or Loss of Habitat on Listed Bird Species	86
Table 5.4-8:	Summary of Residual Effect Characteristics for Change in Mortality on Listed Bird Species Subcomponent	93
Table 5.4-9:	Summary of Residual Effect Characteristics for Change in Movement Patterns on Listed Bird Species Subcomponent	100
Table 5.4-10:	Summary of Change in Suitable Nesting Habitat for Raptors Subcomponent	103
Table 5.4-11:	Summary of Residual Effect Characteristics for Alteration and/or Loss of Habitat on Raptors Subcomponent	106

Table 5.4-12:	Summary of Residual Effect Characteristics for Change in Mortality on Raptors Subcomponent	110
Table 5.4-13:	Summary of Residual Effect Characteristics for Change in Movement Patterns on Raptors Subcomponent	117
Table 5.5-1:	Summary of Residual Adverse Effects on the Avian Species Valued Component (VC)	119
Table 6.1-1:	Projects and Activities Included in the Cumulative Effects Assessment (CEA) for the Avian Species Valued Component (VC) Based on Spatial and Temporal Interaction	125
Table 6.3-1:	Summary of the Cumulative Effects Characterisation for Alteration and/or Loss of Habitat on the Avian Species Valued Component (VC)	132
Table 6.3-2:	Summary of the Cumulative Effects Characterisation for Change in Mortality on the Avian Species Valued Component (VC)	136
Table 6.3-3:	Summary of the Cumulative Effects Characterisation for a Change in Movement Patterns on the Avian Species Valued Component (VC)	140
Table 6.4-1:	Summary of Cumulative Effects on the Avian Species Valued Component (VC)	142

LIST OF APPENDICES

Appendix 4.9-A Avian Baseline Report

ABBREVIATIONS AND ACRONYMS

Abbreviation or Acronym	Long Form of Abbreviation or Acronym
AIR	Application Information Requirements
APLIC	Avian Power Line Interaction Committee
AQMP	Air Quality Management Plan (S13.0-C2)
ARD	acid rock drainage
BC	British Columbia
BC EAO	British Columbia Environmental Assessment Office
BC MAL	British Columbia Ministry of Agriculture and Lands
BC MECCS	British Columbia Ministry of Environment and Climate Change Strategy
BC MEMLI	British Columbia Ministry of Energy, Mines and Low Carbon Innovation
BC MFLNRO	British Columbia Ministry of Forests, Lands and Natural Resource Operations
BC MFLNRORD	British Columbia Ministry of Forests, Lands, Natural Resource Operations and Rural Development
BC MOE	British Columbia Ministry of Environment
BC MOTI	British Columbia Ministry of Transportation and Infrastructure
BC MWLAP	British Columbia Ministry of Water, Land and Air Protection
BEC	Biogeoclimatic Ecosystem Classification
BGC	biogeoclimatic
BMP	best management practice
C	Chapter
CBC	Christmas Bird Count
CCME	Canadian Council of Ministers of the Environment
CEA	cumulative effects assessment
CEMP	Construction Environmental Management Plan (S13.0-C4)
CMSTHP	Chemicals and Materials, Storage, Transfer, and Handling Plan (S13.0-C3)
COPC	contaminant of potential concern
COSEWIC	Committee on the Status of Endangered Wildlife in Canada
CPP	Coal Processing Plant
CUS	Cultural Use Study
DMP	Discharge Management Plan (S13.0-C5)
EA	environmental assessment
EAA	<i>Environmental Assessment Act</i> , SBC 2002, c 43 (Government of British Columbia [GovBC] 2002)
EAC	Environmental Assessment Certificate
ECCC	Environment and Climate Change Canada

Abbreviation or Acronym	Long Form of Abbreviation or Acronym
EMA	<i>Environmental Management Act</i> , SBC 2003, c. 53 (Government of British Columbia [GovBC] 2003)
EMP	Explosives Management Plan (S13.0-C6)
ESSFmc	Engelmann Spruce – Subalpine Fir Moist Cold
FMSCP	Fuel Management and Spill Control Plan (S13.0-C7)
FRPA	<i>Forest and Range Practices Act</i> , SBC 2002, c 69 (Government of British Columbia [GovBC] 2002b)
FSR	Forest Service Road
GovBC	Government of British Columbia
GovCan	Government of Canada
HSI	habitat suitability index
LSA	Local Study Area
MERP	Mine Emergency Response Plan (S13.0-C9)
ML	metal leaching
ML/ARDMP	Metal Leaching (ML)/Acid Rock Drainage (ARD) Management Plan (S13.0-C12)
MTCP	Minesite Traffic Control Plan (S13.0-C10)
MWMP	Minesite Water Management Plan (S13.0-C11)
non-PAG	non potentially acid generating
PAG	potentially acid generating
PAMP	Public Access Management Plan (S13.0-C14)
PEM	Predictive Ecosystem Mapping
Project	Tenas Project
QP	Qualified Professional
RCP	Reclamation and Closure Plan (S13.0-C15)
RDBN	Regional District of Bulkley-Nechako
ROM	run-of-mine
ROW	right-of-way
RSA	Regional Study Area
S	Section
SARA	<i>Species at Risk Act</i> , SC 2002, c 29 (Government of Canada [GovCan] 2002c)
SBSdk	Sub-Boreal Spruce Dry Cool
SBSmc2	Sub-Boreal Spruce Babine Moist Cold
SEMP	Socio-economic Management Plan (S13.0-C16)
SEPSCP	Surface Erosion Prevention and Sediment Control Plan (S13.0-C17)
TAC	Tenas Access Corridor
TCL	Telkwa Coal Limited

Abbreviation or Acronym	Long Form of Abbreviation or Acronym
TEM	Terrestrial Ecosystem Mapping
TK	Traditional Knowledge
TSA	timber supply area(s)
UV	ultraviolet
VC	Valued Component
VMP	Vegetation Management Plan (S13.0-C18)
WHA	Wildlife Habitat Area
WMP	Wildlife Management Plan (S13.0-C21)
WMPRE	Waste Management Plan for Refuse and Emissions (S13.0-C20)
ZOI	zone of influence

UNITS OF MEASURE

Abbreviation	Long form of Abbreviation or Acronym
°C	degrees Celsius
%	percent
>	greater than
dBA	A-weighted decibels
ha	hectares
km	kilometre
km ²	square kilometres
km/h	kilometres per hour
kV	kilovolt
m	metre
m ³	cubic metre
V	volt

EXECUTIVE SUMMARY

This chapter addresses the potential effects of the Tenas Project (Project) on the Avian Species Valued Component (VC). Avian Species as a VC includes the collection of avian species that occur on the landscape. Avian Species was selected as a VC based on the likelihood of interaction with the Project, federal and provincial government management obligations, and its contributing role to biodiversity and ecosystem function. Avian species contribute to environmental, socio-economic, and cultural values of Indigenous groups, the public, and stakeholders.

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**. The Avian Species VC is divided into three (3) subcomponents:

1. Migratory Breeding Birds;
2. Listed Bird Species; and
3. Raptors;

The assessment of subcomponents was based on evaluating three (3) indicators: change in habitat, including direct and indirect disturbance (including sensory disturbance), change in mortality, and change in movement patterns measured quantitatively where data allowed otherwise measured qualitatively.

Potential adverse effects of the Project on the Avian Species VC subcomponents include the following:

- ▶ alteration and/or loss of habitat;
- ▶ change in mortality; and
- ▶ change in movement patterns.

Alteration of habitat is defined as indirect habitat alteration (i.e., habitat fragmentation, edge effects, and sensory disturbance) where suitable habitat for avian species remains physically intact but is rendered less suitable or unsuitable for avian use (i.e., reduced use or avoidance). Loss of habitat is defined as direct habitat loss where suitable habitat for avian species is physically disturbed to the extent that it is rendered functionally unsuitable for avian use. Change in mortality is defined as a change in the abundance of avian species due to direct and indirect sources of mortality. Change in movement patterns is defined as a change in the daily and seasonal movement patterns of avian species through the displacement of individuals due to direct (i.e., habitat loss) and indirect (i.e., habitat alteration) Project effects or the attraction of individuals to Project components that may support life requisites (e.g., food, cover, breeding, migration).

Mitigation measures to address the potential adverse effects of the Project on the Avian Species VC are described herein. They include mitigation measures developed by Telkwa Coal Limited (TCL) that have been incorporated in the Project's design and/or operational procedures and additional mitigation measures specific to the Avian Species VC. These mitigation measures are based on proven and accepted mitigation used on other similar approved projects in British Columbia (BC) (e.g., Red Mountain Underground Gold, Blackwater Gold) that had similar potential adverse effects on avian species, as well as standard industry guidelines and best management practices (BMPs). The mitigation measures implemented during all Project phases are expected to limit the potential adverse effects of the Project on the Avian Species VC; however, these effects are not anticipated to be fully mitigated and residual effects (i.e., effects remaining after consideration of mitigation measures and management strategies) of the Project on the Avian Species VC subcomponents are anticipated. These residual effects were carried forward in the assessment.

The Project-related residual effects on Migratory Breeding Birds, Listed Bird Species, and Raptors subcomponents were predicted to be **Not Significant**. Considering this, the Project is not expected to result in a change to the Avian Species VC and is not expected to alter avian population viability or persistence within the Avian Species Regional Study Area (RSA) beyond an acceptable level (i.e., the composition and population of the Avian Species VC are expected to remain sustainable and available to contribute to biodiversity and ecosystem function) and the Project-related residual effects on the Avian Species VC are predicted to be **Not Significant**.

All Project-related residual effects were carried forward into the cumulative effects assessment (CEA) and were assessed in relation to their overlap in time and space with the comparable residual effects of other projects and activities within the Avian Species RSA. Cumulative effects are expected to occur but are not expected to alter avian population viability or persistence within the Avian Species RSA beyond an acceptable level (i.e., the composition and population of the Avian Species VC are expected to remain sustainable and available to contribute to biodiversity and ecosystem function). Future forestry activities are anticipated to have the greatest contribution to cumulative effects on the Avian Species VC; however, this is expected to be mitigated with the implementation of provincial and regional biodiversity and old growth forest management objectives. As such, the cumulative effects on the Avian Species VC are predicted to be **Not Significant**. The Level of Confidence for these predictions is Moderate. No additional mitigation is deemed necessary. Follow-up programs (i.e., to verify the accuracy of the Project-related residual effects and cumulative effects predictions) specific to the Avian Species VC are not warranted at this time.

1. INTRODUCTION

This chapter presents the assessment of the residual adverse effects of the Project and the cumulative effects on the Avian Species Valued Component (VC) in a thorough, rigorous, and concise manner. For this Environmental Assessment Certificate (EAC) Application for the Tenas Project (Project), the Avian Species VC includes the following subcomponents:

- ▶ Migratory Breeding Birds,
- ▶ Listed Bird Species; and
- ▶ Raptors.

This assessment is comprised of the following steps:

- ▶ **Regulatory Context:** A description of the applicable legislation, policies, standards, and guidelines pertaining to the protection of the Avian Species VC;
- ▶ **Scope of the Assessment:** A description of the assessment scope including issues scoping, rationale for the selection of the Avian Species VC, subcomponents and indicators, and definition spatial and temporal boundaries of the assessment;
- ▶ **Existing Conditions:** A description of the baseline studies undertaken for the Project, other relevant information, and descriptions of the Avian Species VC within the defined spatial boundaries;
- ▶ **Assessment of Project-related Effects:** A description of the potential interactions between the Project and the Avian Species VC, potential adverse effects, proposed mitigation measures, an evaluation of potential residual effects that remain following implementation of the proposed mitigation measures, and an assessment of residual effects including characterisation of significance;
- ▶ **Cumulative Effects Assessment (CEA):** A characterisation of the cumulative effects on the Avian Species VC and their significance 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 and, (if/where necessary) the development of additional mitigation measures;
- ▶ **Follow-up Strategy:** A presentation of monitoring programs to verify assessment predictions and evaluate mitigation effectiveness, and a discussion of adaptive management program(s) to be implemented to address any unexpected Project effects on the Avian Species VC.

2. REGULATORY CONTEXT

This EAC Application has considered applicable federal and provincial legislation, regulations, strategies, guidelines, plans, and best management practices (BMPs) relevant to the Avian Species 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 EAC Application for the Avian Species VC to meet the provincial environmental assessment (EA) requirements under the BC *Environmental Assessment Act*, SBC 2002, c 43 (Government of British Columbia [GovBC] 2002a). The EAC Application for the Avian Species VC follows these guidelines and legislated requirements and is consistent with the requirements of the Project AIR. Legislation specific to the Avian Species VC, and descriptions of the data requirements to assess the environmental effects, are presented in the following subsections.

2.1 Federal Legislation and Regulations

The Pacific/Yukon region of Environment and Climate Change Canada (ECCC) administers or shares responsibility for several Acts addressing legislation directly or indirectly applicable to the Avian Species VC. Federal legislation and regulations applicable to the Project and relevant to the Avian Species VC are summarized in **Table 2.1-1**.

Table 2.1-1: Summary of Federal Legislation and Regulations Applicable to the Avian Species Valued Component (VC)

Name	Year	Description
<i>Canadian Environmental Protection Act</i> , SC 1999, c 33 (Government of Canada [GovCan] 1999).	1999	The Act focuses on protecting environmental and human health by preventing, controlling, and managing pollutants, wastes, and other toxic substances and by contributing to sustainable development (Government of Canada [GovCan] 2019).
<i>Migratory Birds Convention Act</i> , 1994, S.C. 1994, c. 22 (GovCan 1994a).	1994	The Act protects and conserves migratory birds (as individuals and populations), their eggs, and their nests in Canada through the implementation of the Migratory Birds Regulations, CRC, c 1035 (GovCan 1994b) and the Migratory Birds Sanctuary Regulations, CRC, c 1036 (GovCan 1994c). Removal of migratory birds, their eggs, or nests from a site is only permissible if the migratory birds are causing or may cause damage to property and equipment (subject to permitting). Deposit of substances harmful to birds in areas or waters frequently visited by migratory birds is prohibited.
<i>Species at Risk Act</i> , SC 2002, c 29 (GovCan 2002) (SARA)	2002	SARA provides for the legal protection of plant and wildlife species to conserve their biological diversity and prevent extirpation or extinction (GovCan 2016). Under SARA, the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) identifies and assesses plant and wildlife species considered at risk, which may then qualify for legal protection and recovery under SARA. Once listed under Schedule 1 of SARA, species management or recovery plans are legal requirements to secure the necessary actions for species management and recovery. Management plans and recovery strategies have been developed for the following SARA-listed species that may occur within the Tenas Project Area:

Name	Year	Description
		- Management Plan for the Rusty Blackbird (<i>Euphagus carolinus</i>) in Canada (Environment Canada 2015) - Management Plan for the Short-eared Owl (<i>Asio flammeus</i>) in Canada (Environment and Climate Change Canada [ECCC] 2018) - Recovery Strategy for the Common Nighthawk (<i>Chordeiles minor</i>) in Canada (Environment Canada 2016a) - Recovery Strategy for the Olive-sided Flycatcher (<i>Contopus cooperi</i>) in Canada (Environment Canada 2016b)

2.2 Provincial Legislation and Regulations

The British Columbia Ministry of Forests, Lands, Natural Resource Operations and Rural Development (BC MFLNRORD) is responsible for managing avian species and their habitats within the region containing the Project. The spatial assessment boundaries for the Avian Species VC are located within the Regional District of Bulkley-Nechako (RDBN) in the Skeena Region (Region 6). Provincial legislation and regulations applicable to the Project and relevant to the Avian Species VC are summarized in **Table 2.2-1**.

Table 2.2-1: Summary of Provincial Legislation and Regulations Applicable to the Avian Species Valued Component (VC)

Name	Year	Description
<i>Ecological Reserve Act</i> , RSBC 1996, c. 103 (Government of British Columbia [GovBC] 1996b).	1996	The Act provides for the establishment and administration of ecological reserves, which may be created to protect and preserve species at risk and their habitats (British Columbia [BC] Parks 2019). Two (2) ecological reserves occur within the spatial assessment boundaries for the Avian Species Valued Component (VC): the Burnt Cabin Bog Ecological Reserve and the Det San Ecological Reserve (British Columbia Ministry of Environment and Climate Change Strategy [BC MECCS] 2020).
<i>Environmental Assessment Act</i> , SBC 2002, c. 43 (GovBC 2002a) (EAA).	2002	The EAA provides a mechanism for the Province of British Columbia (BC) to review all major projects proposed in BC to assess for any potentially adverse environmental, economic, social, heritage, or health effects (Government of British Columbia [GovBC] 2020a). The Tenas Project (Project) requires an assessment of potential adverse environmental effects under the Reviewable Projects Regulation, BC Reg 243/2019 (GovBC 2019) of the EAA because the Project exceeds a production capacity of 250,000 tonnes per year.
<i>Environmental Management Act</i> , SBC 2003, c. 53 (GovBC 2003) (EMA).	2003	The EMA regulates pollution, hazardous waste, contaminated site remediation, and the discharge of municipal and industrial waste to the environment while ensuring the protection of human health and the environment (GovBC 2020b). The Contaminated Sites Regulations, BC Reg 375/96 (GovBC 1996a) of the EMA provide quantitative standards to define site contamination and to evaluate reclamation success.
<i>Forest and Range Practices Act</i> , SBC 2002, c 69 (GovBC 2002b) (FRPA).	2002	The FRPA outlines standards and requirements for how forest and range practices and natural resource activities should be conducted on Crown land in BC in a manner that protects natural resources, including avian species (GovBC 2020c). Mechanisms under FRPA that protect species at risk include Wildlife Habitat Areas (WHAs). A WHA is an area of habitat that is critical to meeting the habitat requirements of an Identified Wildlife species (British Columbia Ministry of Environment [BC MOE] 2020). Within a WHA, activities are managed to minimize adverse effects to Identified Wildlife (BC MOE 2020). The spatial assessment boundaries for the Avian Species VC do not overlap any approved WHAs for avian species.

Name	Year	Description
<i>Mines Act</i> , RSBC 1996, c 293 (GovBC 1996c).	1996	The Act and accompanying Health, Safety and Reclamation Code for Mines in British Columbia (British Columbia Ministry of Energy, Mines and Low Carbon Innovation [BC MEMLI] (2017) (Code) includes provisions for the protection of land and watercourses by minimizing the environmental risks associated with mining activities, in addition to reclamation requirements for disturbed areas.
<i>Water Sustainability Act</i> , SBC 2014, c 15 (GovBC 2014a).	2014	The Act manages the diversion and use of water resources in BC and is intended to ensure a sustainable supply of fresh, clean water for BC residents at present and into the future (GovBC 2020d).
<i>Wildlife Act</i> , RSBC 1996, c 488 (GovBC 1996d).	1996	The Act defines wildlife as all native (and some non-native) amphibians, birds, mammals, and reptiles that live in BC (British Columbia Ministry of Forests, Lands and Natural Resource Operations [BC MFLNRO] 2020). The Act provides for the protection, conservation, and management of wildlife populations and habitats within BC (GovBC 2020e). Under Section 34 of the Act, it is an offence to possess, take, injure, molest, or destroy a bird, its egg(s), or a nest that is occupied by a bird or its egg(s), except as provided by regulation. The nests of certain species ¹ are protected regardless of whether they are occupied, except as provided by regulation. Wildlife species can be legally designated as endangered, threatened, or special concern under the Act, which enables penalties for killing or harming wildlife, or the establishment of Critical Wildlife Habitats in WHAs. ¹ Eagle, peregrine falcon (<i>Falco peregrinus</i>), gyrfalcon (<i>Falco rusticolus</i>), osprey (<i>Pandion haliaetus</i>), heron, or burrowing owl (<i>Athene cunicularia</i>).

2.3 Strategies, Guidelines, Plans, and Best Management Practices (BMPs)

Strategies, guidelines, plans, and BMPs applicable to the Project and relevant to the Avian Species VC are summarized in **Table 2.3-1**. These documents were considered when identifying the potential effects of the Project, developing appropriate mitigation measures, and characterising Project residual effects and cumulative effects.

Table 2.3-1: Summary of Strategies, Guidelines, Plans, and Best Management Practices (BMPs) Applicable to the Avian Species Valued Component (VC)

Name	Year	Description
A Compendium of Wildlife Guidelines for Industrial Development Projects in the North Area, British Columbia – Interim Guidance (British Columbia Ministry of Forests, Lands and Natural Resource Operations [BC MFLNRO] 2014a)	2014	These guidelines provide direction for considering and mitigating threats to wildlife and wildlife habitat in the North Area (i.e., Peace, Omineca, and Skeena regions) during industrial activities.
A Scientific Basis for Managing Northern Goshawk Breeding Areas in the Interior of British Columbia: Best Management Practices (Stuart-Smith et al. 2012)	2012	These best management practices (BMPs) provide direction for northern goshawk breeding habitat management in the interior of British Columbia (BC).
Canadian Biodiversity Strategy (Government of Canada [GovCan] 1995)	1995	The three (3) objectives of this strategy are the conservation of biodiversity, the sustainable use of biological resources, and the fair and equitable sharing of the benefits that result from the use of genetic resources.

Name	Year	Description
Conservation Framework: Conservation Priorities for Species and Ecosystems Primer (British Columbia Ministry of Environment [BC MOE] 2009)	2009	A science-based framework designed to prioritize species and ecosystems for conservation, select effective conservation actions, and coordinate management actions. Results are used to advise conservation programs for a variety of stakeholders and organizations.
Develop With Care 2014: Environmental Guidelines for Urban and Rural Land Development in British Columbia: Section 4 (GovBC 2014b)	2014	These guidelines provide province-wide direction for maintaining environmentally valuable resources during urban and rural land development. Environmentally valuable resources include species, features, or environmentally valuable resource locations that enhance the biodiversity of an area; these may include common or rare species or habitats.
Environmental Assessment Best Practice Guide for Wildlife at Risk in Canada (Environment Canada 2004)	2004	This best practice guide for considering plant and wildlife species at risk in environmental assessment (EA) provides best practice guidelines, key sources of information, policy commitments and laws, and a discussion of the implications of the federal <i>Species at Risk Act</i> , SC 2002, c 29 (GovCan 2002) (SARA).
Guidelines for Raptor Conservation during Urban and Rural Land Development in British Columbia (GovBC 2013)	2014	These guidelines help maintain raptor populations and habitats during urban and rural land development in BC (Caskey and Chutter 2013). The document is a companion document to Develop With Care 2014: Environmental Guidelines for Urban and Rural Land Development in British Columbia: Section 4 (GovBC 2014b).
Identified Wildlife Management Strategy – Accounts and Measures for Managing Identified Wildlife: Northern Interior Forest Region (British Columbia Ministry of Water, Land and Air Protection [BC MWLAP] 2004a)	2004	This strategy summarizes the status, life history, distribution, and habitat requirements of identified species and plant communities, and outlines specific guidelines for habitat conservation and management.
Identified Wildlife Management Strategy – Procedures for Managing Identified Wildlife (BC MWLAP 2004b)	2004	The strategy describes the procedures for establishing, modifying, and rescinding a Wildlife Habitat Area (WHA), and for implementing strategic and landscape level planning recommendations.
Policy for Mitigating Impacts on Environmental Values (BC MOE 2014a)	2014	This policy provides guidance for decisions concerning environmental mitigation measures. It incorporates environmental, social, and economic values, encourages use of the best available data and data sharing, and provides a recommended mitigation hierarchy and mitigation process and plan.
Procedures for Mitigating Impacts on Environmental Values (BC MOE 2014b)	2014	These procedures outline recommended guidance and approaches for implementing the policy described above. The procedures describe how to select valued components, conduct environmental assessments (EAs), apply the mitigation hierarchy, and complete mitigation and monitoring plans.
Protecting Vulnerable Species: A Five-Year Plan for Species at Risk in British Columbia (GovBC 2014c)	2014	This plan works to manage and protect species at risk in British Columbia (BC) while balancing economic, environmental, and community values. This plan outlines five (5) main goals and recommends strategic action items to achieve these goals.

Name	Year	Description
Reducing Avian Collisions with Power Lines: The State of the Art in 2012 (Avian Power Line Interaction Committee [APLIC] 2012)	2012	This document provides recommendations for reducing avian collisions with powerlines.
Science-Based Guidelines for Managing Northern Goshawk Breeding Areas in Coastal British Columbia (McClaren et al. 2015)	2015	These guidelines provide direction for northern goshawk breeding habitat management in BC.
Suggested Practices for Avian Protection On Power Lines: The State of the Art in 2006 (APLIC 2006)	2006	This document provides suggested practices for avoiding or mitigating electrocution risk for avian species on powerlines.

2.4 Land Use Plans

The spatial assessment boundaries for the Avian Species VC are located within lands governed by the Bulkley Land and Resource Management Plan (LRMP) (Government of British Columbia [GovBC] 1998), the Bulkley Valley Sustainable Resource Management Plan (British Columbia Ministry of Agriculture and Lands [BC MAL] 2005), and the Morice Land and Resource Management Plan (BC MAL 2007). Together, these land use plans describe resource management goals and objectives for wildlife, including avian species (**Table 2.4-1**). These management goals and objectives were considered in the development of mitigation measures described in **5.3**.

Table 2.4-1: Management Goals and Objectives Established in Land Use Plans Applicable to the Avian Species Valued Component (VC)

Land Use Plan	Avian Resource	Goal	Objective
Bulkley Land and Resource Management Plan (LRMP) (GovBC 1998)	Wildlife	Maintain wildlife habitat diversity	Maintain a wildlife corridor (for wetlands)
Bulkley Valley Sustainable Resource Management Plan (British Columbia Ministry of Agriculture and Lands [BC MAL] 2005)	Nothing specific to avian species	n/a	n/a
Morice Land and Resource Management Plan (BC MAL 2007)	Northern goshawk	Protection of known nest sites	Buffer around nest trees; limitations on nearby industrial activities during nesting and fledging seasons

Notes: n/a=not available

3. SCOPE OF THE ASSESSMENT

The assessment of the Wildlife VC, including 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 this **EAC Application**.

The subsection outlines the scope of the assessment, including the rationale for the inclusion of Avian Species as a VC along with its subcomponents, the selection of indicators, and the definition of spatial and temporal boundaries. The assessment is informed by the **Avian Species Baseline Study** presented in **Appendix 4.9-A**, as well as input from Indigenous groups, the public and government agencies through working groups and comment solicitation, which identified the importance of Avian Species and aided in identifying specific species and mechanisms of effects. This assessment is organized into three (3) subcomponents: Migratory Breeding Birds, Listed Bird Species, and Raptors (**3.2.2 Subcomponents**).

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** and **S12.0 Public Consultation** of the **EAC Application** for details). The 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 of interest.

3.2 Rationale for Selection of the Avian Species Valued Component (VC)

The Avian Species VC and associated subcomponents were selected during the pre-Application phase of the Project following the VC selection process outlined in **S3-Chapter (C) 1-2.4.1 Selection of Valued Components** of the **EAC Application** and used the methodology provided in Guideline for the Selection of Valued Components and Assessment of Potential Effects (BC EAO 2013). The goal was to focus on relevant issues, concerns, and components of the natural and human environment that may be affected by the Project. Baseline study findings; conservation status; review of applicable government legislation, policies, and plans; effects assessments for other relevant projects; professional judgement of the EA team; and input from Working Group members, government agencies, Indigenous groups, the public, and other interested parties during consultation were considered and used to inform the selection of VCs and subcomponents. Inclusion of species at risk and migratory birds was a theme due to their legal context within the *Species at Risk Act*, SC 2002, c 29 (Government of Canada [GovCan] 2002c) (SARA) and *Migratory Birds Convention Act*, 1994, SC 1994, c 22 (GovCan 1994a).

3.2.1 Valued Component (VC)

Avian Species were selected as a VC based on the likelihood of interaction with the Project, federal and provincial management concerns, and the contributing role of avian species to biodiversity and ecosystem function. Avian species also contribute to environmental, socio-economic, and cultural values of Indigenous groups, regulators, the public, and other stakeholders.

The Avian Species VC is dependent on, and supports, the following VCs:

► **Dependent on:**

- **Aquatic Resources VC (S4.0-C5)** – Aquatic resources can provide habitat for feeding, nesting, rearing, and/or cover for certain avian species;

- ▶ **Atmospheric Environment VC (S4.0-C1)** – Air quality and noise can affect the suitability of any habitat that is used by avian species;
- ▶ **Fish and Fish Habitat VC (S4.0-C6)** – Fish and fish habitat can provide resources used for feeding, nesting, rearing, and/or cover by certain avian species;
- ▶ **Groundwater VC (S4.0-C4)** – Groundwater can be linked to aquatic resources and fish and fish habitat depending on hydrological connectivity;
- ▶ **Land and Resource Use VC (S6.0-C4)** – Avian species are a component of land and resource use through hunting of certain species;
- ▶ **Surface Water VC (S4.0-C3)** – Avian species can be exposed to surface water, which can provide habitat for feeding, nesting, rearing, and/or cover for certain avian species;
- ▶ **Terrain and Soils VC (S4.0-C2)** – Terrain and soils are important components of the habitat types used by various avian species;
- ▶ **Vegetation VC (S4.0-C7)** – Vegetation is an important component of the habitat types used by various avian species;
- ▶ **Visual Resources VC (S6.0-C2)** – Effects on visual resources can result in indirect effects on habitat, thereby affecting its suitability for use by avian species; and
- ▶ **Wildlife VC (S4.0-C8)** – Avian species may prey on certain wildlife species, thereby affecting habitat use.
- ▶ **Supporting:**
 - ▶ **Heritage Resources VC (S7.0-C1)** – Lands traditionally used are expected to include areas supporting avian species that were harvested for food, either seasonally or year-round;
 - ▶ **Human Health VC (S8.0-C1)** – Avian species have been, and continue to be, harvested for food, and as such, are part of the exposure pathway from environment to avian species to humans;
 - ▶ **Land and Resource Use VC (S6.0-C4)** – Avian species are harvested for food, either seasonally or year-round; and
 - ▶ **Wildlife VC (S4.0-C8)** – Avian species can be a food source for certain wildlife species, either seasonally or year-round.

3.2.2 Subcomponents

Subcomponents have been selected to focus assessment of the Avian Species VC on species groups of interest identified through consultation and engagement, and review of information. These ecologically important and/or sensitive species groups are expected to reflect potential Project-related effects on the Avian Species VC. Subcomponents of the Avian Species VC include Migratory Breeding Birds, Listed Bird Species, and Raptors. Representative habitat guilds or avian species were selected to inform the assessment for each subcomponent (**Table 3.2-1**).

3.2.2.1 Migratory Breeding Birds

The Migratory Breeding Birds subcomponent encompasses migratory species known to occur within the Avian Species Regional Study Area (RSA) such as passerines (i.e., songbirds) and a variety of waterbird and shorebird species (e.g., ducks, geese, swans, cranes, sandpipers, plovers). Habitat guilds were used to group migratory species for the purpose of developing habitat suitability models to inform the assessment of the Migratory Breeding Birds subcomponent. Migratory species were placed into habitat guilds based on known nesting habitat associations, which are intended to represent the dominant nesting habitats within the Avian Species RSA. These include wetlands, young forest/grasslands (hereafter referred to as early seral), and old/mature forest.

3.2.2.2 Listed Bird Species

Avian species listed under Schedule 1 of SARA that are known to occur in the Avian Species RSA were selected to inform the assessment of the Listed Bird Species subcomponent. These species include bank swallow (*Riparia riparia*), barn swallow (*Hirundo rustica*), black swift (*Cypseloides niger*), common nighthawk (*Chordeiles minor*), olive-sided flycatcher (*Contopus cooperi*), rusty blackbird (*Euphagus carolinus*), and short-eared owl (*Asio flammeus*) (**Table 3.2-2**). Some of these species are also of provincial management concern.

3.2.2.3 Raptors

Northern goshawk (*Accipiter gentilis atricapillus*) and short-eared owl were selected to inform the assessment of the Raptors subcomponent. Northern goshawk is a species of provincial management concern and short-eared owl is listed under Schedule 1 of SARA (**Table 3.2-2**). Northern goshawk was chosen as a proxy to represent raptor species that nest in forest habitats and short-eared owl was chosen as a proxy to represent raptor species that nest in open habitats. Although northern goshawk and short-eared owl may not be representative of all forest and open nesting raptors known to occur in the Avian Species RSA, they were selected as a proxy for effects on the Raptors subcomponent because northern goshawks and short-eared owls are sensitive to clearing activities and sufficient information is available for each species to facilitate development of a habitat suitability model, particularly for northern goshawk (Mahon and Doyle 2003, BC MAL 2007, Mahon 2009, Stuart-Smith et al. 2012).

Table 3.2-1: Summary of Rationale for Selection of the Avian Species Valued Component (VC) Subcomponents and Their Linkages

Subcomponent	Rationale for Inclusion	Source of Information	Valued Component (VC) Linkages	
Migratory Breeding Birds - Wetlands - Early seral - Old/mature forest	- Potential for Project interaction - Federal management concern - Contribute to biodiversity and ecosystem function - Cultural importance - Historic and recent observed use within the Tenas Project (Project) Area - Historically addressed for previous projects with similar conditions	- Federal <i>Migratory Birds Convention Act 1994</i>, S.C. 1994, c. 22 (Government of Canada [GovCan] 1994a) - Issues scoping	Dependent on: - Aquatic Resources - Atmospheric Environment - Fish and Fish Habitat - Groundwater - Land and Resource Use - Surface Water - Terrain and Soils - Vegetation - Visual Resources - Wildlife	Supporting: - Land and Resource Use - Wildlife - Heritage - Human Health
Listed Bird Species - Bank swallow - Barn swallow - Black swift - Common nighthawk - Olive-sided flycatcher - Rusty blackbird - Short-eared owl	- Potential for Project interaction - Federal and provincial management concern - Contribute to biodiversity and ecosystem function - Cultural importance - Historic and recent observed use within the Project Area - Historically addressed for previous projects with similar conditions	- Federal <i>Species at Risk Act</i>, SC 2002, c 29 (GovCan 2002c) (SARA) <i>Wildlife Act</i>, RSBC 1996, c 488 (Government of British Columbia [GovBC 1996a]) - BC Conservation Data Centre - Issues scoping		
Raptors - Northern goshawk - Short-eared owl	- Potential for Project interaction - Provincial management concern - Contribute to biodiversity and ecosystem function - Cultural importance - Historic and recent observed use within the Project Area - Historically addressed for previous projects with similar conditions	<i>Wildlife Act</i>, RSBC 1996, c 488 (GovBC1996a) - BC Conservation Data Centre - Issues scoping		

Table 3.2-2: Provincial and Federal Listings for Representative Species Selected to Inform the Assessment of the Avian Species Valued Component (VC)

Species	Scientific Name	BC ¹	COSEWIC ²	SARA ³
Bank swallow	<i>Riparia riparia</i>	Yellow	Threatened	Threatened
Barn swallow	<i>Hirundo rustica</i>	Blue	Threatened	Threatened
Black swift	<i>Cypseloides niger</i>	Blue	Endangered	Endangered
Common nighthawk	<i>Chordeiles minor</i>	Yellow	Special concern	Threatened
Northern goshawk, <i>atricapillus</i> subspecies	<i>Accipiter gentilis atricapillus</i>	Blue	Not at risk	Not applicable
Olive-sided flycatcher	<i>Contopus cooperi</i>	Blue	Special concern	Threatened
Rusty blackbird	<i>Euphagus carolinus</i>	Blue	Special concern	Special concern
Short-eared owl	<i>Asio flammeus</i>	Blue	Special concern	Special concern

Notes: BC=British Columbia; COSEWIC=Committee on the Status of Endangered Wildlife in Canada; SARA=Species at Risk Act, SC 2002, c 29 (Government of Canada [GovCan] 2002c)

¹Species listed under the Wildlife Act, RSBC 1996, c 488 (Government of British Columbia [GovBC] 1996d) in BC. (Blue=special concern; Yellow=not at risk).

²Species recommended by the COSEWIC for listing under Schedule 1 of SARA.

³Species listed under Schedule 1 of the federal SARA.

3.2.3 Indicators

Indicators are quantitative or qualitative parameters used to describe existing VC subcomponent conditions and trends, and to evaluate potential Project effects and cumulative effects on the VC subcomponents. Indicators used in the assessment of Avian Species VC subcomponents are summarized in **Table 3.2-3**.

Table 3.2-3: Indicators for the Avian Species Valued Component (VC)

Indicator	Rationale for Selection
Migratory Breeding Birds, Listed Bird Species, and Raptors Subcomponents	
Change in habitat, including direct and indirect disturbance (including sensory disturbance)	The Tenas Project (Project) has the potential to reduce the amount of suitable habitat available for Migratory Breeding Birds, Listed Bird Species, and Raptors through direct habitat loss. The Project also has the potential to alter the suitability of habitat available for Migratory Breeding Birds, Listed Bird Species, and Raptors subcomponents through indirect habitat alteration (i.e., habitat fragmentation, edge effects, and sensory disturbance).
Change in mortality	The Project has the potential to alter the abundance of Migratory Breeding Birds, Listed Bird Species, and Raptors subcomponents through direct and indirect mortality.
Change in movement patterns	The Project has the potential to alter the daily and seasonal movement patterns of Migratory Breeding Birds, Listed Bird Species, and Raptors subcomponents through the displacement of individuals due to direct (i.e., habitat loss) and indirect (i.e., habitat alteration) effects or the attraction of individuals to Project components that may support life requisites (e.g., food, cover, breeding, migration).

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 Avian Species VC. The administrative and technical boundaries represent any constraints that may be placed on the EAC Application due to political, social, and economic realities (i.e., administrative boundaries), or limitations in predicting or measuring changes (i.e., technical boundaries).

3.2.4.1 Spatial Boundaries

The spatial boundaries delineated for the Avian Species VC are described in **Table 3.2-4** and shown in **Figure 3.2-1**. The Project Area is 1,853 hectares (ha) and encompasses the area that would potentially be directly disturbed by Project activities. It is a conservative estimate of the area of direct disturbance effects on the Avian Species VC within this assessment. The Project Area is described in **S3.0-C1-3. Assessment of Boundaries of the EAC Application**.

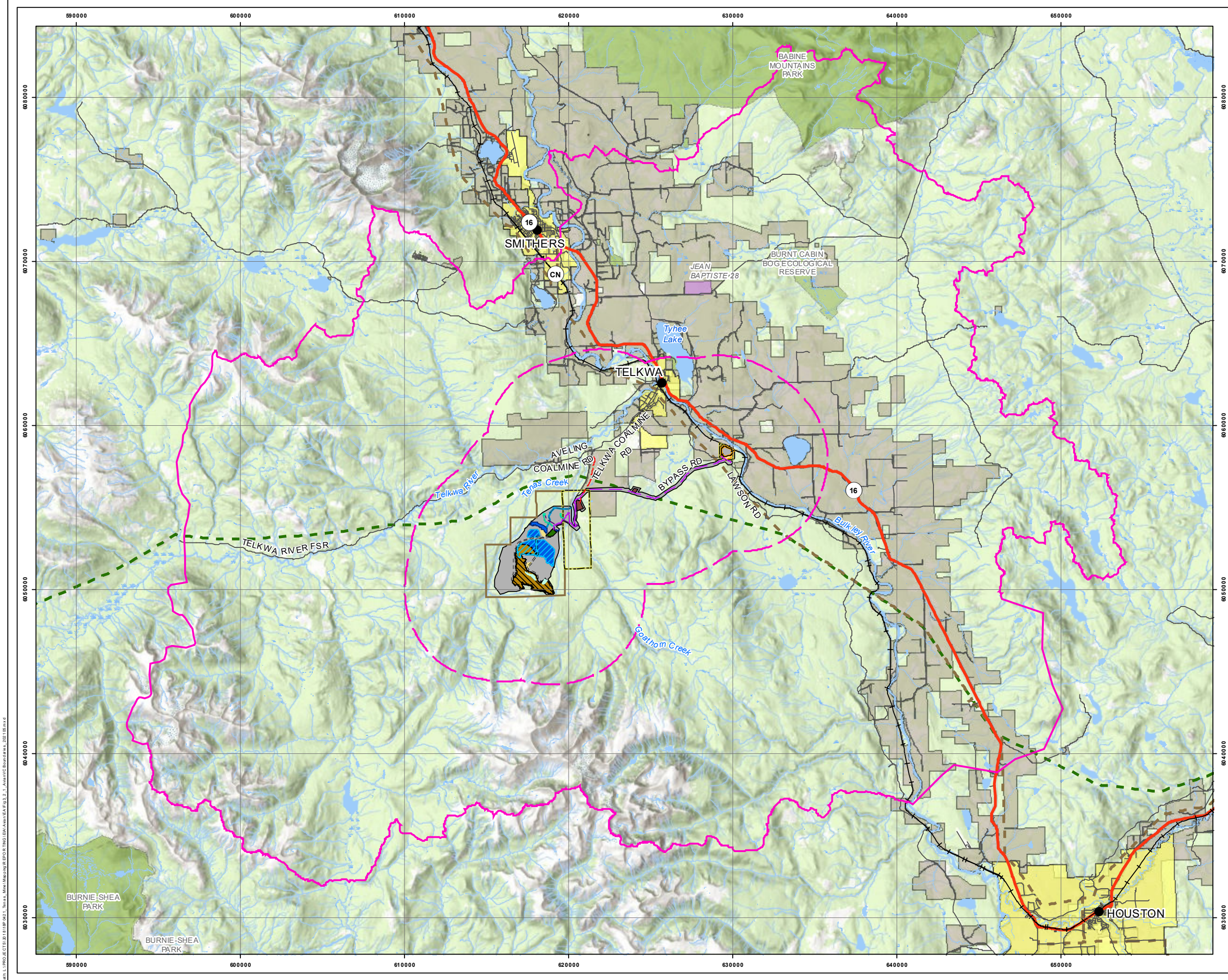
The Avian Species Local Study Area (LSA) is 35,726 ha and encompasses a minimum 5-kilometre (km) buffer around the Project Area. The Avian Species LSA was chosen to be identical for all three (3) subcomponents and represents the area within which 1) potential Project effects (i.e., direct and indirect) are expected to occur on avian species and 2) most fine-scale baseline data were collected for analyses. The Avian Species LSA includes the Village of Telkwa and part of Tyhee Lake to the north; Round Lake to the east; the lower slopes of Hunter Basin to the south; and the lowest reaches of Pine Creek to the west. It overlaps portions of the Telkwa and Bulkley rivers, as well as Tenas and Goathorn creeks. The Avian Species LSA has a notable anthropogenic footprint including the Village of Telkwa and overlap with the Highway 16 corridor. Agricultural development and rural residences are common at lower elevations within the Avian Species LSA, while higher elevation areas show a history of forestry activities.

The Avian Species RSA is 194,651 ha and encompasses the Avian Species LSA plus the intersection of all watersheds that overlap within a 10 km buffer around the Project Area, with the exception of major watersheds (i.e., the Telkwa River and the Bulkley River). The Avian Species RSA is used to provide regional context on the spatial distribution and abundance of the Avian Species VC subcomponents and is the area within which potential Project effects (i.e., direct and indirect) are expected to interact with the effects of other past, present, and reasonably foreseeable future projects or activities. The Avian Species RSA is characterised by a mixed landscape of Crown and private lands. Pre-existing habitat loss and fragmentation due to road development, forestry activities, and mineral exploration activities have altered habitats within the Avian Species RSA over time. The Avian Species RSA includes the Village of Telkwa (as part of the Avian Species LSA) and part of the Town of Smithers. Elevation within the Avian Species RSA ranges from 470 to 2,300 metres (m).

Table 3.2-4: Spatial Boundary Definitions for the Avian Species Valued Component (VC)

Spatial Boundary	Description of Study Area
Project Area	Encompasses the area that would potentially be directly disturbed by Project activities.
Avian Species Local Study Area (LSA)	Encompasses a minimum 5 km buffer around the Project Area.
Regional Study Area (RSA)	Encompasses the Avian Species LSA plus the intersection of all watersheds that overlap within a 10 km buffer around the Project Area, with the exception of major watersheds (i.e., the Telkwa River and the Bulkley River).

Notes: km=kilometre; LSA=Local Study Area; Project=Tenas Project; RSA=Regional Study Area



Tenas Project

Spatial assessment boundaries for the Avian Species Valued Component

Legend

● City/Town	▨ Backfill Area
—+— Rail Line	■ Control and Plant Sedimentation Pond
— Highway	■ Explosive Infrastructure
— Road	▨ Management Pond
— Watercourse	■ Mine Infrastructure Complex
▨ Wetland	■ Open Pit
■ Waterbody	■ Pit Lake
■ Park or Protected Area	■ Quarry
■ First Nation Reserve	■ Rail Infrastructure
■ Municipal Area	■ Topsoil Stockpile
■ General Private Property	■ Tenas Coal Licenses
— 138 kV Transmission Line	▨ Telkwa Coal Limited Private Property
— 500 kV Transmission Line	■ Project Area
— 25 kV Power Line	▨ Avian Species Local Study Area
=== Haul Road	▨ Avian Species Regional Study Area
— Rail Loop	
— Discharge Path	
— Tenas Access Corridor	

Project Features

- Existing 25 kV Power Line
- 25 kV Power Line
- Haul Road
- Rail Loop
- Discharge Path
- Tenas Access Corridor

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

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Kilometres

NAD 1983 UTM Zone 9N

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3.2.4.2 Temporal Boundaries

As described in **S3.0 Assessment Methodology** of the **EAC Application**, the temporal boundaries for the assessment of potential Project effects on the Avian Species VC encompass the time periods during which the Project is expected to interact with avian species. These include the Construction, Operation, Decommissioning and Reclamation, and Post-closure phases (**Table 3.2-5**).

Table 3.2-5: 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.

3.2.4.3 Administrative Boundaries

No administrative boundaries were identified for the assessment of the Avian Species VC.

3.2.4.4 Technical Boundaries

Knowledge of avian species within the Avian Species RSA is based on Traditional Knowledge (TK), where available, scientific and other information, baselines studies undertaken for the Project, and the professional judgement of the EA team. Technical boundaries that may impose constraints on the ability to predict the effects of the Project on the Avian Species VC include:

- ▶ limited information on species ranges and population numbers in the region;
- ▶ limited knowledge of habitat requirements for species at risk and species that rarely occur in the region;
- ▶ limited knowledge of species and individual response to disturbance and the relationship to potential population-level effects;
- ▶ limited knowledge of the effects of climate change on avian species;
- ▶ use of predictive habitat suitability models to assess potential adverse Project effects; and
- ▶ limited existing data (e.g., provincial forest data, Predictive Ecosystem Mapping [PEM], Terrestrial Ecosystem Mapping [TEM], imagery) in terms of coverage, level of detail across the Avian Species RSA and absence of field verification.

4. EXISTING CONDITIONS

This subsection describes the existing conditions of the Avian Species VC based on TK, scientific and other information, and baseline studies completed for the Project.

4.1 Background Information and Studies

4.1.1 Traditional Knowledge (TK)

The purpose of this subsection is to demonstrate awareness of TK and describe how it influenced the assessment of the Avian VC.

TK related to the Avian Species VC was obtained from the **Cultural Use Study (CUS)** completed for the Project (**Appendix 7.1-B of the EAC Application**), the Country Foods Baseline Assessment completed for the Davidson Project (Rescan Environmental Services Ltd. 2008), and the Stage I Heritage Resources Overview completed for the Project (Warner 1983). Available TK specific to avian species within the Avian Species RSA is limited and primarily related to harvest species, including the past and present harvest of grouse species, particularly in the Telkwa Pass (Rescan Environmental Services Ltd 2008, Crossroads Cultural Resource Management [Crossroads] 2021), and the past harvest of migratory birds in the spring (Crossroads 2021) and fall (Warner 1983). Refer to the **Avian Baseline Report (Appendix 4.9-A)** of the **EAC Application** for additional details.

4.1.2 Scientific and Other Information

The purpose of this subsection is to demonstrate awareness of existing scientific and other information, and its applicability to the assessment of the Avian VC.

As part of baseline reporting for avian species (**Appendix 4.9-A**), available published and unpublished scientific data, citizen science data (e.g., eBird Canada), and local knowledge were reviewed to summarize existing information related to avian species within the Avian Species RSA. Applicable federal and provincial legislation, regulations, strategies, guidelines, plans, BMPs, and land use plans were reviewed as relevant to the Avian Species VC. The results of this desktop review were used to create a comprehensive list of avian species that may occur within the Avian Species RSA, including species of conservation concern. The data sources used to characterise avian occurrence and distribution within the Avian Species RSA are summarized in **Table 4.1-1**. Refer to **Appendix 4.9-A** for additional details about the methodology and results of the desktop review.

Table 4.1-1: Summary of Data Sources Reviewed as Part of Baseline Reporting for the Avian Species Valued Component (VC)

Data Source	Content	Reference
British Columbia Breeding Bird Atlas (2008–2012)	Point count survey results and general occurrence records within the Avian Species RSA.	Davidson et al. 2015
Breeding Bird Survey (1966–present)	Point count survey results within the Avian Species RSA.	Smith et al. 2019
Birds of British Columbia	General reference books that provide an overview of birds in British Columbia with some local occurrence information	Campbell et al. 1997, 2001, 1990a, 1990b

Data Source	Content	Reference
Christmas Bird Count (CBC) (1900–present)	General occurrence records for overwintering birds in or adjacent to the Avian Species RSA (the Smithers CBC partially overlaps the Avian Species RSA)	National Audubon Society 2020
COSEWIC Status Reports	Reports that provide distribution and habitat information for specific species, with some local occurrence information.	COSEWIC 2008, 2011, 2013, 2015, 2017, 2018a, b
eBird (2002–present)	Occurrence records for birds within the Avian Species RSA.	eBird 2020
iMapBC	Occurrence records for birds within the Avian Species RSA.	Government of British Columbia (GovBC) 2020f

Notes: COSEWIC=Committee on the Status of Endangered Wildlife in Canada; RSA=Regional Study Area

4.1.3 Baseline Studies

Baseline studies for avian species (**Appendix 4.9-A**) were completed by Ardea Biological Consulting (Ardea; Smithers, BC) from 2017 to 2019 to characterise the baseline conditions. The baseline studies included various species inventories and habitat suitability modelling that were conducted in accordance with provincial standards. The avian baseline program was completed under the oversight and coordination of Laurence Turney, R.P.Bio. with the support of several local consulting firms. Lis Rach (Terraniche Environmental Solutions) conducted landbird and waterfowl surveys and contributed to authoring the baseline report. Frank Doyle, R.P.Bio. (Wildlife Dynamics Consulting) conducted raptors and waterfowl surveys. Theresa White, R.P.Bio. (Cedrus Consulting) conducted landbird surveys. The Avian Species baseline report (**Appendix 4.9-A**) was prepared by EDI Environmental Dynamics Inc. (EDI) in collaboration with Ardea. Mike Boyd, R.P.Bio. (EDI) and Pablo Jost, R.P.Bio. (EDI) completed habitat modelling. Todd Mahon, R.P.Bio. (EDI) and Frank Doyle, R.P.Bio. (Wildlife Dynamics Consulting) contributed to northern goshawk baseline. Vicki Smith, R.P.Bio. (EDI) and Mike Boyd, R.P.Bio. (EDI) authored the report and Anne MacLeod, R.P.Bio. (EDI) reviewed the report.

Table 4.1-2 provides a summary of the baseline studies completed for the Avian Species VC. Refer to the Avian Baseline Report in **Appendix 4.9-A** for details about the methodology and results for each study.

Table 4.1-2: Summary of Baseline Studies and Habitat Suitability Models Completed for the Avian Species Valued Component (VC)

Study Name	Study Purpose, Duration, and Spatial Boundaries
Point Count Surveys	Point count surveys were conducted to determine the relative abundance of migratory bird species within the Avian Species LSA. Surveys were conducted between early June and mid-July in 2017 and 2018. Survey locations were selected to cover the representative habitat types within the Project Area. (Appendix 4.9-A)
Northern Goshawk Playback Surveys and Habitat Suitability Model	Call playback surveys for northern goshawk were conducted to determine the possible presence of this species within the Avian Species LSA. Call playback surveys were conducted in conjunction with point count surveys when potential goshawk breeding habitat (i.e., mature and old growth forest) was encountered or in the nearby vicinity. The suitability of goshawk nesting habitat was rated at each call playback station using a four (4)-class rating system (i.e., Nil, Low, Moderate, and High). These habitat suitability ratings were used to inform the development of the habitat suitability model for northern goshawk. (Appendix 4.9-A)

Study Name	Study Purpose, Duration, and Spatial Boundaries
Waterbird Migration Surveys	Aerial and ground-based spring migration surveys were conducted in April and May 2019 to document waterbird species and habitat use in representative habitat types within the Avian Species LSA and RSA. (Appendix 4.9-A)
Bird Acoustic Monitoring	Acoustic recordings of avian species were collected from 2017 to 2019 in nine (9) locations throughout the Avian Species LSA. The avian songs and calls were collected for potential future monitoring purposes. (Appendix 4.9-A)
Incidental Observations	Incidental observations of avian species were noted during other terrestrial baseline work completed within the Avian Species LSA and RSA from 2017 to 2019. (Appendix 4.9-A)
Migratory Breeding Bird and Listed Bird Species Habitat Suitability Modelling	Quantitative habitat suitability models were created to rate available habitat for three (3) migratory breeding bird habitat guilds (i.e., wetlands, early seral, and old/mature forest) and four (4) species of conservation concern (i.e., common nighthawk, olive-sided flycatcher, northern goshawk, and short-eared owl) within the Avian Species LSA and RSA. The habitat suitability model for each habitat guild was developed using a two (2)-class rating system (i.e., suitable and unsuitable). The habitat suitability model for each species of conservation concern was developed using a four (4)-class rating system (i.e., Nil, Low, Moderate, and High Suitability) with Moderate and High suitability representing suitable nesting habitat. (Appendix 4.9-A)
Listed Bird Species Qualitative Habitat Assessments	Qualitative habitat assessments were used to identify habitat for four (4) species of conservation concern (i.e., bank swallow, barn swallow, black swift, and rusty blackbird) within the Avian Species LSA and RSA. Habitat suitability modelling was not completed for these species due to their preference for specific habitat features that are not generally identifiable using available spatial data (i.e., bank swallow, barn swallow, and black swift) or because the habitat guild suitability models covered focal habitats used by the species (i.e., suitable nesting habitat for rusty blackbird is represented by the wetlands habitat guild model). (Appendix 4.9-A)
Density Analysis	Point count data collected during baseline studies were combined with point count data from the British Columbia Breeding Bird Atlas (Davidson et al. 2015) to estimate bird densities within the Avian Species RSA. (Appendix 4.9-A)

Notes: LSA=Local Study Area; Project=Tenas Project; RSA=Regional Study Area

Previous baseline studies were completed for the Project in 1984 (Taesco Consultants Ltd 1984), 1990 (Hatler 1990) and 1998 (Edie 1998). These included four (4) (i.e., winter, spring, summer, and fall) transect surveys for birds that evaluated seasonal habitat use, species distribution, and relative abundance throughout the survey study area (Taesco Consultants Ltd 1984). A total of 74 bird species were observed during these surveys; no Listed Bird Species were detected. It was noted that waterfowl and shorebird occurrence was limited by a lack of suitable habitat within the survey study area. Upland game birds were reported to be abundant and accounted for much of the hunting effort in the survey study area.

The 1990 baseline studies provided additional data on wildlife north of the Telkwa River (Hatler 1990). Specific bird surveys were not completed; however, 25 bird species were documented between nine (9) ground transect surveys conducted in May and incidental observations, including four (4) bird species that were not documented during the 1984 baseline studies. No Listed Bird Species were detected. Ruffed grouse was the only bird species that was widely detected throughout the 1990 study area (i.e., one (1) or more observation for each ground transect).

The 1998 wildlife assessment (Edie 1998) included a summary of short-eared owl presence in the Bulkley Valley. Short-eared owls are known to occur in the Bulkley Valley during spring and summer and sometimes stay into the winter. Nests were detected in agricultural areas, including in hayfields along what was known at the time as the “Telkwa high road”. Suitable nesting habitat was identified in fields near Goathorn Creek

and north of the Telkwa River. Surveys were conducted in potential nesting habitats over two (2) days in mid-June and three (3) days in early July and did not detect any short-eared owls.

4.2 Description of Existing Conditions

This subsection provides a description of pre-Project conditions (i.e., conditions prior to interaction with the Project) based on TK (where available), scientific and other information, and baseline studies completed for the Project.

4.2.1 Avian Species Habitat Overview

Most of the Project Area lies within the Sub-Boreal Spruce Dry Cool (SBSdk) and the Sub-Boreal Spruce Babine Moist Cold (SBSmc2) biogeoclimatic (BGC) subzones. A small portion of the Project Area overlaps the Engelmann Spruce – Subalpine Fir Moist Cold (ESSFmc) BGC subzone. The SBSdk occurs at lower elevations and valley bottoms and transitions into the SBSmc2 and then into the ESSFmc as elevation increases (Banner et al. 1993). These same BGC subzones are found throughout the Avian Species LSA and RSA along with several additional BGC subzones/variants. The regional climate is reflected in the Biogeoclimatic Ecosystem Classification (BEC), with the SBS zone having a mostly continental climate with some coastal influences in the Bulkley Valley (Banner et al. 1993). Wildfire, which is climate driven and more frequent in the SBSdk than the SBSmc2, has contributed to the development of deciduous stands in the valley bottoms, which in turn has enhanced the value of forested habitats for avian species (Banner et al. 1993).

The Avian Species RSA provides a variety of aquatic and terrestrial habitats for avian species, ranging from wetlands, lakes, and riparian habitats to extensive forest habitats, to rocky alpine peaks. Elevation within the Avian Species RSA ranges from approximately 470 to 2,300 m. The Avian Species RSA also has an extensive anthropogenic footprint, including the Village of Telkwa, part of the Town of Smithers, and overlap with the Highway 16 corridor. Agricultural development and rural residences are common at lower elevations throughout the Avian Species RSA, while higher elevation areas show a history of forestry activities and other industrial development.

The elevation range is narrower within the Avian Species LSA and Project Area (i.e., from approximately 525 to 1,100 m) and consequently, the diversity of habitats available for avian species within these areas is lower compared to the Avian Species RSA. Baseline reporting summarized habitat for avian species within the Avian Species LSA and Project Area by mine features (i.e., Minesite), linear features (i.e., Tenas Access Corridor (TAC) and powerline and substation), and rail features (i.e., Rail Infrastructure).

- ▶ The Minesite area is located almost entirely within the SBSmc2, with minor portions located in the SBSdk and ESSFmc. Past forestry activities have influenced the surrounding landscape, creating a mosaic of regenerating coniferous forest (in a shrub or pole/sapling structural stage) interspersed with remnant patches of mature and old growth forests. Smaller areas of deciduous forest, mixed forest, shrub habitat, and wetland habitat (predominantly small, forested bogs) are scattered throughout;
- ▶ The TAC and powerline and substation areas are located primarily within the SBSdk. These linear features cross a variety of habitat types, including cultivated fields and pastures; coniferous, deciduous, and mixed forest habitats (ranging from pole/sapling to mature and old growth forests); tall/low shrub habitats; floodplain ecosystems (particularly along Goathorn Creek and the Telkwa River); and wetland habitats (predominantly small marshes and swamps). Anthropogenic disturbance is prominent, including agricultural development, rural residences, transmission lines, natural gas pipelines, and various access roads and trails; and

- ▶ The Rail Infrastructure area is located adjacent to the Bulkley River within the SBSdk. Rural/farmland activities have influenced the surrounding landscape, creating a patchy distribution of young to mature forests scattered amongst cultivated fields and pastures. The forested areas tend to contain dry or mesic ecosystems, although upland and floodplain deciduous forests are present. Several ponds created via snowmelt and surface water runoff provide stopover sites for avian species during the spring migration, and a wetland complex comprised of three (3) constructed ponds located northwest of the Rail Infrastructure area provides breeding habitat for waterbirds during the summer nesting season.

Refer to **Appendix 4.9-A** for additional details regarding habitat for avian species within the Avian Species RSA.

4.2.2 Migratory Breeding Birds Subcomponent

The desktop review completed as part of baseline reporting (**Appendix 4.9-A**) identified 195 avian species that have been previously documented within the Avian Species RSA. Most of these species are migratory and occur within the Avian Species RSA during the summer nesting season. The diversity of avian species within the Avian Species RSA during the winter is lower due to the relatively harsh weather conditions in the region; approximately 50 avian species may overwinter within the Avian Species RSA.

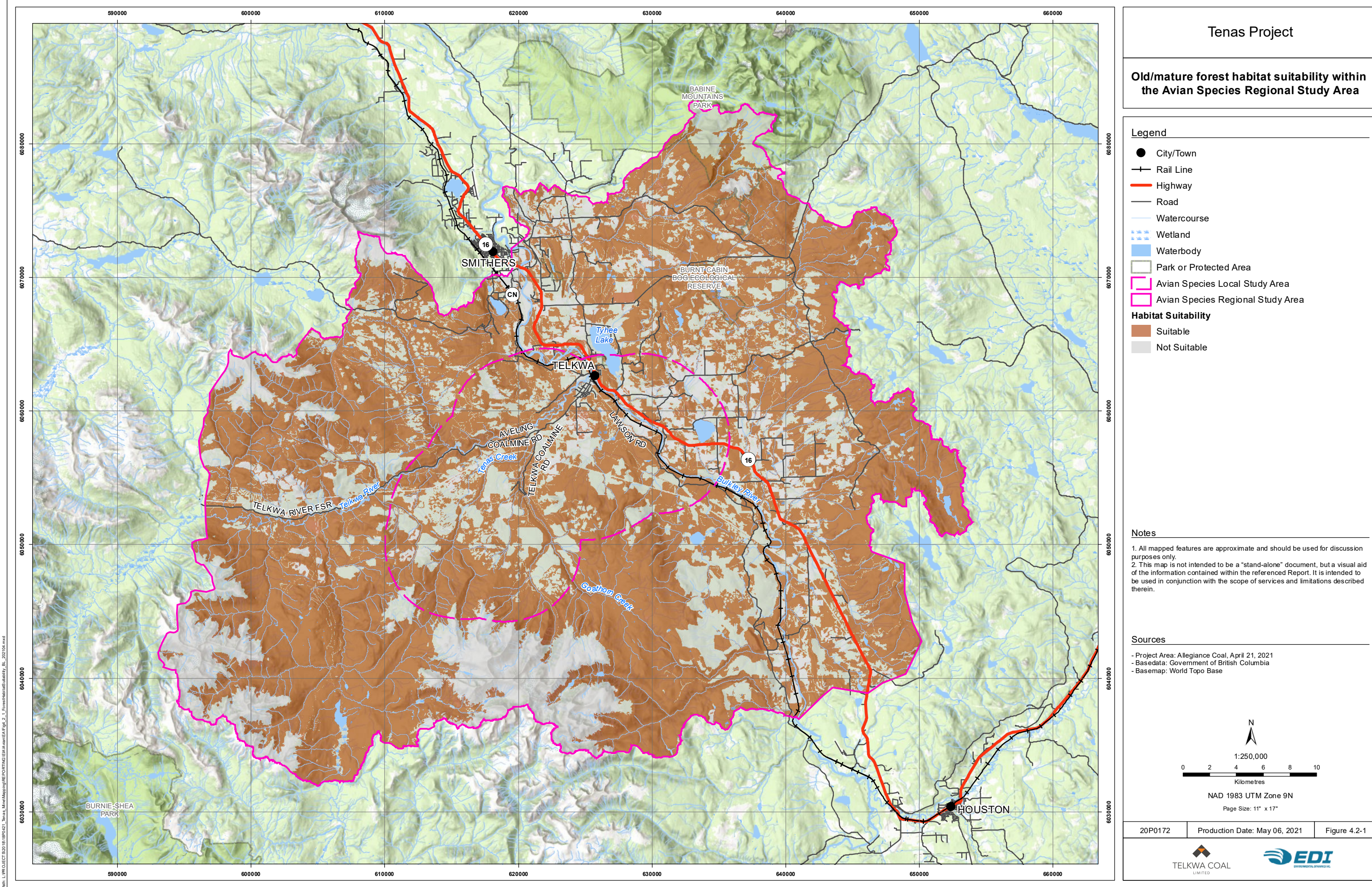
A total of 105 avian species were detected within the Avian Species RSA during baseline studies (**Appendix 4.9-A**) including five (5) avian species that have not been previously documented within the Avian Species RSA. Baseline studies for avian species focused on terrestrial habitat surveys for landbirds (i.e., point count surveys) and aquatic habitat surveys for waterbirds (i.e., waterbird migration surveys), with additional information collected through incidental observations. Landbird data were analyzed quantitatively via a density analysis and habitat suitability modelling whereas waterbird data were analyzed qualitatively by identifying suitable summer breeding areas and migration stopover sites within the Avian Species LSA and RSA. A brief overview of the baseline results is provided in the following paragraphs.

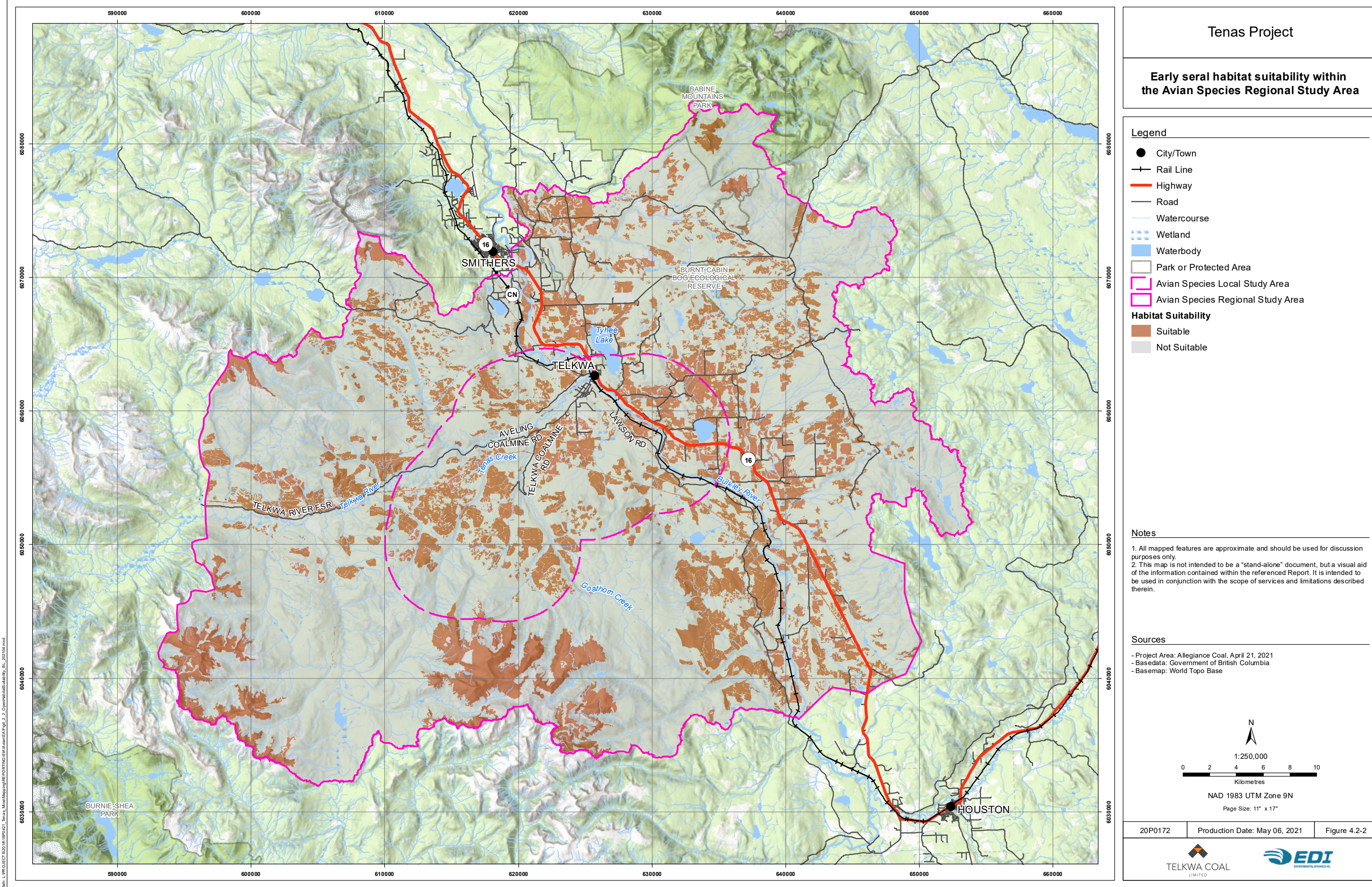
4.2.2.1 Landbird Species

Sixty-eight (68) landbird species were detected during baseline studies; most of these landbird species are expected to breed within the Avian Species RSA. The most common landbird species detected were predominately forest-dwelling and generalist species. Bird densities were highest in the SBSdk and decreased with an increase in elevation (i.e., SBSdk greater than (>) SBSmc2 > ESSFmc), with the highest estimated densities found in riparian forest habitats within the SBSdk.

Landbird species use a variety of terrestrial habitats (e.g., grassland, shrubland, wetland, forest, subalpine, alpine) during the summer nesting season. To assess the availability of suitable nesting habitat within the Avian Species RSA, habitat suitability modelling was completed for three (3) habitat guilds (i.e., broad habitat types divided into: old/mature forest, early seral, and wetland). These habitat suitability models were developed to support the assessment of Project-related effects on the Migratory Breeding Birds subcomponent. The modelling results estimated that 54 percent (%) of the Avian Species RSA is composed of old/mature forest habitats (**Figure 4.2-1**), 20% is early seral habitat (**Figure 4.2-2**) and 17% is wetland habitat (**Figure 4.2-3**). The remaining areas within the Avian Species RSA were classified as not suitable as nesting habitat (e.g., rock, ice, urban).

Refer to **Appendix 4.9-A** for additional details about 1) the methodology and results of the desktop review; 2) the methodologies and results of the baseline studies as they pertain to landbird and waterbird species; and 3) the habitat suitability modelling completed for each habitat guild.





4.2.2.2 Waterbird Species

Based on the results of the desktop review and baseline field studies, approximately 36 waterbird species are expected to breed within the Avian Species RSA; 22 of these 36 species were detected during baseline studies. Waterbirds use a variety of aquatic habitats (e.g., rivers, streams, lakes, ponds, wetlands) during the summer nesting season. Available aquatic habitats within the Avian Species LSA and RSA are found primarily throughout the lower elevations and along the valley bottoms within the SBSdk. At higher elevations, aquatic habitats are less common and consist predominantly of streams, associated riparian areas, and smaller wetlands. Suitable nesting habitat for waterbird species is somewhat limited within the Project Area as no lakes, rivers, or large wetlands are present. Available nesting habitat for waterbirds within the Project Area is focused in riparian areas along streams and smaller wetlands. Subsequently, baseline observations of waterbirds made during the nesting season were limited within the Project Area.

Migration stopover sites for waterbirds are often characterised by wetland habitats that provide seasonal foraging opportunities and safe resting sites during the spring and fall migrations (**Appendix 4.9-A**). Baseline studies included targeted surveys during the spring migration season based on local knowledge that indicated certain parts of the Avian Species LSA may provide stopover sites for large numbers of migrating waterbirds. Waterbirds observed during the spring migration surveys used lower elevations in the SBSdk, with 61% observed in seasonally available habitats (i.e., cultivated fields and seasonal ponds that were temporarily flooded because of snow melt). The remaining waterbirds were detected in pond habitats (26%), wetland habitats (11%), and cultivated field (not seasonally flooded), stream, or river habitats (2%). Most spring migration activities were observed near the Rail Infrastructure area where several ponds created by snowmelt and surface water runoff provided stopover sites for migrating waterbirds. Waterbirds were observed occasionally within the Project Area.

4.2.3 Listed Bird Species Subcomponent

The desktop review completed as part of baseline reporting (**Appendix 4.9-A**) confirmed the presence of all avian species selected to inform the assessment of the Listed Bird Species subcomponent (i.e., bank swallow, barn swallow, black swift, common nighthawk, olive-sided flycatcher, rusty blackbird, and short-eared owl). Bank swallow (Howie 2015, eBird 2020), black swift (Boyd 2015a, eBird 2020), rusty blackbird (Di Corrado 2015, eBird 2020), and short-eared owl (Cannings 2015, eBird 2020) were previously documented within the Avian Species RSA during the nesting season. Barn swallow (Hearne 2015, eBird 2020), common nighthawk (Boyd 2015b, eBird 2020), and olive-sided flycatcher (Weber 2015, eBird 2020) were previously documented within the Avian Species LSA and RSA during the nesting season.

Of the avian species selected to inform the assessment of the Listed Bird Species subcomponent, barn swallow and olive-sided flycatcher were detected during baseline studies (**Appendix 4.9-A**). Barn swallows were detected once. The single observation was of 10 individuals nesting on outbuildings associated with a farm property within the Avian Species LSA, 720 m west of the proposed Rail Infrastructure area. Olive-sided flycatchers were detected at several locations within the Avian Species LSA and RSA, predominantly in coniferous forest habitats characterised by a matrix of regenerating cutblock and remnant patches of mature forest. Several detections were made within or adjacent to the Project Area, particularly in the Minesite area. Active nesting was not confirmed for olive-sided flycatcher during baseline studies.

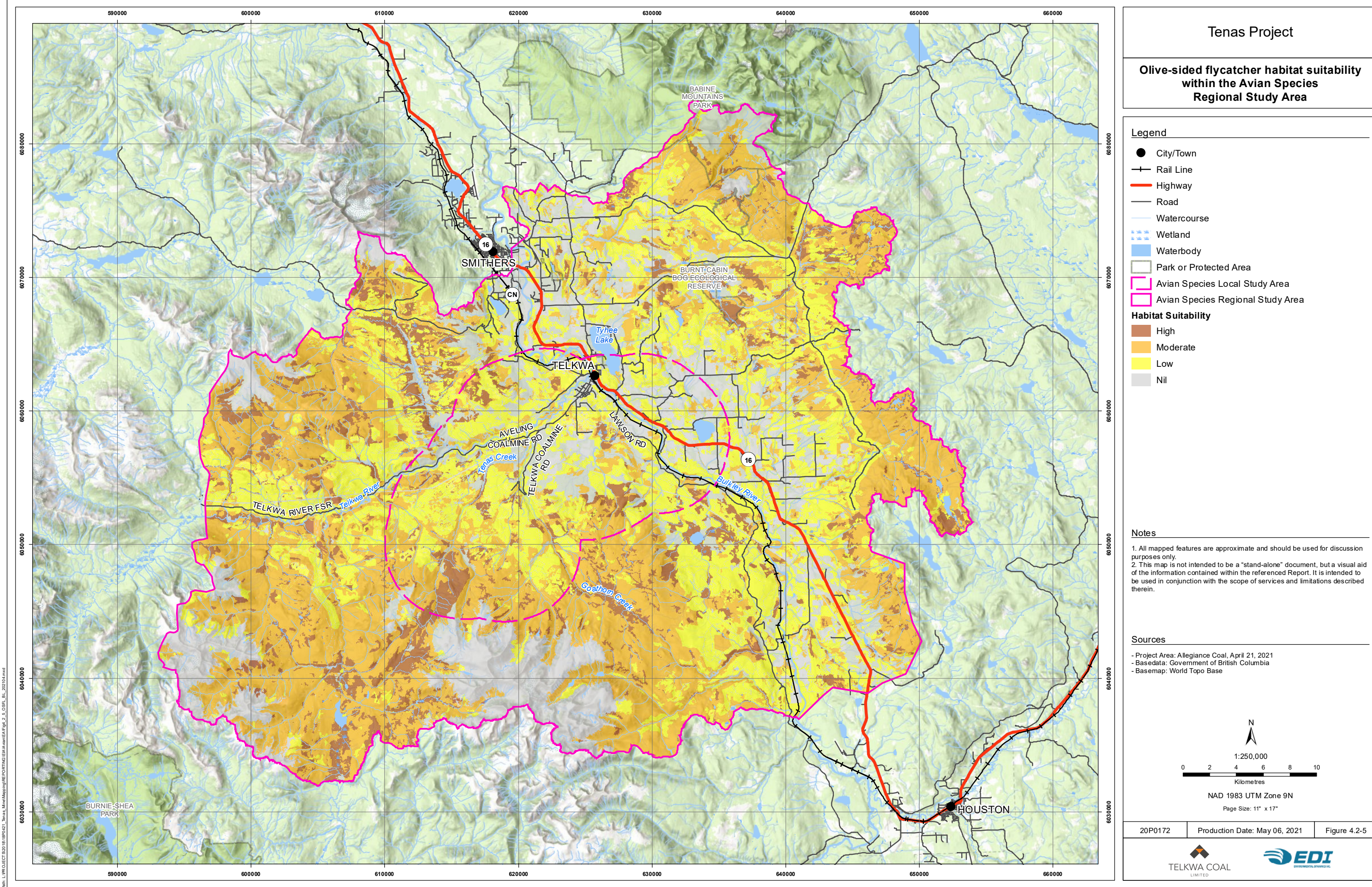
Habitat suitability modelling was completed for common nighthawk, olive-sided flycatcher, and short-eared owl as part of baseline reporting (**Appendix 4.9-A**) to delineate suitable nesting habitat (i.e., Moderate and High suitability) for each species within the Avian Species RSA. These habitat suitability models were completed to support the assessment of Project-related effects on the Listed Bird Species subcomponent. Modelling results for common nighthawk estimated that 30% of the Avian Species LSA and 22% of the Avian Species RSA were rated as suitable nesting habitat (**Figure 4.2-4**). Modelling results for olive-sided

flycatcher indicated that suitable nesting habitat is relatively abundant, comprising 33% of the Avian Species LSA and 47% of the Avian Species RSA (**Figure 4.2-5**). Modelling results estimated that 11% of the Avian Species LSA and 13% of the Avian Species RSA were rated as suitable nesting habitat for short-eared owl (**Figure 4.2-6**). Suitable nesting habitat for rusty blackbird, as represented by the wetlands habitat guild model (**Figure 4.2-3**), was identified within the Avian Species LSA and RSA.

Habitat suitability modelling was not completed for bank swallow, barn swallow, or black swift due to these species' preference for specific habitat features that are not generally identifiable using available spatial data. Therefore, these species were addressed qualitatively as part of baseline reporting (**Appendix 4.9-A**). These qualitative habitat assessments were developed to support the assessment of Project-related effects on the Listed Bird Species subcomponent.

- ▶ Bank swallow: Based on aerial imagery and observations made during baseline studies, suitable nesting habitat for bank swallows was identified at several locations within the Avian Species LSA, including along sections of the Bulkley and Telkwa rivers, and Goathorn and Tenas creeks (**Appendix 4.9-A**). Given this species' tendency to nest in colonies ranging in size from approximately 10 to 100+ active nests (Howie 2015, Garrison and Turner 2020), and their association with typically open habitats (i.e., near open water), active bank swallow colonies tend to be readily detectable. The lack of detections within the Avian Species LSA during baseline studies suggests this species may not be nesting near the Project Area; however, based on the desktop review, nesting by bank swallows is expected within the Avian Species RSA;
- ▶ Barn swallow: Suitable nesting habitat for barn swallows was identified within the Avian Species LSA and RSA, primarily to the north and east of the Project Area, where anthropogenic activity has resulted in cleared forests and suitable structures for nesting (e.g., barns, bridges) (Hearne 2015, eBird 2020); and
- ▶ Black swift: No suitable nesting habitat was identified within the Avian Species LSA for black swifts. It is expected that suitable nesting habitat may be present for this species within the Avian Species RSA; however, within the Avian Species LSA, neither baseline studies nor a desktop review of aerial imagery located notable waterfalls or other rock faces, cliffs, or caves suitable for nesting.

Refer to **Appendix 4.9-A** for details about the methodology and results of the desktop review and the baseline studies as they pertain to the Listed Bird Species subcomponent. See Appendix B, C, D, and E of **Appendix 4.9-A** for additional details about the habitat suitability modelling completed for common nighthawk, olive-sided flycatcher, short-eared owl, and the wetlands habitat guild. Refer to Appendix F of **Appendix 4.9-A** for additional details about the qualitative habitat evaluations completed for bank swallow, barn swallow, and black swift.



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4.2.4 Raptors Subcomponent

The desktop review completed as part of baseline reporting (**Appendix 4.9-A**) identified 22 species of raptors that have been previously documented within the Avian Species RSA, including both raptor species selected to inform the assessment of the Raptors subcomponent (i.e., northern goshawk and short-eared owl). Several potential breeding records for northern goshawk (eBird 2020) and short-eared owl (Cannings 2015, eBird 2020) were identified within the Avian Species RSA. Refer to **Appendix 4.9-A** for details about the methodology and results of the desktop review.

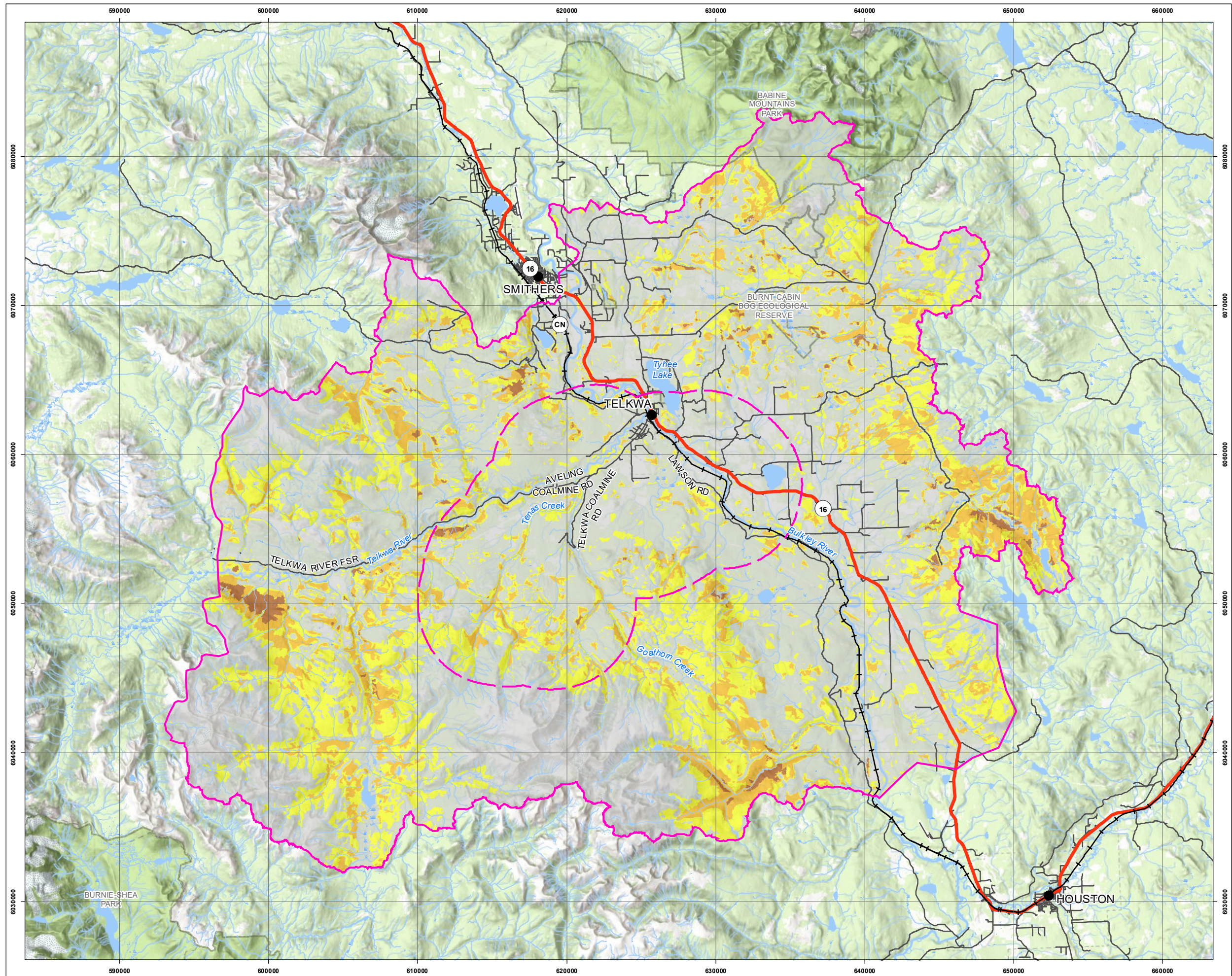
Eleven (11) raptor species were detected within the Avian Species RSA during baseline studies (**Appendix 4.9-A**). Of the raptor species selected to inform the assessment of the Raptors subcomponent, northern goshawk was detected during baseline studies, and only within the Avian Species LSA, and no evidence of active breeding was noted. Refer to **Appendix 4.9-A** for additional details about the methodologies and results of the baseline studies as they pertain to the Raptors subcomponent. A brief summary of baseline results is provided in the following paragraphs.

Northern goshawk detected during baseline studies were within or adjacent to the Project Area in Moderate or Nil rated nesting habitat (as identified by habitat suitability modelling). Habitat suitability modelling for northern goshawk indicated that suitable nesting habitat (i.e., Moderate and High suitability) within the Avian Species LSA and RSA is fragmented, and few contiguous patches of suitable nesting habitat are predicted to be available (**Figure 4.2-7**). Consequently, 6% of the Avian Species LSA and 10% of the Avian Species RSA were rated as suitable nesting habitat for northern goshawk. However, based on the habitat requirements of goshawk breeding territories (Doyle et al. 2020), it is unlikely that an active breeding territory is located within or adjacent to the Avian Species LSA (Doyle 2020). The results of habitat suitability modelling indicated that the closest predicted active breeding territory is likely located approximately 10 km west of the Avian Species LSA (**Figure 4.2-7**) (Doyle 2020).

Refer to Appendix A and D of **Appendix 4.9-A** for additional details about the habitat suitability modelling completed for northern goshawk. Baseline information applicable to the habitat suitability modelling completed for short-eared owl is summarized under **4.2.2.2**. These habitat suitability models were developed to support the assessment of Project-related effects on the Raptors subcomponent.

Breeding was confirmed for three (3) raptor species (i.e., Cooper's hawk, osprey, and red-tailed hawk) during baseline studies (**Appendix 4.9-A**). Four (4) occupied raptor nests and one (1) suspected nesting territory were identified within the Avian Species LSA but outside the Project Area (i.e., the area expected to be directly disturbed by Project activities).

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Tenas Project

Northern goshawk habitat suitability within the Avian Species Regional Study Area

Legend

- City/Town
- Rail Line
- Highway
- Road
- Watercourse
- Wetland
- Waterbody
- Park or Protected Area
- Avian Species Local Study Area
- Avian Species Regional Study Area

Habitat Suitability

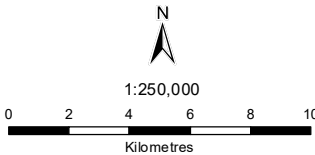
- High
- Moderate
- Low
- Nil

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



NAD 1983 UTM Zone 9N
Page Size: 11" x 17"

20P0172 Production Date: May 06, 2021 Figure 4.2-7



5. ASSESSMENT OF PROJECT-RELATED EFFECTS

The information provided within this subsection includes:

- ▶ identification of potential interactions between the Project and the Avian Species VC;
- ▶ description of potential adverse Project effects on the Avian Species VC;
- ▶ development of mitigation measures to avoid, minimize, or rehabilitate onsite the potential Project effects on the Avian Species VC; and
- ▶ characterisation of Project residual effects and prediction of their significance on the Avian Species VC.

5.1 Potential Project-related Interactions with the Avian Species Valued Component (VC)

The intention of this subsection is to focus the assessment on those Project interactions with potential to adversely affect the Avian Species VC. Project interactions with the Avian Species VC were determined by evaluating Project components and activities in relation to the Avian Species VC and associated subcomponents. Each potential interaction was rated using the terms provided in **Table 5.1-1**. Project interactions and the likelihood of interaction were determined with spatial analysis of the extent of the Project's potential effects and the existing conditions of the Avian Species VC (see **4. Existing Conditions**). Based on the evaluation, potential interactions between the Project and the Avian Species VC were carried forward in the assessment to determine the effects of the interaction.

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

Term	Definition
No Interaction	Tenas Project (Project) activity will not interact with the Avian Species Valued Component (VC) and no adverse effect is expected; no additional consideration is warranted.
Interaction	Interaction between the Project activity and the Avian Species 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.

Table 5.1 2 provides a summary of potential interactions between Project components and activities and the Avian Species VC subcomponents. Interactions expected to result in potential effects on the Avian Species VC are discussed further in **5.2 Potential Project-related Effects**.

Table 5.1-2: Interactions between the Avian Species Valued Component (VC) and the Tenas Project

Project Activities	Subcomponents		
	Migratory Breeding Birds	Listed Bird Species	Raptors
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 Creek Bridge 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
Construction of Explosives Magazine (storage building)	X	X	X

Project Activities	Subcomponents		
	Migratory Breeding Birds	Listed Bird Species	Raptors
Employment and labour			
Operation			
Mining the open pit (soil salvaging, drilling and blasting, excavation of material, dewatering, loading, hauling, unloading)	X	X	X
Operation of Surface Water Management Infrastructure including channels and ponds (sedimentation, control, management, storage)	X	X	X
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	X	X	X
Operate Coal Processing Plant	X	X	X
Maintain fuel and lubricant storage facilities	X	X	X
Maintain administration buildings (first aid, maintenance, mine dry, warehouse, laboratory, and vehicle wash facilities)	X	X	X
Maintain 25 kV powerline and a 600 V substation adjacent to the Coal Processing Plant	X	X	X
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	X	X	X
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	X	X	X
Maintain Explosives Magazine (storage building)			

Project Activities	Subcomponents		
	Migratory Breeding Birds	Listed Bird Species	Raptors
Progressive reclamation	X	X	X
Employment and labour			
Decommissioning and Reclamation			
Dismantle and remove mining equipment and facilities (including Powerline infrastructure, 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 and quarries	X	X	X
Reclamation and closure of permanent bridge over Goathorn Creek	X	X	X
Reclamation and closure of Powerline infrastructure	X	X	X
Reclamation and closure of Rail Infrastructure	X	X	X
Implement post-mining systems and monitoring	X	X	X
Employment and labour			
Post-closure			
Maintain post-mining systems and ongoing monitoring	X	X	X
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): Project activity will not interact with the VC; no adverse effect is expected; no further consideration is warranted.

Project activity-VC interactions that are expected to result in potential effects on the Avian Species VC include those that are anticipated to result in loss of habitat during the Construction Phase or alteration of habitat during the Construction, Operation, Decommissioning and Reclamation, and/or Post-closure phases. They also include those that are anticipated to result in changes in mortality or movement patterns on the Avian Species VC during the Construction, Operation, Decommissioning and Reclamation, and/or Post-closure phases. Where an interaction is identified as possible, the anticipated potential effect(s) is identified and carried forward in the assessment to determine the effects of the interaction.

Project activity-VC interactions for the Avian Species VC that were identified but excluded from additional assessment include the following:

- ▶ employment and labour during all Project phases;
- ▶ operating the water supply wells, storage, and distribution system during the Operation Phase; and
- ▶ maintaining the Explosives Magazine (storage building) during the Operation Phase.

These Project activity-VC interactions were excluded because they are not expected to result in potential effects on the Avian Species VC. None of these interactions are expected to result in alteration or loss of habitat or changes in mortality or movement patterns on the Avian Species VC.

5.2 Potential Project-related Effects

This subsection considers potential Project-related effects on the Avian Species VC arising from potential interactions with Project components and activities, as identified in Table 5.1-2, and in relation to the indicators listed in **Table 3.2-3**. Following a preliminary overview of the potential adverse Project-related effects on the Avian Species VC, effects are described at the Avian Species VC level by Project phase as they are expected to be common among the subcomponents. More detailed descriptions of Project-related effects as they relate to the representative habitat guilds or avian species for each subcomponent of the Avian Species VC are provided in the discussions about residual effects in **5.4.2**, **5.4.3**, and **5.4.4**.

Based on the timing and nature of the interactions identified in **Table 5.1-2**, the following potential Project-related effects on the Avian Species VC have the potential to occur, as predicted within the Project AIR (BC EAO 2021):

- ▶ alteration and/or loss of habitat;
- ▶ change in mortality; and
- ▶ change in movement patterns.

Alteration of habitat is defined as indirect habitat alteration where suitable habitat for avian species remains physically intact but is rendered less suitable or unsuitable for avian use (i.e., reduced use or avoidance). Sources of indirect habitat alteration include Project-related habitat fragmentation (i.e., the breaking apart of continuous habitat into smaller, spatially distinct patches), edge effects (i.e., the influence of recently cleared areas on adjacent intact habitats), and sensory disturbance (e.g., the influence of noise, light, dust, or human presence on adjacent intact habitats). Alteration of habitat may affect the distribution and/or abundance of avian species within the Avian Species RSA. See **5.2.1** for additional details.

Loss of habitat is defined as direct habitat loss where suitable habitat for avian species is physically disturbed to the extent that it is rendered functionally unsuitable for avian use. Sources of direct habitat loss include Project-related site clearing and vegetation management, and the construction and installation of

Project components. Loss of habitat may affect the distribution and/or abundance of avian species within the Avian Species RSA. See **5.2.1** for additional details.

Change in mortality is defined as a change in the abundance of avian species due to direct and indirect sources of mortality. Direct sources of mortality include incidental take (i.e., inadvertent destruction of migratory birds and/or their nests and eggs); entrapment in Project components (e.g., buildings, pipes, vents, other enclosed spaces); collisions with Project-related vehicles, mobile equipment, trains, and components (e.g., buildings, windows); and collisions and/or electrocutions associated with the Project powerline. Indirect sources of mortality include nest failure or abandonment; disorientation of nocturnal migrating birds by artificial light; changes in predator-prey dynamics; exposure to hazardous materials; and contamination of avian habitats and food resources. Change in mortality may affect the abundance of avian species within the Avian Species RSA. See **5.2.2** for additional details.

Change in movement patterns is defined as a change in the daily and seasonal movement patterns of avian species through the displacement of individuals due to direct (i.e., habitat loss) and indirect (i.e., habitat alteration) Project-related effects or the attraction of individuals to Project components that may support life requisites (e.g., food, cover, breeding, migration). Daily movements include those related to daily activities such as foraging, escaping predators, and breeding activities (e.g., establishing and defending a territory, nest building, and nestling provisioning) within established home ranges and breeding territories. Seasonal movements include those during spring and fall migration, including the use of stopover sites for resting, feeding, and drinking. Change in movement patterns may affect the distribution and/or abundance of avian species within the Avian Species RSA. See **5.2.3** for additional details.

The potential Project-related effects are described below as they relate to the Project phases during which each potential effect is expected to occur. Most potential effects are expected to be similar among all Avian Species VC subcomponents. Mitigation measures for each potential effect are described in **5.3**.

5.2.1 Alteration and/or Loss of Habitat

5.2.1.1 Construction Phase

Alteration of habitat for avian species is expected to occur during the Construction Phase due to indirect disturbance through Project-related habitat fragmentation. Habitat fragmentation occurs when continuous habitat is fragmented by natural processes (e.g., forest fires) or anthropogenic disturbances (e.g., site clearing) into smaller, spatially distinct patches (Andrén 1994, Manuwal and Manuwal 2002, Crooks et al. 2017). Habitat fragmentation may affect avian species in a variety of ways, including changes in habitat connectivity (i.e., access to suitable habitat) or the creation of isolated patches of suitable habitat that no longer support a species' life requisites (Andrén 1994, Villard et al. 1999, Manuwal and Manuwal 2002, Vance et al. 2003, Crooks et al. 2017). A minimum patch size is often required for an individual to occupy or use an isolated patch on a landscape (Robbins et al. 1989, Askins 1994, Vance et al. 2003, Butcher et al. 2010). When available suitable habitat is below a minimum patch size threshold, a reduction in occupancy may occur despite the continued presence of suitable habitat on the landscape. As a result, patch size at the individual and population level may have a species-specific effect on use of suitable habitat and could influence reproductive output, health, and survival (Askins 1994, Villard et al. 1999, Vance et al. 2003, Suorsa et al. 2004, Butcher et al. 2010). Habitat fragmentation may result in reduced use or avoidance of otherwise suitable habitat when connectivity between areas of suitable habitat is reduced or lost, or when a minimum patch size threshold is no longer met (Vance et al. 2003, Butcher et al. 2010, Crooks et al. 2017). The potential displacement of individuals into other, possibly less suitable, areas could increase crowding and subsequent inter-and intra-specific competition for breeding habitat, food, and other resources (Hagan et al. 1996, Schmiegelow et al. 1997, Calizza et al. 2017). The resulting physiological

stress could have implications for reproductive output and survival. Overall, Project-related habitat fragmentation may affect the distribution and/or abundance of avian species within the Avian Species RSA.

Alteration of habitat for avian species is expected to occur during the Construction Phase due to indirect disturbance through Project-related edge effects. Edge effects include the influence of recently cleared areas on adjacent intact habitats. Gradients of light intensity, temperature, wind, relative humidity, and snow accumulation and melt may occur along the interface between cleared areas and intact habitats (Bannerman 1998, Kremsater and Bunnell 1999, George and Dobkin 2002), which could influence ecosystem structure and function over time and alter habitat suitability for avian use. Edge effects may affect avian species in a variety of ways, including changes to feeding or breeding opportunities, and changes in security or thermal cover (Bannerman 1998, Kremsater and Bunnell 1999, Bishop and Brogan 2013). Some species may benefit from edge effects and their abundance may increase in edge habitats while other species may use edge habitats less frequently or avoid them (Bannerman 1998, Kremsater and Bunnell 1999, George and Dobkin 2002). The resulting changes could alter prey availability and predator-prey dynamics in edge habitats (Bannerman 1998, Kremsater and Bunnell 1999, George and Dobkin 2002, Bishop and Brogan 2013). The potential influx of individuals into edge habitats, or the potential displacement of individuals into other areas, may increase crowding and subsequent inter-and intra-specific competition for breeding habitat, food, and other resources (Hagan et al. 1996, Schmiegelow et al. 1997, Bannerman 1998, George and Dobkin 2002, Calizza et al. 2017). The resulting physiological stress could have implications for reproductive output and survival. Overall, Project-related edge effects may affect the distribution and/or abundance of avian species within the Avian Species RSA.

Alteration of habitat for avian species is expected to occur during the Construction Phase due to indirect disturbance through Project-related sensory disturbance. Sensory disturbance includes the effects of noise, light, dust, and human presence on habitat suitability for avian use. Site clearing, the construction and installation of Project components, and the transportation of equipment, materials, and personnel are expected to result in sensory disturbance. Avian species are typically most sensitive to sensory disturbance during the breeding season and at stopover sites (Sinnott 2000). Sensory disturbance may elicit behavioural and/or physiological responses in avian species (e.g., increased energy expenditures, elevated stress levels, nest abandonment), which could have implications for reproductive output and survival (Korschgen and Dahlgren 1992, Richardson and Miller 1997, Gill 2007, Price 2008, Borgmann 2011, Strasser and Heath 2013). Increased noise levels may interfere with the ability of individuals to establish or defend a territory, attract a mate, deliver distress calls, or detect prey sounds or approaching predators, which could also have implications for reproductive output and survival (Warren et al. 2006, Gill 2007). Artificial light may attract migrating or foraging birds, which could alter movement patterns or habitat selection, or may deter individuals, resulting in reduced use or avoidance (Adams et al. 2019). Dust may alter the productivity of adjacent forests and wetlands by influencing photosynthesis, respiration, and transpiration, which could have implications for habitat suitability and feeding opportunities (Farmer 1993, Creuzer 2016). Visual stimuli (e.g., human presence) may interfere with incubation, nestling provisioning, feeding opportunities, or aggregation behaviour, which could have implications for reproductive output and survival (Gill 2007). Sensory disturbance may also result in reduced use or avoidance of disturbed areas (Benítez-López et al. 2010). The potential displacement of individuals into other, possibly less suitable, areas could increase crowding and subsequent inter-and intra-specific competition for breeding habitat, food, and other resources (Hagan et al. 1996, Schmiegelow et al. 1997, Calizza et al. 2017). The resulting physiological stress could have implications for reproductive output and survival. Overall, Project-related sensory disturbance may affect the distribution and/or abundance of avian species within the Avian Species RSA.

Project-related site clearing and the construction and installation of Project components are expected to be limited to the Project Area. Both activities are expected to result in a loss of habitat for avian species within the Project Area during the Construction Phase. Loss of habitat may affect avian species in a variety of ways, including the loss of feeding, breeding, or stopover habitats, or the loss of security or thermal cover.

The potential displacement of individuals into other, possibly less suitable, areas could increase crowding and subsequent inter-and intra-specific competition for breeding habitat, food, and other resources (Hagan et al. 1996, Schmiegelow et al. 1997, Calizza et al. 2017). The resulting physiological stress could have implications for reproductive output and survival. Overall, loss of habitat may affect the distribution and/or abundance of avian species within the Avian Species RSA.

5.2.1.2 Operation Phase

Alteration of habitat for avian species through Project-related habitat fragmentation, edge effects, and sensory disturbance is expected in the Operation Phase. Additional Project activities that may result in sensory disturbance on avian species include vegetation management along linear Project right(s)-of-way (ROW); routine maintenance of Project components (e.g., roads, powerline infrastructure, Rail Infrastructure, buildings and storage facilities, material storage piles); mining the open pit; operation of the Surface Water Management Infrastructure and water discharge infrastructure; operation of the CPP and material handling systems; operation of the solid waste management systems; and progressive reclamation of completed Minesite areas.

Loss of habitat for avian species is expected to be limited during the Operation Phase; however, vegetation management may occur along the ROW of linear Project features (e.g., roads, Rail Infrastructure, powerline), which may limit the progression of natural succession and could alter habitat suitability for avian species.

5.2.1.3 Decommissioning and Reclamation Phase

The effect of alteration and/or loss of habitat during the Decommissioning and Reclamation Phase is expected in this Phase although less due to the positive effect that will occur related to habitat regeneration that will occur within the Project Area. Alteration of habitat for avian species through Project-related habitat fragmentation, edge effects, and sensory disturbance is expected in the Decommissioning and Reclamation Phase. Project activities that may result in sensory disturbance on avian species include dismantling and removal of mining equipment and facilities; reclamation and closure of Minesite activities, Project roads, powerline infrastructure, and Rail Infrastructure; and implementation of post-mining systems and monitoring.

Loss of habitat for avian species is not expected during the Decommissioning and Reclamation Phase; alteration of habitat for avian species is expected to occur in this phase.

5.2.1.4 Post-closure Phase

The effect of alteration and/or loss of habitat during the Post-closure phase is expected to be positive as habitat regeneration is expected to continue within reclaimed areas. Alteration of habitat for avian species through Project-related habitat fragmentation and edge effects is expected in the Post-closure Phase; however, fragmentation and edge effects are expected to decrease over time as revegetation and tree growth create a gradual structural transition throughout disturbed areas and along forest edges (e.g., a tall shrub or pole/sapling structural stage, approximately 20 years following reclamation). Alteration of habitat through Project-related sensory disturbance is also expected to continue; however, activities onsite are expected to be limited, resulting in isolated sensory disturbance on avian species during occasional vehicle traffic and maintenance and monitoring activities.

Loss of habitat for avian species is not expected during the Post-closure Phase; alteration of habitat for avian species is expected to occur in this phase.

5.2.2 Change in Mortality

5.2.2.1 Construction Phase

Change in mortality of avian species through direct and indirect effects is expected to occur during the Construction Phase. Project-related site clearing may result in direct mortality of avian species via incidental take. Incidental take is the inadvertent destruction of migratory birds and/or their nests and eggs during anthropogenic activities (Williams 2010, Canadian Wildlife Service and Environment Canada 2014). When anthropogenic activities such as land clearing occur during the nesting season, the risk of incidental take greatly increases, especially if large areas of land are affected. Project-related sensory disturbance resulting from site clearing, the construction and installation of Project components, and the transportation of equipment, materials, and personnel may disrupt nesting activities in adjacent habitats, which could lead to nest failure or abandonment (Carney and Sydeman 1999, Beale and Monaghan 2004, Price 2008, Strasser and Heath 2013).

Collisions with Project-related vehicles, mobile equipment, trains, and components (e.g., buildings, windows) may result in direct mortality of avian species (Erickson et al. 2005, Loss et al. 2012, 2014, 2015, Bishop and Brogan 2013, Calvert et al. 2013, Machtans et al. 2013, Cabrera-Cruz et al. 2018). These types of collisions may be more likely in areas of high bird density (e.g., near feeding, breeding, or stopover habitats), during the nesting season, and /or during migration (Erickson et al. 2005, Bishop and Brogan 2013). Collisions may also occur when avian scavengers (e.g., northern goshawk) are attracted to animal carcasses along Project roads or the Rail Loop. Artificial light may attract and disorient nocturnal migrating birds within illuminated areas, which could lead to exhaustion and eventual collision with the ground or Project components, resulting in indirect avian mortality (Arnold and Zink 2011, Longcore et al. 2012, Machtans et al. 2013, Adams et al. 2019).

Entrapment of avian species in Project components (e.g., buildings, pipes, vents, other enclosed spaces) may lead to exhaustion as the birds try to escape, and could result in dehydration, starvation, and eventual death (Loss et al. 2015, Vancouver Bird Advisory Committee 2015, University of British Columbia 2019).

The construction of Project-related access roads and ROW may facilitate increased public access and use by off-road vehicles, which could alter predator-prey dynamics within the Project Area and adjacent habitats and indirectly influence avian mortality (Francis et al. 2009, Rodewald et al. 2011, Hethcoat and Chalfoun 2015).

Project-related spills of fuels and other hazardous materials, malfunctions, and other accidents may result in contamination of avian habitats and food resources or oiling of individuals, which could indirectly influence avian mortality (Erickson et al. 2005). Change in mortality may affect the abundance of avian species within the Avian Species RSA.

Estimated water quality for the Project (**S4.0-C3 Surface Water VC** of the **EAC Application**) was used to screen parameters, with an aim to establish contaminant(s) of potential concern (COPC) for ingestion exposure (i.e., drinking water) by wildlife (including avian species). The parameters were screened through a comparison of predicted (modelled) mean monthly concentrations to relevant Canadian benchmarks, including:

- ▶ BC Approved Water Quality Guidelines: Aquatic Life, Wildlife & Agriculture (British Columbia Ministry of Environment and Climate Change Strategy [BC MECCS] 2019); and
- ▶ Canadian Water Quality Guidelines for the Protection of Agricultural Water Uses (Canadian Council of Ministers of the Environment [CCME] 1999).

For the specific ingestion exposure route (i.e., drinking water) by ecological receptors, **Table 5.2-1** provides the benchmarks appropriate for those receptors (based on how they are derived).

Table 5.2-1: Ecological Receptor Benchmarks for the Water Ingestion Exposure Route

No.	Set of Benchmarks	Derivation Based on Toxicity Test Data for Ecological Receptors
1	BC Approved Water Quality Guidelines: Aquatic Life (British Columbia Ministry of Environment and Climate Change Strategy [BC MECCS] 2019)	Fish, Amphibians, Invertebrates, Aquatic Plants
2	Canadian Water Quality Guidelines for the Protection of Aquatic Life (Canadian Council of Ministers of the Environment [CCME] 2014)	Fish, Amphibians, Invertebrates, Aquatic Plants
3	BC Approved Water Quality Guidelines: Wildlife & Agriculture (BC MECCS 2019)	Bird and Mammals (some amphibians; e.g., terrestrial (toads))
4	Canadian Water Quality Guidelines for the Protection of Agricultural Water Uses (CCME 1999)	Birds and Mammals

Exceedance factors of less than 1 indicated no risk to biota, while those greater than 1 required further evaluation. Exceedance factor is the maximum predicted value divided by the lowest guideline for that parameter or the Site Performance Objective (SPO) where one has been derived for the Project.

Table 5.2-2 presents the results of the COPC screening conducted. Given that Site Performance Objectives (SPOs) were derived for seven (7) of the site parameters (i.e., aluminum, cobalt, cadmium, nitrite, selenium, sulfate, and thallium) for this Project (by the Windward/Borealis team), COPC screening was conducted for the guidelines and the SPO values listed above. Additional detail is provided in the **S4.0-C3 Surface Water VC** on the context and baseline conditions for these seven (7) parameters.

Based on this screening exercise, one (1) of the parameters—aluminum—yielded an exceedance factor of >1 (i.e., concentration was above WQGs and its SPO). The predicted exceedance factor was 1.25. This required further assessment to evaluate potential risks to avian species.

The predicted aluminum concentrations exceed aquatic life and an amphibian species was used to evaluate the context of risk. Aluminum toxicity data are generally rare, and, therefore, a wide range of appropriate toxicity reference values (TRV) are not available to use as benchmarks. Recently, ECCC derived and published a federal environmental quality guideline (FEQG) for aluminum (ECCC 2021). As part of the aquatic toxicity profile for aluminum (ECCC 2021; Table 4), a normalized¹ effect concentration of 0.421 milligram per litre (mg/L) (based on a 7-day no observed effect concentration (NOEC) endpoint for the common toad, *Bufo bufo*) is cited, based on data from Gardner et al. (2002). Using this benchmark for comparison to the predicted maximum mean monthly concentration for aluminum (0.26 mg/L), the exceedance factor (i.e., the maximum mean monthly value over the aluminum TRV = $0.26/0.421=0.62$), indicates an exceedance factor of < 1 and therefore, poses limited risk to this species.

The COPC are not predicted to result in an adverse effect on the Avian Species VC and were scoped out of the assessment from this point forward due to this screening-level analysis.

¹Normalized to pH=7.5, DOC=0.5 milligram per litre (mg/L), hardness=50 mg/L (ECCC 2021).

Table 5.2-2: Screening of Water Quality Parameters Against Aquatic Life, Wildlife, Livestock Guidelines, and Site Performance Objectives

Parameter	Maximum Modelled Mean Monthly (mg/L)	Location of Greatest Exceedance of WQG	Lowest BC or CCME WQG (Aquatic, Wildlife or Livestock) ^{1,2}	SPO	Exceedance Factor WQG (Maximum Modelled Mean/WQG)	Exceedance Factor SPO (Maximum Modelled Mean/SPO)
Aluminum, total	0.26	Telkwa R, S09	0.1	0.208	2.60	1.25
Arsenic, total	0.0016	Four Cr, S03_DS	0.005		0.32	-
Beryllium, total	0.000082	Four Cr, S03_DS	0.00013		0.63	-
Boron, total	0.21	Four Cr, S03_DS	1.2		0.18	-
Cadmium, dissolved	0.00026	Four Cr, S03_DS	0.00008	0.00026	3.25	1.00
Chloride	13	Four Cr, S03_DS	100		0.13	-
Chromium, total	0.0021	Four Cr, S03_DS	0.0049		0.43	-
Cobalt, total	0.0011	Four Cr, S03_DS	0.001	0.0174	1.10	0.06
Copper, total	0.0041	Four Cr, S03_DS	0.0047		0.87	-
Fluoride	0.095	Four Cr, S03_DS	0.12		0.79	-
Iron, total	0.47	Telkwa R, S09	1		0.47	-
Lead, total	0.0004	Four Cr, S03_DS	0.004		0.10	-
Manganese, total	0.057	Four Cr, S03_DS	0.1		0.57	-
Mercury, total	0.0000025	Four Cr, S03_DS	0.00001		0.25	-
Molybdenum, total	0.0036	Four Cr, S03_DS	0.01		0.36	-
Nickel, total	0.004	Four Cr, S03_DS	0.025		0.16	-
Nitrate	1.9	Tenas Cr, S04	3		0.63	-
Nitrite	0.045	Tenas Cr, S04	0.02	0.0524	2.25	0.86
Selenium, total	0.0058	Four Cr, S03_DS	0.002	0.008	2.90	0.73
Silver, total	0.000005	Four Cr, S03_DS	0.00005		0.10	-
Strontium	0.89	Four Cr, S03_DS	7		0.13	-
Sulfate	360	Four Cr, S03_DS	128	593	2.81	0.61
Thallium	0.00027	Four Cr, S03_DS	0.0008		0.34	
Uranium	0.0022	Four Cr, S03_DS	0.0085		0.26	-
Zinc	0.0074	Four Cr, S03_DS	0.023		0.32	-

Notes: BC=British Columbia; WQG = Water Quality Guidelines; CCME=Canadian Council of Ministers of the Environment; mg/L=milligram per litre; SPO = Site Performance Objective

¹ = BC or CCME WQG for stream with highest modelled concentration

5.2.2.2 Operation Phase

Change in mortality to avian species through direct and indirect effects is expected in the Operation Phase. Project-related site clearing is expected to be limited; however, vegetation management may occur along

the ROW of linear Project features (e.g., roads, Rail Infrastructure, powerline) and may result in direct mortality via incidental take (Williams 2010, Canadian Wildlife Service and Environment Canada 2014). Sensory disturbance caused by vegetation management and additional Project activities (e.g., routine maintenance of Project components; mining the open pit) may disrupt nesting activities in adjacent habitats, which could lead to nest failure or abandonment (Carney and Sydeman 1999, Beale and Monaghan 2004, Price 2008, Strasser and Heath 2013).

Collisions with the Project powerline or electrocutions caused by contact with powerline infrastructure may result in direct mortality of avian species (Erickson et al. 2005, Avian Power Line Interaction Committee [APLIC] 2006, 2012, Loss et al. 2012, 2015, Calvert et al. 2013). The susceptibility of avian species to collisions with the Powerline and/or electrocution caused by contact with powerline infrastructure is influenced by the species involved and certain behaviours, surrounding habitat use and land use, seasonal and environmental factors, and the location and configuration of the powerline (APLIC 2006, 2012). Collisions with the powerline and electrocutions caused by contact with powerline infrastructure may be more likely in areas of high bird density (e.g., near feeding, breeding, or stopover habitats) and/or during migration (Erickson et al. 2005, APLIC 2012).

Exposure to hazardous materials produced or used during Project activities (e.g., waterfowl landing on a contaminated channel or pond; individuals exposed to chemicals used for herbicide spraying during invasive plant management) could indirectly influence avian mortality (Erickson et al. 2005). As indicated in **5.2.2.1**, COPC are not predicted to be a residual effect on the Avian Species VC and were scoped out of the assessment.

5.2.2.3 Decommissioning and Reclamation Phase

The effect of change in mortality during the Decommissioning and Reclamation phase is expected to be positive as habitat regeneration will be initiated within the Project Area. Change in mortality through direct and indirect effects is expected in the Decommissioning and Reclamation Phase; however, Project-related site clearing is not expected, and incidental take is not anticipated. Project activities that may result in sensory disturbance on avian species include dismantling and removal of mining equipment and facilities; reclamation and closure of Minesite activities, Project roads, powerline infrastructure, and Rail Infrastructure; and implementation of post-mining systems and monitoring.

5.2.2.4 Post-closure Phase

The effect of change in mortality during the Post-closure phase is expected to be positive as habitat regeneration is expected to continue within reclaimed areas. Change in mortality to avian species through direct and indirect effects is expected in the Post-closure Phase; however, Project activities onsite are expected to be limited, resulting in isolated sensory disturbance or collision risk to avian species during occasional vehicle traffic and maintenance and monitoring activities. The risk of Project-related spills, malfunctions, and other accidents occurring is expected to be limited. Project-related site clearing is not expected during the Post-closure Phase; therefore, incidental take is not anticipated.

5.2.3 Change in Movement Patterns

5.2.3.1 Construction Phase

Change in movement patterns of avian species is expected to occur during the Construction Phase through the displacement of individuals due to direct (i.e., habitat loss) and indirect (i.e., habitat alteration) Project effects. Alteration and/or loss of habitat (as defined in **5.2.1**) may change habitat suitability for avian species, which could result in reduced use or avoidance of disturbed areas and the displacement of individuals into

other, possibly less suitable, areas (Hagan et al. 1996, Schmiegelow et al. 1997, Bannerman 1998, Kremsater and Bunnell 1999, Bélisle and St. Clair 2001, George and Dobkin 2002, Betts et al. 2006, Gill 2007, Benítez-López et al. 2010, Rousseau et al. 2012, Akresh et al. 2015). Displacement may affect the daily (e.g., access to food, cover, or breeding habitats; ability to find a mate or escape predators) or seasonal (e.g., access to stopover sites during migration) movement patterns of avian species, which could have implications for reproductive output and survival. Displacement may also increase crowding and subsequent inter- and intra-specific competition for breeding habitat, food, and other resources (Hagan et al. 1996, Schmiegelow et al. 1997, Calizza et al. 2017). The resulting physiological stress could also have implications for reproductive output and survival. Change in movement patterns may affect the distribution and/or abundance of avian species within the Avian Species RSA.

5.2.3.2 Operation Phase

Change in movement patterns of avian species due to alteration of habitat is expected in the Operation Phase. Change in movement patterns due to loss of habitat is expected to be limited; however, vegetation management may occur along the ROW of linear Project features (e.g., roads, Rail Infrastructure, powerline). Vegetation management may limit the progression of natural succession and change habitat suitability for avian species, which could result in reduced use or avoidance of disturbed areas and the displacement of individuals into other, possibly less suitable, areas. Change in movement patterns due to the attraction of individuals to Project components that may support life requisites (e.g., food, cover, breeding, migration) may occur during the Operation Phase. Avian species may be attracted to Project components that offer new feeding, cover, breeding, or stopover opportunities and could alter their daily or seasonal movement patterns to take advantage of these components (e.g., insectivorous birds feeding on flying insects attracted to artificial light; swallows nesting on the eaves of buildings; waterfowl resting on a channel or pond during spring or fall migration; Raptors perching on powerline infrastructure for hunting, feeding, resting, or roosting purposes).

5.2.3.3 Decommissioning and Reclamation Phase

The effect of change in movement patterns during the Decommissioning and Reclamation phase is expected to be positive as habitat regeneration will be initiated within the Project Area. Change in movement patterns of avian species due to alteration of habitat is expected in the Decommissioning and Reclamation Phase. Change in movement patterns due to loss of habitat or attraction of individuals to Project components that may support life requisites is not expected.

5.2.3.4 Post-closure Phase

The effect of change in movement patterns during the Post-closure phase is expected to be positive as habitat regeneration is expected to continue within reclaimed areas. Change in movement patterns of avian species due to alteration of habitat through Project-related habitat fragmentation and edge effects is expected in the Post-closure Phase; however, fragmentation and edge effects are expected to decrease over time as revegetation and tree growth create a gradual structural transition throughout disturbed areas and along forest edges (e.g., a tall shrub or pole/sapling structural stage, approximately 20 years following reclamation). Change in movement patterns due to alteration of habitat through Project-related sensory disturbance is also expected to continue; however, Project activities on site are expected to be limited, resulting in isolated sensory disturbance on avian species during occasional vehicle traffic and maintenance and monitoring activities. Change in movement patterns due to loss of habitat or attraction of individuals to Project components that may support life requisites is not expected during the Post-closure Phase.

5.3 Mitigation Measures

This subsection describes the mitigation measures to address the potential Project-related effects on the Avian Species VC, as described in **5.2 Potential Project-related Effects**. The mitigation measures are consistent with the mitigation definition provided by the BC EAO (2013). Measures may include applicable standards, guidelines, and BMPs supported by specific guidance documents.

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 mitigation measures are outlined in **S1.0 Overview of Project Proponent Description** of the **EAC Application**; those mitigation measures that are relevant to minimizing potential Project-related effects on the Avian Species VC are summarized in **5.3.1** to **5.3.12**. Additional mitigation measures specific to the Avian Species VC that are provided in **5.3.13** to **5.3.19** and the **Wildlife Management Plan (S13.0-C21) (WMP)** are based on proven and accepted mitigation used on other similar approved projects in BC (e.g., Red Mountain Underground Gold, Blackwater Gold) that had comparable potential adverse effects on avian species. They also include standard industry guidelines and BMPs (**2.3**) such as A Compendium of Wildlife Guidelines for Industrial Development Projects in the North Area, British Columbia (British Columbia Ministry of Forests, Lands and Natural Resource Operations [BC MFLNRO] 2014a) and Guidelines for Raptor Conservation during Urban and Rural Land Development in British Columbia (Caskey and Chutter 2013). As such, 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 at this time.

Mitigation measures developed to mitigate potential adverse effects on Avian Species VC will be incorporated into the various Project management plans, such as the following:

- ▶ **WMP;**
- ▶ **Vegetation Management Plan (S13.0-C18) (VMP);**
- ▶ **Air Quality Management Plan (S13.0-C2) (AQMP);**
- ▶ **Reclamation Closure Plan (S13.0-C15) (RCP);**
- ▶ **Chemicals and Materials Storage, Transfer, and Handling Plan (S13.0-C3) (CMSTHP);**
- ▶ **Construction Environmental Management Plan (S13.0-C4) (CEMP);**
- ▶ **Discharge Management Plan (S13.0-C5) (DMP);**
- ▶ **Explosives Management Plan (S13.0-C6) (EMP);**
- ▶ **Fuel Management and Spill Control Plan (S13.0-C7) (FMSCP);**
- ▶ **Mine Emergency Response Plan (S13.0-C9) (MERP);**
- ▶ **Minesite Traffic Control Plan (S13.0-C10) (MTCP);**
- ▶ **Minesite Water Management Plan (S13.0-C11) (MWMP); and**
- ▶ **Metal Leaching (ML)/Acid Rock Drainage (ARD) Management Plan (S13.0-C12) (ML/ARDMP).**

The management plans provide additional 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 Avian Species VC are described in detail below and summarized in **Table 5.3-1**.

5.3.1 Avoid Sensitive Environments

The Project has been designed to:

- ▶ avoid known wetlands and sensitive ecosystems such as riparian areas; and
- ▶ avoid activities within watercourses.

5.3.2 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 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 Administration Building;
- ▶ Align linear Project features (such as powerlines, roads, water distribution) into a common 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;
- ▶ Minimize the length of haul roads, access roads, and rail line where possible. Use or improve existing roads where practical;
- ▶ Utilize a loop design configuration for the rail that requires half the space and subsequent footprint compared to the standard teardrop shape seen at other operating or proposed coal mines in western Canada;
- ▶ Place reclamation material (surface soil and woody debris) stockpiles within development areas such as the open pit and haul roads to avoid disturbance, while overburden is directly placed on Project components for future reclamation activities;
- ▶ Limit the TAC to a single lane width for long distances and utilize existing Forest Service Roads (FSRs) or private roads where appropriate;
- ▶ Backfill approximately 50 percent (%) of non-coal material back into the open pit; and;
- ▶ Place processed rock from the CPP within the management ponds versus a separate permanent pile to avoid any potential ARD from this material and reduce Project footprint.

5.3.3 Reclamation Measures

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

- ▶ Use progressive reclamation techniques 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;
- ▶ Salvage reclamation materials (surface soil, woody debris, and overburden), for later use in accordance with the **RCP**;

- ▶ Vegetate all temporary surface soils and overburden stockpiles to minimize the potential for erosion and sediment generation, to prevent subsequent potential effects on water quality, and to prevent losses of surface soils;
- ▶ Implement progressive reclamation on embankments, buttresses, backfills, TAC cut and fill slopes, and other Project components where possible to minimize fugitive dust emissions and reduce erosion and sediment generation;
- ▶ The reclaimed landscape will be shaped and contoured to achieve variations of slope steepness, slope length, aspect, and form to assist in creating landform diversity suitable for the establishment of varied plant communities and to reduce visual effects;
- ▶ PAG material deposited in the management ponds will be flooded to prevent acid mine drainage but will also be covered with an engineered cover consisting of non-PAG rock, overburden, and surface soils to allow for terrestrial revegetation;
- ▶ Majority of open pit features (e.g., highwalls and footwalls) are covered/resurfaced/recontoured with non- PAG rock and overburden; and
- ▶ Revegetate with native plant species appropriate for the target ecosystems, which will include species for merchantable timber, subsistence foods, and ceremonial purposes in consultation with the Wet'suwet'en.

5.3.4 Project Footprint Boundaries

The following apply to Project footprint boundaries:

- ▶ Implement “No Activity” buffers for identified features such as riparian areas and watercourses that were previously documented or identified by methodologies provided in the related management plans (e.g., **CEMP**, **WMP**, **VMP**);
- ▶ Clearly delineate the boundaries of no activity buffers for sensitive features in the proximity of planned disturbances to facilitate avoidance during all phases of the Project, where possible; and
- ▶ Clearly delineate Project footprint boundaries, adhering to construction plans, and restrict identified machine use to defined areas within the Project footprint.

5.3.5 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;
- ▶ Build, maintain, and use the TAC for transport of personnel, goods, and services 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 (if requested and based on sufficient employees in these locations) to facilitate potential employee 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 dust 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, 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 size and weight; and
- ▶ Avoid (i.e., with appropriate “No Activity” buffers) known raptor nests along the route of the TAC (where identified during baseline studies).

5.3.6 Project Component Design

The following apply to Project component design:

- ▶ Manage light effects using acceptable best management practices (BMPs) and engineering design.
- ▶ TCL will also incorporate the following mitigation measures associated with effects from lighting:
 - ▶ For areas visible to the public from sensitive viewpoints, investigate eliminating night lighting of buildings and structures and block light from windows where possible considering safety requirements;
 - ▶ Direct lighting shall be directed towards the ground and have appropriate covers to avoid fugitive light emissions; and
 - ▶ Lighting should be sensitive to environmental conditions and automatically shut off during daylight hours.

5.3.7 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 into the surrounding environment; and

- ▶ Use noiseless lead lines on the surface to minimize the effects of noise from blasts.

5.3.8 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 greenhouse gas (GHG) and dust emissions;
- ▶ Use BMPs in flowsheet design to maximize the reuse of process water by the CPP and allow the recirculation of grey water from Project equipment wash bays in the Maintenance Facility by the CPP; and
- ▶ Use belt filter presses to dewater fine processed rock material versus conventional slurry fine processed rock to reduced water consumption by the CPP.

5.3.9 Seepage Management Measures

The following mitigation measures are associated with seepage management:

- ▶ Use overburden bentonite liners for management ponds to reduce the amount of groundwater seepage and potential effects on surface water and groundwater quality;
- ▶ Use liners in the Tenas Control Pond, Wastewater Storage Pond, Soil Treatment Facility, Potable Water Storage Pond, sedimentation pond at CPP site to minimize the risk of seepage to groundwater and potential effects on surface water and groundwater quality;
- ▶ Monitor seepage, groundwater, and surface water levels, and quality/quantity downstream and upstream of the Project as per the monitoring programs set up in the **MWMP**; and
- ▶ Establish trigger levels that require the implementation of contingency mitigation measures described in the **DMP** to protect surface and groundwater quality and maintain minimum flow levels downstream of the Project.

5.3.10 Water Capture Measures

The designs of the management ponds, sedimentation ponds, collection and diversion channels, and all other water management structures are documented in **S1.0-1.22 Management Ponds (Tailings Storage Facility) and Control Pond Aspects, Appendix 1.0-G Tenas Project Water Management Technical Design Report**, and the **MWMP**. The following mitigation measures apply to water capture:

- ▶ Construct diversion channels where practical, to prevent non-contact water from entering the Project Area and remain as non-contact water;
- ▶ Sedimentation and control ponds will have sufficient storage capacity to allow fine sediments to settle out for 1 in 10-year storm events and will be designed to structurally withstand a 1 in 200-year storm event; total suspended solids (TSS) and/or turbidity will be monitored prior to release;
- ▶ Establish flocculent addition systems for sedimentation and/or control ponds that will directly discharge to surface waters to provide additional sedimentation control to reduce potential effects on surface water quality;
- ▶ If monitoring indicated, construct wetlands within or downstream of sedimentation and/or control ponds to reduce potential effects on surface water quality;

- ▶ Include a control structure on the outflow from the C02 diversion channel south of the East Management Pond to control high flow events discharging into the upstream portion of Four Creek by enabling overflow to the East Management Pond directly in the Post-closure Phase or to a channel going into the Tenas Control Pond in the Operation, and Decommissioning and Reclamation phases;
- ▶ Maintain sufficient capacity in the Tenas Control Pond to store up to a 1 in 10-year storm event to control discharge;
- ▶ Monitor and control water discharges from Tenas Control Pond to a tributary of Goathorn Creek based on downstream water flow rates and water quality to meet in-stream guidelines and flow requirements during the Operation, and Decommissioning and Reclamation phases; and
- ▶ Develop the open pit in a manner that will allow it to collect water in the Decommissioning and Reclamation, Post-closure Phases to provide additional sedimentation control.

5.3.11 Management of Metal Leaching/Acid Rock Drainage (ML/ARD)

The following mitigation measures apply to preventing potential ARD:

- ▶ Identify and segregate PAG material while mining the open pit, and place PAG material in management ponds and submerge PAG material under a minimum of 1.0 metre (m) of water within an average of six (6) months after excavation but no longer than 12 months and under at least two (2) m of water once the management pond has met its PAG material storage requirements (North Management Pond is completed first, followed by the East Management Pond and finally the West Management Pond) to prevent potential ARD and subsequent effects on surface water quality;
- ▶ Place approximately a one (1) to two (2) m layer of non-PAG rock on top of the submerged PAG material below the active water level of the respective management pond, followed by approximately one (1) to three (3) m layer of overburden to create a dry landform above water, followed by an approximately 30 centimetre (cm) layer of reclamation materials (surface soil) to reduce evaporative losses from the management ponds and provide a landscape more similar to pre-Project development;
- ▶ No PAG material will be used in construction of any external piles, pads, roads, embankments, buttresses, or for backfilling the open pit, to prevent potential ARD and subsequent effects on surface water quality;
- ▶ Open pit walls will be covered by non-PAG material to limit oxygen and water ingress into the open pit walls and provide a neutralizing effect on the open pit wall material below;
- ▶ Some of the open pit walls will be flooded with water to further reduce the likelihood of ARD from the covered open pit walls;
- ▶ Establish a material geochemical testing program for future Project exploration drillholes and Operation phase blast holes as part of the blasting program to verify PAG versus non-PAG materials. Maintain a PAG geological model while the open pit is being mined to reflect any changes observed;
- ▶ Maintain a database of geochemical testing results and material placement to avoid the incorrect placement of PAG material and potential ARD with subsequent effects on surface water quality;
- ▶ Establish a material tracking system to document the location and type of material being excavated and hauled to avoid misplacement of material and/or remediate any misplacement that may occur;

- ▶ Controlled open pit wall blasting will be conducted on both the highwall and footwall to limit the amount of damage to the open pit wall to minimize the potential for particle size reduction and provide pathways for water and oxygen to enter the open walls prior to them being covered;
- ▶ Majority of material near the open pit footwall will not be blasted again to minimize the potential of water and oxygen accessing this material;
- ▶ Progressive reclamation will be undertaken to reduce the infiltration of water and oxygen into the open pit walls by placing non-PAG rock and overburden on the open pit walls once mining is completed for an open pit wall section in question and people operating equipment have moved at least 100 m away from proposed backfilling operation. Furthermore, this non-PAG material is expected to provide a permanent high neutralization potential (NP) water source to prevent ARD generation from PAG material present in the open pit walls; and
- ▶ Provide annual reports to British Columbia Ministry of Energy, Mines and Low Carbon Innovation (BC MEMLI) and BC MECCS and designated Indigenous groups summarizing the results of geochemical testing.

The following mitigation measures for minimizing potential ML:

- ▶ Progressive reclamation will be undertaken to reduce the infiltration of water and oxygen into the non-PAG backfills, buttresses, and embankments;
- ▶ Non-PAG rock will be covered with overburden as much as material constraints allow to reduce the infiltration of water and oxygen;
- ▶ Place some non-PAG rock into management ponds that are characterised as PAG because of the mine planning process using a neutralization potential ratio (NPR) value of 2NP (neutralizing potential):1AP (acid potential [AP]) to classify non-PAG material from PAG material versus the geochemistry NPR value of 1.2NP:1AP used for classifying non-PAG material from PAG material; and
- ▶ In the Post-closure Phase, approximately half of non-PAG material will be flooded with water in the open pit to prevent oxygen ingress and further oxidization of this material resulting in a reduction of metal leaching once this occurs.

5.3.12 People, Employees, Contractors, and Onsite Policy

The following mitigation measures apply to people, employees, contractors, and onsite policies:

- ▶ Establish and implement an onsite policy prohibiting shooting, hunting, and fishing within the Project Area.

5.3.13 Powerline Design and Siting

- ▶ Powerlines will be designed and sited following guidelines for avian protection to minimize collision and electrocution risk on the Avian Species VC (APLIC 2006, 2012). Deflectors will be used on transmission lines and phase conductors will be used on distribution lines. Measures such as spike installation will be taken to discourage birds, particularly raptors, from nesting on utility poles.

5.3.14 Timing Considerations

- ▶ Clearing of vegetation will be conducted outside of the nesting season, whenever practicable. The nesting season for migratory birds in the Avian Species RSA is approximately May 1 to July 31 annually; however, the dates may differ for certain species. The nesting season for Raptors is

generally longer. Refer to the **WMP** for additional details about nesting windows for select species; and

- ▶ If vegetation clearing must occur during the nesting season, a Qualified Professional (QP) will conduct pre-clearing nest surveys to limit the risk of incidental take. Works will commence within a time frame deemed appropriate by the QP to minimize the chance for new nests to be initiated between the survey and commencement of work.

5.3.15 Establish “No Activity” Buffers Around Nests

- ▶ Active nests and suspected nest locations will be protected with a “No Activity” buffer consistent with guidelines, the level of the activity, and the landscape context until the young birds have successfully fledged, the nest is confirmed as no longer active (e.g., abandoned or depredated), or the nesting window has passed (for suspected nest locations). Refer to the **WMP** for additional details about “no activity” buffers, including proposed mitigation for the four (4) occupied raptor nests and one (1) suspected nesting territory identified within the Avian Species LSA during baseline studies (**Appendix 4.9-A**);
- ▶ Under Section 34 of the BC *Wildlife Act*, RSBC 1996, c 488 (GovBC 1996d), it is an offence to possess, take, injure, molest, or destroy the nests of certain raptor species (e.g., eagle, osprey) (**Table 2.2-1**) regardless of whether the nests are occupied, except as provided by regulation. As such, the nests of these raptor species will not be disturbed by the Project activities even when the nests are unoccupied. For such nests, a QP will provide guidance on appropriate “no activity” buffers for unoccupied nests;
- ▶ Blasting activities in the vicinity of active raptor nests will be managed to minimize sensory effects (e.g., alter blasting patterns or delay blasting if an occupied nest is visible from the blast pattern and deemed to be in harms way); and
- ▶ Directed lighting or light shielding, rather than broad lighting, will be implemented to minimize sensory effects on the Avian Species VC, and lighting will be focused on work sites and not surrounding areas. Appropriate lamps will be used, or lamps will be fitted with ultraviolet (UV) filters, whenever practicable. Times during evening hours when lighting is used will be limited, particularly between May and September, to minimize sensory effects on the Avian Species VC.

5.3.16 Wildlife Education Program

- ▶ A Wildlife Education Program will be implemented in accordance with the **WMP**;
- ▶ Employees and contractors will be provided with wildlife education and awareness training, including education about potential avian issues onsite and associated mitigation measures to avoid, minimize, or rehabilitate onsite the potential effects of change in habitat, change in mortality, and change in movement patterns on the Avian Species VC. Employees and contractors will be educated on waste management policies that limit human-avian interactions. Designated site employees will be trained in appropriate avian deterrent techniques to minimize avian interactions with the Project; and
- ▶ Employees and contractors will be required to report avian observations onsite. Avian encounters and outcomes will be monitored, and logbooks will be used to record observations. Logbooks and reports will be available to employees, contractors, and visitors.

5.3.17 Wildlife Protection Protocols

- ▶ Wildlife Protection Protocols will be implemented in accordance with the **WMP** to avoid or minimize wildlife habitat interactions that may result in the mortality, morbidity, or injury to wildlife or employees/contractors:
 - ▶ Personal firearms within the Project Area will be prohibited for employees and contractors;
 - ▶ Policies prohibiting employees and contractors from feeding, approaching, or harassing avian species within the Project Area will be implemented;
 - ▶ A "No Domestic Pet Policy" for employees, visitors, and contractors will be implemented in the Project Area; and
 - ▶ Buildings and other Project infrastructure will be designed and maintained to exclude birds. Physical, visual, and/or auditory deterrents will be used to discourage avian use of buildings and other Project infrastructure for refuge, shelter, or nesting, and to prevent birds from potentially becoming entrapped.

5.3.18 Manage Chemical Hazards

- ▶ Chemical hazards will be handled, stored, and disposed of using measures, such as those in the **FMSCP** and **CHWSTF**, to avoid attracting avian species (e.g., use of wildlife proof containers or exclusion fencing);
- ▶ Physical exclusion measures will be employed around hazardous materials to discourage avian use (e.g., wire grids above contaminated waterbodies with streamers or flagging); and
- ▶ Vegetation management will be incorporated in the vicinity of contaminated waterbodies to discourage avian use.

5.3.19 Manage Potential Attractants

- ▶ Waste will be collected and stored in wildlife proof containers (e.g., trash bins, dumpsters) to avoid attracting avian scavengers. Wildlife proof containers will be inspected regularly. If evidence of avian presence or access to waste disposal facilities is detected, or a waste disposal compliance problem is detected, modified systems will be implemented and/or offsite waste disposal frequencies will be increased;
- ▶ If a carcass is found within the Project Area, it will be reported and removed promptly to discourage avian scavengers. The BC Conservation Officer Service will be notified and consulted regarding proper disposal of dead animals;
- ▶ Physical, visual, and/or auditory deterrents will be used to discourage avian use of Surface Water Management Infrastructure (e.g., channels, ponds) as feeding, breeding, or stopover sites; and
- ▶ Management of waste and/or wildlife attractants will be included in the Wildlife Education Program (refer to **WMP**).

5.3.20 Summary of Mitigation Measures

A summary of all mitigation measures applicable to the Avian Species 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. Each potential effect applies to all Avian Species VC subcomponents, and all potential effects are predicted to be residual effects that continue through all phases and are carried forward in the assessment.

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

Potential Effect	Contributing Activities within the Project Phases (C, O, D, P)	Proposed Mitigation Measures	Applicable Valued Component (VC) Subcomponent	Residual Effect (Yes/No)
Alteration and/or Loss of Habitat	- Transportation of equipment, materials, and personnel (C, O, D, P) - Site clearing (C) - Construction of Surface Water Management Infrastructure; Bypass Road; haul roads and service roads; Goathorn Creek Bridge; Coal Processing Plant (CPP); administration buildings; powerline and substation; Rail Infrastructure; water discharge infrastructure; and material handling systems (C) - Improvements to existing private road and Forest Service Roads (FSR) (C) - Mining the open pit (O) - Operation of Surface Water Management Infrastructure; CPP; water discharge infrastructure; material handling systems; and solid waste management systems (O) - Maintenance of Bypass Road; improved private road and FSR; haul roads and service roads; bridge over Goathorn Creek; administration buildings; powerline and substation; Rail Infrastructure; and storage piles and stockpiles (O) - Progressive reclamation (O) - Dismantle and remove mining equipment and facilities (D) - Reclamation and closure activities at Minesite (D) - Reclamation and closure of Bypass Road; bridge over Goathorn Creek; powerline and substation; and Rail Infrastructure (D) - Implement post-mining systems and monitoring (D) - Maintain post-mining systems and ongoing monitoring (P)	- Avoid sensitive environments - Limit Project footprint and Project Area - Reclamation measures (Refer to RCP) - Project footprint boundaries - Transport measures - Project component design - Blasting measures (Refer to EMP) - Coal processing measures - Seepage management measure - Water capture measures - Management of ML/ARD - Timing considerations (Refer to WMP) - Establish “No Activity” buffers around nests (Refer to WMP) - Wildlife education program (Refer to WMP) - Wildlife protection protocols (Refer to WMP)	- Migratory Breeding Birds - Listed Bird Species - Raptors	Yes

Potential Effect	Contributing Activities within the Project Phases (C, O, D, P)	Proposed Mitigation Measures	Applicable Valued Component (VC)Subcomponent	Residual Effect (Yes/No)
Change in Mortality	- Transportation of equipment, materials, and personnel (C, O, D, P) - Site clearing (C) - Construction of Surface Water Management Infrastructure; Bypass Road; haul roads and service roads; Goathorn Creek Bridge; CPP; administration buildings; Powerline and substation; Rail Infrastructure; water discharge infrastructure; and material handling systems (C) - Improvements to existing private road and FSR (C) - Mining the open pit (O) - Operation of Surface Water Management Infrastructure; CPP; water discharge infrastructure; material handling systems; and solid waste management systems (O) - Maintenance of Bypass Road; improved private road and FSR; haul roads and service roads; bridge over Goathorn Creek; administration buildings; powerline and substation; Rail Infrastructure; and storage piles and stockpiles (O) - Progressive reclamation (O) - Dismantle and remove mining equipment and facilities (D) - Reclamation and closure activities at Minesite (D) - Reclamation and closure of Bypass Road; bridge over Goathorn Creek; Powerline and substation; and Rail Infrastructure (D) - Implement post-mining systems and monitoring (D) - Maintain post-mining systems and ongoing monitoring (P)	- Avoid sensitive environments - Limit Project footprint and Project Area - Project footprint boundaries - Transport measures - Project component design - Blasting measures (Refer to EMP) - Coal processing measures - Seepage management measures - Water capture measures - Management of ML/ARD - People, employees, contractors, and onsite policies - Powerline design and siting - Timing considerations (Refer to WMP) - Establish “No Activity” buffers around nests (Refer to WMP) - Wildlife education program (Refer to WMP) - Wildlife protection protocols (Refer to WMP) - Manage chemical hazards - Manage potential attractants (Refer to WMP)	- Migratory Breeding Birds - Listed Bird Species - Raptors	Yes
Change in Movement Patterns	- Transportation of equipment, materials, and personnel (C, O, D, P) - Site clearing (C)	- Avoid sensitive environments - Limit Project footprint and Project Area - Reclamation measures (refer to RCP)	Migratory Breeding Birds	Yes

Potential Effect	Contributing Activities within the Project Phases (C, O, D, P)	Proposed Mitigation Measures	Applicable Valued Component (VC)Subcomponent	Residual Effect (Yes/No)
	- Construction of Surface Water Management Infrastructure; Bypass Road; haul roads and service roads; Goathorn Creek Bridge; CPP; administration buildings; powerline and substation; Rail Infrastructure; water discharge infrastructure; and material handling systems (C) - Improvements to existing private road and FSR (C) - Mining the open pit (O) - Operation of Surface Water Management Infrastructure; CPP; water discharge infrastructure; material handling systems; and solid waste management systems (O) - Maintenance of Bypass Road; improved private road and FSR; haul roads and service roads; bridge over Goathorn Creek; administration buildings; powerline and substation; Rail Infrastructure; and storage piles and stockpiles (O) - Progressive reclamation (O) - Dismantle and remove mining equipment and facilities (D) - Reclamation and closure activities at Minesite (D) - Reclamation and closure of Bypass Road; bridge over Goathorn Creek; powerline and substation; and Rail Infrastructure (D) - Implement post-mining systems and monitoring (D) - Maintain post-mining systems and ongoing monitoring (P)	- Project footprint boundaries - Transport measures - Project component design - Blasting measures (Refer to EMP) - Coal processing measures - Seepage management measures - Water capture measures - Management of ML/ARD - Powerline design and siting - Timing considerations (Refer to WMP) - Establish “No Activity” buffers around nests (Refer to WMP) - Wildlife education program (Refer to WMP) - Wildlife protection protocols (Refer to WMP) - Manage chemical hazards - Manage potential attractants (Refer to WMP)	- Listed Bird Species - Raptors	

Notes: C, O, D, P represent Project phases: (C)onstruction, (O)peration, (D)ecommissioning and Reclamation, (P)ost-closure.

EMP=Explosives Management Plan (S13.0-C6); ML/ARD=metal leaching/acid rock drainage; ML/ARD=Metal Leaching/Acid Rock Drainage; Project=Tenas Project; RCP=Reclamation and Closure Plan (S13.0-C15); WMP=Wildlife Management Plan (S13.0-C21);

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 anticipated residual adverse effects of the Project on the Avian Species VC subcomponents. Residual effects are the adverse Project effects that remain after the implementation of all mitigation measures and management strategies and are the expected consequences of the Project on the Avian Species VC.

The approach to assessing the residual effects of the Project on the Avian Species VC subcomponents follows the methodology outlined in **S3.0 Assessment Methodology** of the **EAC Application**. For each subcomponent of the Avian Species VC, each residual effect is assessed in the context of Project activities that are expected to occur during each Project phase. Each residual effect is then characterised based on the combined predicted residual effect for all Project phases, including an evaluation of likelihood, significance, and level of confidence.

5.4.1 Description of Evaluation Criteria

5.4.1.1 Residual Effects Characteristics

Residual effects on the Avian Species VC subcomponents have been characterised in terms of Magnitude, Geographic Extent, Duration, Frequency, Reversibility, and Context. Definitions and ratings for each residual effect characteristic are provided in **Table 5.4-1**.

Table 5.4-1: Effect Characteristics Considered when Determining the Significance of Residual Effects on the Avian Species Valued Component (VC)

Residual Effect Characteristic	Definition	Rating
Magnitude	The intensity of the residual effect, or a measure of the degree of change from existing (i.e., baseline) conditions.	Low: Effect occurs that might be detectable but is expected to be within the range of baseline or guideline values, or within the range of natural variability (i.e., 0 to 5% change). Moderate: Effect is expected to be at or to slightly exceed the limits of baseline or guideline values (i.e., 6 to 15% change) – clearly an effect and may become a management concern. High¹: Effect is expected to exceed the limits of baseline or guideline values (i.e., >15% change) – can pose a serious risk and represents a management concern.
Geographic Extent	The geographic area within which the residual effect is expected to occur.	Project Area: Effect is limited to the Project Area. Local: Effect is limited to the Avian Species LSA. Regional¹: Effect extends beyond the Avian Species LSA into the Avian Species RSA.
Duration	Length of time over which the residual effect is expected to persist.	Short-term: Less than two (2) years (i.e., effect happens during the Construction Phase only). Medium-term: two (2) years to 52 years (i.e., effect happens from the Construction Phase through to the end of the Post-closure Phase). Long-term¹: More than 52 years (i.e., effect extends beyond the Post-closure Phase).

Residual Effect Characteristic	Definition	Rating
Frequency	How often the residual effect is expected to occur.	Infrequent: Effect occurs several times at sporadic intervals. Frequent: Effect occurs many times on a regular basis. Continuous ¹ : Effect occurs continuously.
Reversibility	Whether or not the residual effect can be reversed once the activity causing the residual effect ceases.	Fully reversible: A residual effect that is expected to diminish to baseline conditions. Partially reversible: A residual effect that is expected to partially diminish to baseline conditions. Irreversible ¹ : A residual effect that is not expected to diminish to baseline conditions.
Context	The extent to which the Avian Species VC has been affected by past and present environmental and socio-economic processes and conditions, its potential sensitivity to the Project residual effect, and its ability to recover from that effect (i.e., resilience).	Low: Subcomponent has high resilience to stress or ecological change. This resilience can be a result of the ecological characteristics of the species or ecosystem, and/or a lack of historic and ongoing anthropogenic or natural disturbance. No listed species expected to be present and/or affected. Moderate: Subcomponent has moderate resilience to stress or ecological change. This resilience can be a result of the ecological characteristics of the species or ecosystem, and/or an intermediate level of historic or ongoing anthropogenic or natural disturbance with the capacity to assimilate more change. Expected presence of and/or Project-related effects on blue-listed species (i.e., special concern in BC). High ¹ : Subcomponent has weak resilience to stress or ecological change. This resilience can be a result of the ecological characteristics of the species or ecosystem, and/or a high level of historic or ongoing anthropogenic or natural disturbance. Expected presence of and/or Project-related effects on red-listed species (i.e., endangered or threatened in BC) and/or SARA-listed species (i.e., endangered, threatened, or special concern in Canada).

Notes: %=percent; >=greater than; BC=British Columbia; LSA=Local Study Area; RSA=Regional Study Area; SARA=Species at Risk Act, SC 2002, c 29 (Government of Canada [GovCan] 2002); VC=Valued Component

¹These ratings are referred to as “unfavourable” in the Significance determination.

Magnitude is assessed quantitatively by assigning thresholds to express the relative percentage of habitat loss or alteration relative to the total habitat available in the Avian Species RSA. Evidence from scientific literature regarding avian (and mammal) species suggests that below a critical threshold level of 10 to 30% remaining suitable habitat, major ecological change occurs (e.g., rapid population decline, species loss) (Andrén 1994, Radford et al. 2005, Swift and Hannon 2010). This critical threshold level suggests that a population decline due to habitat alteration and/or loss is acceptable as long as the population persists; however, this is not considered to be a conservative approach to effects assessments. A conservative approach is used in this assessment and precautionary thresholds have been identified for species for which specific thresholds are not known. A precautionary threshold is defined as the point before a resource would be expected to undergo an unacceptable change, either from an ecological, regulatory, or social perspective. This definition allows for adaptive mitigation measures to be enacted with sufficient time to

prevent the particular resource (i.e., subcomponent) from reaching or exceeding the true ecological threshold.

The precautionary thresholds used in this assessment for the alteration and/or loss of habitat identified a loss of 0 to 5% of suitable habitat as a Low Magnitude, 6 to 15% as a Moderate Magnitude, and a >15% loss of suitable habitat as a High Magnitude. These quantitative Magnitude thresholds apply to the Migratory Breeding Birds habitat guilds (i.e., wetlands, early seral, old/mature forest), Listed Bird Species (i.e., common nighthawk, olive-sided flycatcher, short-eared owl), and Raptors (i.e., northern goshawk and short-eared owl) for which habitat suitability modelling was completed. Habitat suitability modelling was not completed for rusty blackbird because the wetlands habitat guild model already covered focal habitats used by this species. Habitat suitability modelling was also not completed for the remaining Listed Bird Species (i.e., bank swallow, barn swallow, and black swift) due to their preference for specific habitat features that are not generally identifiable using available spatial data. As such, qualitative discussions based on scientific literature, baseline studies, and professional judgement were used to assess change in habitat for bank swallow, barn swallow, and black swift.

For the change in mortality and change in movement pattern effects, the precautionary thresholds lead to the identification of the following ratings: Low, an effect that occurs and might be detectable but is expected to be within the range of baseline or guideline values, or within the range of natural variability; Moderate, an effect that is expected to be at or to slightly exceed the limits of baseline or guideline values — clearly an effect and may become a management concern; and High, an effect is expected to exceed the limits of baseline or guideline values — can pose a serious risk and represents a management concern.

5.4.1.2 *Likelihood*

Likelihood refers to the probability that the predicted residual effect will occur while considering that the mitigation will be successful. Likelihood is defined as Likely or Unlikely:

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

5.4.1.3 *Significance Determination*

The characterisation of residual effects is based on the review of existing conditions (**4. Existing Conditions**), the assessment of Project-related effects (**5.4**), other relevant scientific information, and the professional judgement of the EA team. All residual effects (independent of their Significance rating) are carried forward to the CEA.

The Significance of the residual effect is rated as **Not Significant** or **Significant**, based on the following:

- Not Significant** A residual effect that is not expected to result in a change to an Avian Species VC subcomponent and is not expected to alter its population viability or persistence within the Avian Species RSA beyond an acceptable level is considered **Not Significant**; or

Significant A residual effect that is expected to result in a change to an Avian Species VC subcomponent and is expected to alter its population viability and persistence within the Avian Species RSA beyond an acceptable level (e.g., where it is not sustainable or is unavailable to contribute to biodiversity and ecosystem function) is considered **Significant**.

Limitations of existing data and uncertainty associated with the assessment were also characterised by assigning a Level of Confidence for each residual effect. Confidence levels were considered in relation to:

- ▶ scientific certainty relative to the quantification of the residual effect, including the quality and quantity of the data and the understanding of effect mechanisms;
- ▶ scientific certainty relative to the effectiveness of the proposed mitigation; and
- ▶ professional judgment based on prior experience in predicting effects and the known effectiveness of proven mitigation measures.

Confidence estimates allows the decision-maker to evaluate risk associated with the residual effects of the Project. In the determination of confidence, the following is considered:

- ▶ **Low Confidence:** is assigned when the VC, subcomponent and/or Project interaction is not well understood, and/or the mitigation has not been proven effective;
- ▶ **Moderate Confidence:** is assigned where the VC is understood in similar ecosystems and effects have been documented in the larger regional area or in the literature, and/or the mitigation has been proven effective elsewhere; or
- ▶ **High Confidence:** is assigned when the VC, subcomponent, and Project interactions are well understood, and the mitigation has been proven effective.

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

5.4.2 Migratory Breeding Birds Subcomponent

5.4.2.1 Alteration and/or Loss of Habitat

Alteration and/or loss of habitat was assessed quantitatively by considering the residual effect of the Project on the amount of suitable nesting habitat available to support Migratory Breeding Birds, as represented by the three habitat guilds (i.e., migratory species that prefer wetlands, early seral, or old/mature forest). The habitat suitability model for each habitat guild was developed using a two (2)-class rating system (i.e., suitable and unsuitable). Refer to Appendix E of **Appendix 4.9-A** for additional details about the habitat suitability modelling completed for each habitat guild.

Loss of habitat was quantified for each habitat guild by calculating the amount of suitable nesting habitat expected to be lost within the Project Area during the Construction Phase due to site clearing and the construction and installation of Project components.

Alteration of habitat was considered during all Project phases and was quantified for each habitat guild using a two (2)-step process. Following model development, a zone of influence (ZOI) was delineated around the Project Area to consider the extent of indirect effects (e.g., edge effects, sensory disturbance) into the Avian Species LSA. Then the amount of suitable nesting habitat within the ZOI was quantified for

each habitat guild to estimate the amount of suitable nesting habitat that may be indirectly altered within the Avian Species LSA. The selection of a ZOI for Migratory Breeding Birds was based on scientific literature and professional judgement.

A range of effect distances has been reported in the literature within which avian response to industrial activities has been observed. Most effect distances associated with forested landscapes ranged from 50 to 300 m of industrial activities and/or roads with a few larger effect distances extending out to 365 m or more (Reijnen and Foppen 1994, Reijnen et al. 1995, 1997, Kuitunen et al. 1998, Hanowski et al. 1999, Ortega and Capen 1999, Forman and Deblinger 2000, Habib et al. 2007, Bayne et al. 2008). The larger effect distances were typically associated with a higher level of disturbance than anticipated for the Project. In some cases, certain avian species also displayed lower tolerance to industrial and/or road use disturbance. Based on Project activities, adjacent habitat types, and professional judgement of the EA team, the ZOI for Migratory Breeding Birds is expected to extend up to 200 m into the Avian Species LSA from the outer boundary of the Project Area.

The spatial extent of the 200 m ZOI for Migratory Breeding Birds was compared with the results of the predicted spatial extent of noise levels dispersing from Project activities/components. Refer to **S4.0-C1 Atmospheric Environment VC** and **S4.0-C1-Appendix 4.1-C Noise Modelling Report** of the **EAC Application** for additional details about noise modelling completed for the Project. The 40 A-weighted decibels (dBA) daytime and nighttime noise thresholds encompass 2,073 ha and 1,072 ha, respectively, around the Project Area. The 200 m ZOI encompasses 920 ha around the Project Area. The comparison showed that the 200 m ZOI for Migratory Breeding Birds does not fully encompass the 40 dBA daytime or nighttime noise thresholds. The 40 dBA daytime noise threshold is largest around the Project Area where the Minesite, quarries, and Rail Loadout components are located. The 40 dBA nighttime noise threshold is largest around the Project Area where the Minesite and Rail Loadout components are located. It is expected that the 200 m ZOI does not encompass the 40 dBA daytime or nighttime noise thresholds in the areas where these components are located. However, as outlined in **5.4.2.1.1**, suitable nesting habitat for Migratory Breeding Birds is not considered to be a limiting factor within the Avian Species LSA and RSA. This comparison illustrates that the selected ZOI adequately addressed the Project-related residual effect of alteration of habitat (including noise) on Migratory Breeding Birds.

A similar comparison was completed for dustfall deposition as it relates to the 200 m ZOI for Migratory Breeding Birds. Refer to **S4.0-C1 Atmospheric Environment VC** and **S4.0-C1-Appendix 4.1-B Air Quality Modelling Report** of the **EAC Application** for additional details about air quality modelling completed for the Project. Air quality modelling predicts that dustfall deposition could occur up to 800 m from the Project Area with the most likely zone of deposition expected within 100 m of Project components. The predicted effects resulting from high dustfall deposition are within the 200 m ZOI for Migratory Breeding Birds, demonstrating that the selected ZOI used to assess the Project-related residual effect of alteration of habitat (including dustfall) on Migratory Breeding Birds was appropriate.

Habitat changes predicted to result from the Project on each habitat guild are summarized in **Table 5.4-2**. The amount of suitable nesting habitat expected to be lost within the Project Area was added to the amount of suitable nesting habitat expected to be altered within the Avian Species LSA to estimate the total change in suitable nesting habitat available for each habitat guild. These estimates were then compared to the total amount of suitable nesting habitat available within the Avian Species RSA for each habitat guild. Suitable nesting habitat for the wetlands, early seral, and old/mature forest habitat guilds is depicted in **Figure 5.4-1**, **Figure 5.4-2**, and **Figure 5.4-3**, respectively. The predicted total change in suitable nesting habitat available for all habitat guilds combined is 3,285 ha (1.6%) of the Avian Species RSA.

Table 5.4-2: Summary of Change in Suitable Nesting Habitat for Migratory Breeding Birds

Habitat Guild	Loss of Suitable Nesting Habitat (ha) in the Project Area	Alteration of Suitable Nesting Habitat (ha) in the Avian Species LSA	Predicted Total Change in Suitable Nesting Habitat (ha) ¹	Total Suitable Nesting Habitat (ha) in the Avian Species RSA	Predicted Total Change in Suitable Nesting Habitat (%) ²
Wetlands	412	297	709	33,165	2.1
Early seral	815	296	1,111	44,695	2.5
Old/mature forest	889	576	1,465	128,660	1.1
Total	2,116	1,169	3,285	206,520³	1.6

Notes: %=percent; ha=hectare; LSA=Local Study Area; RSA=Regional Study Area

¹ Predicted total change in suitable nesting habitat (ha) in the Project Area and Avian Species LSA.

² Predicted total change in suitable nesting habitat (%) in the Avian Species RSA.

³ The total amount of suitable nesting habitat (ha) in the Avian Species RSA for all habitat guilds combined. This total may be larger than the total area of the Avian Species RSA (i.e., 194,651 ha) because some suitable habitat areas among the three habitat guilds may overlap.

5.4.2.1.1 *Residual Effect Characteristics*

The residual effect characteristics for alteration and/or loss of habitat on Migratory Breeding Birds are summarized below and provided in **Table 5.4-3**.

The Magnitude is predicted to be Low. The predicted total change in suitable nesting habitat available for all habitat guilds combined is 3,285 ha (1.6%) of the Avian Species RSA (**Table 5.4-2**). Limited changes to suitable nesting habitat available for Migratory Breeding Birds due to the Project are expected, which suggests that a limited number of individuals are expected to interact with the Project and potentially be affected by alteration and/or loss of habitat. Individuals displaced by the Project are expected to relocate to areas of suitable nesting habitat within the Avian Species LSA and RSA. Suitable nesting habitat is not considered to be a limiting factor within the Avian Species LSA and RSA (i.e., the available habitat can support the low numbers of displaced individuals).

The Geographic Extent is predicted to be Local. While the direct loss of suitable nesting habitat is expected to be limited to the Project Area, indirect alteration through edge effects and sensory disturbance is expected to extend up to 200 m into the Avian Species LSA.

The Duration of residual effect is predicted to occur over the Long-term, although differences may exist between the habitat guilds, depending on the areas and types of reclamation and the time frame for regeneration of vegetation within reclaimed areas. Alteration and/or loss of habitat are expected to occur during the Construction Phase and the residual effects are expected to persist until Project activities cease, Project components are removed, disturbed areas are reclaimed, and vegetation has re-established within reclaimed areas. Regeneration of disturbed areas for the old/mature forest habitat guild is expected to extend beyond the Post-closure Phase (i.e., Long-term). Regeneration of disturbed areas for the wetlands and early seral habitat guilds is expected to be achieved by the end of the Post-closure Phase (i.e., Medium-term).

The Frequency is predicted to be Continuous. Alteration and/or loss of habitat are expected to occur during the Construction Phase and the residual effects are expected to persist until Project activities cease, Project components are removed, disturbed areas are reclaimed, and vegetation has re-established within reclaimed areas.

The Reversibility of habitat loss and/or alteration for Migratory Breeding Birds is predicted to be Fully Reversible. Progressive and final reclamation are expected to focus on reclaiming disturbed areas; therefore, suitable nesting habitat predicted to be lost or altered within or adjacent to the Project Area is expected to recover over time following reclamation activities. Once disturbed areas are reclaimed, the breeding areas for Migratory Breeding Birds are expected to progressively include these areas, as dictated by the habitat type that regenerates and its age class.

The Context is predicted to be Moderate. Migratory Breeding Birds have been exposed to historic and ongoing anthropogenic and natural disturbances throughout their ranges, including within the Avian Species RSA. The Project is expected to interact with a limited number of individuals that may potentially be affected by alteration and/or loss of habitat. Individuals displaced by the Project are expected to relocate to areas of suitable nesting habitat within the Avian Species LSA and RSA, as suitable nesting habitat is not considered to be limiting.

Table 5.4-3: Summary of Residual Effect Characteristics for Alteration and/or Loss of Habitat on Migratory Breeding Birds Subcomponent

Residual Effect Characteristic	Rating	Rationale for Rating
Magnitude	Low	The predicted total change in suitable nesting habitat available for all habitat guilds combined is 3,285 ha (1.6%) of the Avian Species RSA (Table 5.4-2). Limited changes to suitable nesting habitat available for Migratory Breeding Birds are expected, which suggests that a limited number of individuals are expected to interact with the Project and potentially be affected by alteration and/or loss of habitat.
Geographic Extent	Local	While the direct loss of suitable nesting habitat is expected to be limited to the Project Area, indirect alteration through edge effects and sensory disturbance is expected to extend into the Avian Species LSA.
Duration	Long-term	Alteration and/or loss of habitat are expected to occur during the Construction Phase and persist until Project activities cease, Project components are removed, disturbed areas are reclaimed, and vegetation has re-established. Regeneration of old/mature forest habitat is expected to extend beyond the Post-closure Phase (i.e., Long-term). Regeneration of wetlands and early seral habitat guilds is expected to be achieved by the end of the Post-closure Phase (i.e., Medium-term).
Frequency	Continuous	Alteration and/or loss of habitat are expected to occur during the Construction Phase and persist until Project activities cease, Project components are removed, disturbed areas are reclaimed, and vegetation has re-established.
Reversibility	Fully Reversible	Progressive and final reclamation are expected to focus on reclaiming disturbed areas; therefore, suitable nesting habitat for Migratory Breeding Birds predicted to be lost or altered within or adjacent to the Project Area is expected to recover over time following reclamation activities.
Context	Moderate	Migratory Breeding Birds have been exposed to historic and ongoing anthropogenic and natural disturbances throughout their ranges, including within the Avian Species RSA. The Project is expected to interact with a limited number of individuals that may potentially be affected by alteration and/or loss of habitat. Individuals displaced by the Project are expected to relocate to areas of suitable nesting habitat within the Avian Species LSA and RSA, as suitable nesting habitat is not considered to be limiting.

Notes: %=percent; ha=hectare; LSA=Local Study Area; m=metre; Project=Tenas Project; RSA=Regional Study Area

5.4.2.1.2 Likelihood

The Likelihood of the residual effect occurring is predicted to be Likely. Suitable nesting habitat for each habitat guild is present within the Project Area and is expected to be lost during site clearing and the construction and installation of Project components. Suitable nesting habitat for each habitat guild is also situated adjacent to the Project Area (i.e., within the 200 m ZOI) and is expected to be indirectly affected.

5.4.2.1.3 Significance Determination

The residual effect of alteration and/or loss of habitat is not expected to result in a change to the Migratory Breeding Birds subcomponent and is not expected to alter its population viability or persistence within the Avian Species RSA beyond an acceptable level. The residual effect of alteration and/or loss of habitat on the Migratory Breeding Birds subcomponent is predicted to be **Not Significant**.

The Level of Confidence in this prediction is Moderate. While the direct effects of clearing on Migratory Breeding Birds are well known, uncertainty exists with respect to the extent and degree of habitat alteration through habitat fragmentation, edge effects, and sensory disturbance. Uncertainty exists regarding the accuracy of the mapping products used to identify suitable nesting habitat for the three habitat guilds within the Avian Species LSA and RSA. Also, limited knowledge exists on the breeding populations of each species, by habitat type, within the Avian Species RSA, and whether habitat outside of disturbed areas has the capacity to accommodate individuals displaced by the Project. Uncertainty is present regarding the resilience of undisturbed suitable nesting habitat to withstand potential Project-related change, and the regeneration of vegetation within reclaimed areas.

Mitigation measures to avoid, minimize, and or rehabilitate onsite the potential effects of alteration and/or loss of habitat on Migratory Breeding Birds are consistent with recently approved EA projects in BC (e.g., Red Mountain Underground Gold, Blackwater Gold), and are expected to appropriately mitigate the predicted Project-related effects.

5.4.2.2 Change in Mortality

Change in mortality was assessed qualitatively by considering the residual effect of the Project on the abundance of Migratory Breeding Birds, as represented by the three (3) habitat guilds (i.e., migratory species that prefer wetlands, early seral, or old/mature forest). Given the diversity of migratory species known to occur within the Avian Species RSA, and considering their respective life requisites and behaviours, several sources of direct and indirect mortality were considered for the assessment of change in mortality on Migratory Breeding Birds.

Potential sources of direct mortality on Migratory Breeding Birds include incidental take during Project-related site clearing and vegetation management; entrapment in Project components (e.g., buildings, pipes, vents, other enclosed spaces); collisions with Project-related vehicles, mobile equipment, trains, and components (e.g., buildings, windows); and collisions with the Project powerline and electrocution caused by contact with powerline infrastructure.

All migratory bird species are vulnerable to incidental take during Project-related site clearing and vegetation management, particularly those that build inconspicuous nests (e.g., small ground-nesting species) or nest on buildings and other structures (e.g., swallows) that require routine maintenance. Species that are more tolerant of anthropogenic activities and/or nesting on buildings and other structures (e.g., swallows) may be more susceptible to entrapment in Project components. Entrapment may lead to exhaustion as the birds try to escape, and could result in dehydration, starvation, and eventual death (Loss et al. 2015, Vancouver Bird Advisory Committee 2015, University of British Columbia 2019). Species that use roadside or rail-side habitats for nesting, feeding, and/or roosting (e.g., passerines that prefer early seral habitats) may be more susceptible to collisions with Project-related vehicles, mobile equipment, and trains. The low-flying daily movements of passerines and other migratory birds (e.g., hummingbirds) may increase vulnerability to collisions with Project-related vehicles, mobile equipment, trains, and low-rise components (e.g., buildings, windows); waterbirds and shorebirds are generally less susceptible to these types of collisions (Erickson et al. 2005, Bishop and Brogan 2013, Machtans et al. 2013). Long distance and/or nocturnal migrants (e.g., passerines, hummingbirds, swifts, waterbirds, shorebirds) may be susceptible to collisions with taller Project components (e.g., buildings, windows) during seasonal migrations, especially well-lit buildings (Calvert et al. 2013, Machtans et al. 2013, Loss et al. 2014, Cabrera-Cruz et al. 2018, Adams et al. 2019).

Larger-bodied birds (e.g., ducks, geese, swans) may be more susceptible to collisions with the Project powerline because they tend to be weaker fliers and/or lack the ability to quickly maneuver in flight (APLIC 2006, 2012, Loss et al. 2015). Larger birds may be more susceptible to electrocution caused by contact

with powerline infrastructure because their physical size easily spans the distance between energized equipment (APLIC 2006). Flocking species, inexperienced juvenile birds, or birds distracted by territorial or courtship displays, or aerial hunting activities may be at greater risk of collision and/or electrocution (APLIC 2006, 2012). Low-flying daily movements between nesting, feeding, and stopover habitats (e.g., movement of waterbirds between nearby wetlands) may also increase collision and electrocution risk with powerline infrastructure (APLIC 2012). Short distance migrants (e.g., waterbirds) may be at greater risk of collision with Powerline infrastructure because they tend to travel at lower altitudes and stop to feed and rest more frequently compared to long distance migrants (e.g., passerines, shorebirds), which typically travel at higher altitudes and stop to feed and rest less frequently (Lincoln et al. 1998, APLIC 2012).

Potential sources of indirect mortality for Migratory Breeding Birds include nest failure or abandonment caused by sensory disturbance from Project activities; exhaustion and eventual collision with the ground or Project components caused by disorientation of nocturnal migrating birds by artificial light; changes in predator-prey dynamics caused by Project-related edge effects or increased public access and use of the Project Area and adjacent habitats by off-road vehicles; exposure to hazardous materials used during Project activities (e.g., chemicals used for herbicide spraying during invasive plant management); and contamination of avian habitats and food resources or oiling of individuals caused by Project-related spills of fuels and other hazardous materials, malfunctions, and other accidents.

Avian species are typically more sensitive to sensory disturbance during the breeding season (Sinnott 2000), with the degree of sensitivity varying depending on the species, individual, and type, level, frequency, and timing of disturbance. The effects of sensory disturbance on avian species (e.g., elevated stress levels; interference with communication or predator detection; and interference with incubation or nestling provisioning) may lead to nest failure or abandonment, which could have implications for reproductive output and survival. The use of broad area artificial lighting (i.e., not focused or directed on specific areas with shielding to prevent stray light upwards) during spring and fall migrations could attract and disorient migrating birds within illuminated areas, which could lead to exhaustion and eventual collision with the ground or Project components. Species most susceptible to disorientation by artificial light include nocturnal migrants (e.g., passerines, waterbirds, shorebirds) (Arnold and Zink 2011, Longcore et al. 2012, Cabrera-Cruz et al. 2018).

Project-related edge effects or the construction of Project-related access roads and ROW that facilitate increased public access and use by off-road vehicles may alter prey availability and predator-prey dynamics within the Project Area and adjacent habitats, which could indirectly influence avian mortality (Bannerman 1998, Kremsater and Bunnell 1999, George and Dobkin 2002, Francis et al. 2009, Rodewald et al. 2011, Bishop and Brogan 2013, Hethcoat and Chalfoun 2015). Species that use roadsides for nesting, feeding, and/or roosting (e.g., passerines that prefer early seral habitats) may be more susceptible to exposure to hazardous chemicals used for herbicide spraying along Project roads during invasive plant management. Waterbirds and shorebirds (e.g., ducks, geese, swans, cranes, sandpipers, plovers) are particularly susceptible to contamination or oiling as they spend extended periods of time in or on the water, feed in aquatic habitats, and submerge all or part of their body during feeding activities. As such, aquatic habitats (e.g., wetlands, lakes) where waterbirds and/or shorebirds congregate for feeding, breeding, and/or stopover purposes during migration are sensitive to Project-related spills of fuels and other hazardous materials, malfunctions, and other accidents.

Mitigation measures identified in 5.3 are expected to limit the potential for interactions between Migratory Breeding Birds and potential sources of direct and indirect mortality, thereby limiting the residual effect of change in mortality during the various Project phases.

5.4.2.2.1 *Residual Effect Characteristics*

The residual effect characteristics for change in mortality on Migratory Breeding Birds are summarized below and provided in **Table 5.4-4**.

The Magnitude is predicted to be Low. Mitigation measures are expected to limit the potential for interactions between Migratory Breeding Birds and potential sources of direct and indirect mortality. Limited changes are expected to suitable nesting habitat available for Migratory Breeding Birds due to the Project (**Table 5.4-2**), which suggests that a limited number of individuals are expected to interact with the Project and potentially be affected by direct and/or indirect sources of mortality. Individuals displaced by the Project are expected to relocate to areas of suitable nesting habitat within the Avian Species LSA and RSA, thereby limiting the potential for interactions with the Project. Suitable nesting habitat is not considered to be a limiting factor within the Avian Species LSA and RSA (i.e., the available habitat can support the low numbers of displaced individuals).

The Geographic Extent is predicted to be Local. While direct mortality is expected to be limited to the Project Area, indirect mortality related to edge effects, sensory disturbance, and increased public access and use by off-road vehicles is expected to extend into adjacent habitats within the Avian Species LSA.

The Duration is predicted to occur over the Long-term. Sources of direct mortality and most sources of indirect mortality are expected to occur during the Construction Phase and the residual effects are expected to persist until Project activities cease and Project components are removed at the end of the Post-closure Phase (i.e., Medium-term). Indirect sources of mortality related to edge effects are also expected to occur during the Construction Phase; however, the residual effects are expected to persist until disturbed areas are reclaimed and vegetation has re-established within reclaimed areas, which may include a time frame that differs between habitat guilds. Regeneration of disturbed areas for the old/mature forest habitat guild is expected to extend beyond the Post-closure Phase (i.e., Long-term). Regeneration of disturbed areas for the wetlands and early seral habitat guilds is expected to be achieved by the end of the Post-closure Phase (i.e., Medium-term).

The Frequency is predicted to be Infrequent. Although Project activities may result in direct and/or indirect mortality of Migratory Breeding Birds, occurrences of mortality are expected to be isolated and infrequent events following the implementation of mitigation measures.

The Reversibility is predicted to be Fully Reversible once Project activities cease, Project components are removed, disturbed habitats are reclaimed, and vegetation has re-established within reclaimed areas.

The Context is predicted to be Moderate. Migratory Breeding Birds have been exposed to historic and ongoing anthropogenic and natural disturbances throughout their ranges, including within the Avian Species RSA. The Project is expected to interact with a limited number of individuals that may potentially be affected by direct and/or indirect sources of mortality. Individuals displaced by the Project are expected to relocate to areas of suitable nesting habitat within the Avian Species LSA and RSA (as suitable nesting habitat is not considered to be limiting), thereby limiting the potential for interactions with the Project.

Table 5.4-4: Summary of Residual Effect Characteristics for Change in Mortality on Migratory Breeding Birds Subcomponent

Residual Effect Characteristic	Rating	Rationale for Rating
Magnitude	Low	Mitigation measures are expected to limit the potential for interactions between Migratory Breeding Birds and potential sources of direct and indirect mortality. Limited changes to suitable nesting habitat available for Migratory Breeding Birds are expected (Table 5.4-2), which suggests that a limited number of individuals are expected to interact with the Project and potentially be affected by direct and/or indirect sources of mortality.
Geographic Extent	Local	While direct mortality is expected to be limited to the Project Area, indirect mortality related to edge effects, sensory disturbance, and increased public access and use by off-road vehicles is expected to extend into adjacent habitats within the Avian Species LSA.
Duration	Long-term	Sources of direct mortality and most sources of indirect mortality are expected to occur during the Construction Phase and persist until Project activities cease and Project components are removed at the end of the Post-closure Phase (i.e., Medium-term). Indirect sources of mortality related to edge effects are expected to persist until disturbed areas are reclaimed and vegetation has re-established, which may include a time frame that differs between habitat guilds. Regeneration of old/mature forest habitat is expected to extend beyond the Post-closure Phase (i.e., Long-term). Regeneration of wetlands and early seral habitat guilds is expected to be achieved by the end of the Post-closure Phase (i.e., Medium-term).
Frequency	Infrequent	Although Project activities may result in direct and/or indirect mortality of Migratory Breeding Birds, occurrences of mortality are expected to be isolated and infrequent events following the implementation of mitigation measures.
Reversibility	Fully Reversible	The residual effect is expected to be Fully Reversible once Project activities cease, Project components are removed, disturbed habitats are reclaimed, and vegetation has re-established.
Context	Moderate	Migratory Breeding Birds have been exposed to historic and ongoing anthropogenic and natural disturbances throughout their ranges, including within the Avian Species RSA. The Project is expected to interact with a limited number of individuals that may potentially be affected by direct and/or indirect sources of mortality. Individuals displaced by the Project are expected to relocate to areas of suitable nesting habitat within the Avian Species LSA and RSA (as suitable nesting habitat is not considered to be limiting), thereby limiting the potential for interactions with the Project.

Notes: LSA=Local Study Area; Project=Tenas Project; RSA=Regional Study Area

5.4.2.2.2 Likelihood

The Likelihood of the residual effect occurring is predicted to be Likely. Suitable nesting habitat for each habitat guild is present within and adjacent to the Project Area; therefore, it is possible that Project activities may interact with Migratory Breeding Birds and result in direct and/or indirect mortality.

5.4.2.2.3 Significance Determination

The residual effect of change in mortality is not expected to result in a change to the Migratory Breeding Birds subcomponent and is not expected to alter its population viability or persistence within the Avian

Species RSA beyond an acceptable level. One (1) residual effect characteristic has an unfavourable rating (i.e., Long-term Duration). Therefore, the residual effect of change in mortality on the Migratory Breeding Birds subcomponent is predicted to be **Not Significant**.

The Level of Confidence in this prediction is Moderate. Uncertainty exists with respect to the extent and degree of effects on the different migratory species that prefer wetlands, early seral, or old/mature forest, and the extent and degree of effects resulting from different sources of mortality.

Mitigation measures to avoid, minimize, or rehabilitate onsite the potential effects of change in mortality on Migratory Breeding Birds are consistent with recently approved EA projects in BC (e.g., Red Mountain Underground Gold, Blackwater Gold), and are expected to appropriately mitigate the predicted adverse Project effects.

5.4.2.3 Change in Movement Patterns

Change in movement patterns was assessed qualitatively by considering the residual effect of the Project on the daily and seasonal movement patterns of Migratory Breeding Birds, as represented by the three (3) habitat guilds (i.e., migratory species that prefer wetlands, early seral, or old/mature forest). Daily movements include those related to daily activities such as foraging, escaping predators, and breeding activities (e.g., establishing and defending a territory, nest building, and nestling provisioning) within established home ranges and breeding territories. Seasonal movements include those during spring and fall migration, including the use of stopover sites for resting, feeding, and drinking. The assessment of change in movement patterns considered the displacement of individuals due to direct (i.e., habitat loss) and indirect (i.e., habitat alteration) Project effects and the attraction of individuals to Project components that may support life requisites (e.g., food, cover, breeding, migration) for Migratory Breeding Birds.

After completing a literature review, it was clear that discussing specific daily and seasonal movements by the three (3) habitat guilds selected to inform the assessment of the Migratory Breeding Birds subcomponent (i.e., migratory species that prefer wetlands, early seral, or old/mature forest) would not be practical due to the range of behaviours of species and individuals within and between the habitat guilds. Considering this, the residual effects of the Project on change in daily and seasonal movement patterns addresses all habitat guilds jointly in the following subsections. Species-specific examples are provided for additional context, as appropriate.

5.4.2.3.1 Daily Movements

Alteration and/or loss of habitat is predicted to change the amount of suitable nesting habitat available to support Migratory Breeding Birds within and adjacent to the Project Area (i.e., based on habitat suitability modelling, **Table 5.4-2**). Individuals displaced by the Project are expected to respond by selecting suitable home ranges and breeding territories outside of affected areas (Schmiegelow et al. 1997, Betts et al. 2006, Gill 2007, Price 2008, Rousseau et al. 2012, Akresh et al. 2015), or at least in areas where they can tolerate some degree of disturbance (e.g., avoiding vehicles or buildings during flight; flushing off a pond) while still obtaining resources to support life requisites. Once new home ranges and breeding territories have been established by displaced individuals, the daily movement patterns within these areas are expected to be similar to those that would occur without the Project being present (i.e., the location of a home range or breeding territory may shift, but daily movement patterns within an established home range or breeding territory are not expected to change).

Migratory Breeding Birds that return to the Project Area to breed may be attracted to Project components that offer new feeding, cover, or breeding opportunities and could alter their daily movement patterns to incorporate these components into their selected home ranges and breeding territories, as appropriate or

required. Project components that may attract Migratory Breeding Birds include artificial light that attracts flying insects (e.g., foraging opportunities for insectivorous birds); eaves of buildings (e.g., nesting opportunities for swallows); and the channels and ponds that are part of the Surface Water Management Infrastructure (e.g., feeding or breeding opportunities for waterbirds). Migratory Breeding Birds (e.g., swallows, finches) may also be attracted to roads as sources of calcium (for their diet) or grit/small pebbles (to aid digestion) if salt and/or gravel products are used for dust suppression or de-icing and winter traction.

Movement patterns (e.g., distance and direction) within an individual's home range and breeding territory are difficult to predict, as they are dependent on ecological and biological processes (e.g., habitat selection, breeding, mating, flocking) that are affected by several direct and indirect factors (e.g., food availability and location, habitat type and structure, habitat fragmentation, predator-prey interactions, population density, topography, human disturbance, climatic conditions, nesting site availability, age, sex, social status) (Rolando 2002). The response of avian species to anthropogenic disturbance, including potential changes in movement patterns, is also difficult to predict and is expected to vary at the species group and individual level (Price 2008).

Research suggests that some species groups may be more sensitive to anthropogenic disturbance, which could make them more vulnerable to subsequent changes in movement patterns. A review of the effects of recreational trails and related human activities on birds concluded that ground-nesting species were typically more sensitive to human disturbance than species that nest above ground, especially ground-nesting species that nest in wetlands (Sinnott 2000). Another study investigated the effect of experimental recreational disturbance on birds and concluded that open cup nesters were typically more sensitive to human disturbance than cavity nesters (Bötsch et al. 2017). The same study also concluded that above ground foragers were typically more sensitive to human disturbance than ground foragers, and that ground-nesting birds did not appear to be sensitive to disturbance; however, the authors cautioned that disturbance on ground foragers and nesters may have been difficult to detect given the lower number of these species types at their study sites (Bötsch et al. 2017).

A study investigating the tolerance and response distances of resident and migrant bird species concluded that flock size and density influenced flushing distance, with migrant species typically forming larger and denser flocks that were more sensitive to human disturbance (Burger and Gochfeld 1991). A review of bird, mammal, and lizard tolerance of human disturbance suggested that carnivorous birds may be more sensitive to human disturbance, possibly because they hunt live prey and are therefore more sensitive to movement on the landscape, or because human disturbance may also disturb their prey and reduce hunting efficiency (Samia et al. 2015). The same review suggested that avian species that use open habitats may be less sensitive to human disturbance compared to species that use forest habitats because they are better able to detect and monitor potential risks (Samia et al. 2015).

A few studies have investigated how body size may influence tolerance of human disturbance in avian species. Some studies suggest that larger species may be more sensitive to human disturbance (Price 2008, Bötsch et al. 2017) because larger species are heavier and may lack the ability to accelerate quickly in flight and/or may be less agile in flight, which could make them more vulnerable to predation (Price 2008). Other studies suggest that larger species may be less sensitive to human disturbance because their large size may deter predators or larger birds may have relatively larger brains and therefore greater cognitive abilities to assess risk and not expend valuable energy on unnecessary escape (Samia et al. 2015).

Response to disturbance, including changes in movement patterns, depends on an individual's assessment of risk, which could be influenced by timing (e.g., birds are typically more sensitive to disturbance during the breeding season); resource availability and/or body condition (e.g., an individual may tolerate a certain degree of disturbance to obtain a resource; an individual in poor body condition may take more risks to obtain food); or previous exposure to disturbance that may result in local adaptation or partial habituation

(Ruddock and Whitfield 2007, Price 2008, Samia et al. 2015). A review of bird, mammal, and lizard tolerance of human disturbance suggested that personality types may influence degree of tolerance, with bolder individuals establishing territories in areas with greater levels of human disturbance compared to shy individuals (Samia et al. 2015). Response to disturbance, including changes in movement patterns, also depends on other factors such as the type, level, frequency, and timing of disturbance and surrounding landscape characteristics that may amplify or mask a disturbance (Ruddock and Whitfield 2007, Price 2008).

Considering the literature review findings, Migratory Breeding Birds that tolerate Project-related disturbances within their home ranges and breeding territories or incorporate Project components into their home ranges and breeding territories are expected to only be inconvenienced by the Project, or be occasionally disturbed in their daily movement patterns, with changes likely only related to avoidance or escape movements, as appropriate. Some species or individuals may be more sensitive to disturbance and more likely to respond to Project components/activities and alter their daily movement patterns if an interaction occurs.

Mitigation measures identified in 5.3 are expected to limit the potential for interactions between Migratory Breeding Birds and Project components/activities, thereby limiting the residual effect of change in daily movement patterns resulting from displacement or attraction during the various Project phases. Additional mitigation for Migratory Breeding Birds that avoid disturbed areas within and adjacent to the Project Area and establish new home ranges and breeding territories outside of affected areas is not considered to be practical or required.

5.4.2.3.2 Seasonal Movements

The Project is located within the Pacific Flyway, which spans over 21 million square kilometres (km²) across the Pacific Coast of North and South America (BirdLife International 2020). It is estimated that at least a billion birds, across 323 species, use the Pacific Flyway each year (Audubon 2014, BirdLife International 2020). The Project Area represents a small proportion of the migratory routes for Migratory Breeding Birds in the Pacific Flyway; therefore, it is expected that a small percentage of Migratory Breeding Birds may pass over and potentially interact with Project components and activities. This also considers natural variation in the seasonal flight paths of Migratory Breeding Birds, which are influenced by factors such as weather (e.g., wind direction and speed).

The altitude of migration differs across avian species and is dependent on the time of year or day, geography and topography, and climatic conditions (Lincoln and Peterson 1979, Kerlinger 1983). Nocturnal migrants (e.g., shorebirds, ducks) typically migrate at higher altitudes than diurnal migrants (e.g., passerines) (Kerlinger 1983), and long distance migrants (e.g., passerines, shorebirds) typically migrate at higher altitudes than short distance migrants (e.g., waterbirds) (Lincoln et al. 1998). Most species migrate at altitudes below 3,000 m (Lincoln and Peterson 1979), with the bulk of migration occurring below 1,000 m (Lincoln and Peterson 1979, Kerlinger 1983). Most small birds migrate at altitudes between 150 and 300 m (Lincoln and Peterson 1979, Lincoln et al. 1998). All Project components and activities are expected to be constructed or conducted below the heights flown by Migratory Breeding Birds; therefore, the Project is not expected to interfere with the migratory routes or flight paths that might be used by Migratory Breeding Birds passing over the Project Area. The potential effects of artificial light on seasonal movements are discussed further below as an attractant.

Stopover sites are often characterised by wetland habitats that provide seasonal foraging opportunities and safe resting sites during the spring and fall migrations. Local knowledge and baseline waterbird surveys, which focused on the spring migration season, indicated that certain parts of the Avian Species LSA may provide stopover habitats for large numbers of migrating waterbirds. All waterbirds observed during baseline

waterbird surveys were located at lower elevations with 61% observed in seasonally available habitats (i.e., cultivated fields and seasonal ponds that were temporarily flooded because of snow melt). The remaining waterbird detections occurred in pond habitats (26%), wetland habitats (11%), and cultivated field (not seasonally flooded), stream, or river habitats (2%). Most spring migration activities were observed near the Rail Infrastructure area where several ponds created via snowmelt and surface water runoff provide stopover sites for migrating waterbirds. While large concentrations of waterbirds were observed in parts of the Avian Species LSA, no large concentrations were found in areas overlapping the Project Area. The Project Area does not overlap any lakes, rivers, or large wetlands. Several lakes, rivers, and large wetlands are present within the Avian Species LSA and RSA and may provide suitable stopover habitats for migrating birds. As such, the potential for interactions between Project components/activities and Migratory Breeding Birds that prefer wetlands, ponds, and seasonally flooded habitats as stopover sites is expected to be limited and/or infrequent.

Existing stopover sites documented during baseline waterbird surveys are not expected to be directly disturbed during Project activities; however, indirect habitat alteration (e.g., edge effects, sensory disturbance) may change the amount of suitable stopover habitat available to support Migratory Breeding Birds adjacent to the Project Area. Individuals displaced by the Project are expected to respond by selecting suitable stopover sites outside of affected areas (Schmiegelow et al. 1997, Betts et al. 2006, Gill 2007, Price 2008, Rousseau et al. 2012, Akresh et al. 2015), or at least in areas where they can tolerate some degree of disturbance (e.g., avoiding vehicles or buildings in flight; flushing off a pond). Once new stopover sites have been established by displaced individuals, seasonal movements through the Avian Species RSA are expected to be similar to those that would occur without the Project being present (i.e., the location of a stopover site may shift, but seasonal movements through the Avian Species RSA are not expected to change).

Migratory Breeding Birds that migrate through the Avian Species RSA may be attracted to Project components that offer new stopover opportunities and could alter their seasonal movement patterns to incorporate these components into their migratory routes, as appropriate or required. Project components that may attract Migratory Breeding Birds include the channels and ponds that are part of the Surface Water Management Infrastructure (e.g., resting and/or feeding opportunities for migrating waterbirds). Artificial light may attract and disorient nocturnal migrating birds within illuminated areas, which could lead to exhaustion and eventual collision with the ground or Project components (Arnold and Zink 2011, Longcore et al. 2012, Machtans et al. 2013, Adams et al. 2019). Any interaction between Migratory Breeding Birds and Project components is expected to be isolated and brief considering the behaviour of migrating birds (e.g., only stop when necessary).

The Daily Movements subsection above describes avian response in the movement patterns to anthropogenic disturbance, which is also applicable to changes in seasonal movement patterns (i.e., migratory movements through the Avian Species RSA and local movements within and between stopover sites).

Considering the literature review findings, Migratory Breeding Birds that tolerate Project-related disturbances within their stopover sites or incorporate Project components into their migration routes (e.g., stopover sites) are expected to only be inconvenienced by the Project, or be occasionally disturbed during their seasonal movement patterns, with changes likely only related to avoidance or escape movements, as appropriate. Some species or individuals may be more sensitive to disturbance and more likely to respond to Project components/activities and alter their daily movement patterns if an interaction occurs.

Mitigation measures identified in **5.3** are expected to limit the potential for interactions between Migratory Breeding Birds and Project components/activities, thereby limiting the residual effect of change in seasonal movement patterns resulting from displacement or attraction during all Project phases. Additional mitigation

for Migratory Breeding Birds that avoid disturbed areas within and adjacent to the Project Area and establish new stopover sites outside of affected areas is not considered to be practical or required.

5.4.2.3.3 *Residual Effect Characteristics*

The residual effect characteristics for change in movement patterns on Migratory Breeding Birds are summarized below and provided in **Table 5.4-5**.

The Magnitude is predicted to be Low. Limited changes are expected to suitable nesting habitat available for Migratory Breeding Birds due to the Project (i.e., based on baseline waterbird surveys and habitat suitability modelling, **Table 5.4-2**), which suggests that a limited number of breeding or migrating individuals are expected to interact with the Project and potentially experience altered daily and/or seasonal movement patterns. Individuals displaced by the Project are expected to relocate to areas of suitable breeding or stopover habitat within the Avian Species LSA and RSA. Suitable breeding and stopover habitat are not considered to be a limiting factor within the Avian Species LSA and RSA (i.e., the available habitat can support the low numbers of displaced individuals).

The Project Area represents a small proportion of the Pacific Flyway, with all Project components and activities expected to be constructed or conducted below the heights typically flown by Migratory Breeding Birds. As such, the percentage of Migratory Breeding Birds that may pass over, and potentially interact with the Project, is expected to be small. With respect to Migratory Breeding Birds that may be attracted to Project components for feeding, cover, breeding, or stopover opportunities, or attracted to artificial light during seasonal migrations, mitigation measures are expected to limit the potential for interactions with Project components/activities, thereby limiting the residual effect of change in daily and/or seasonal movement patterns.

The Geographic Extent is predicted to be Regional. Individuals displaced by the Project are expected to relocate to areas of suitable breeding or stopover habitat within the Avian Species LSA and RSA. Individuals attracted to Project components for feeding, cover, breeding, or stopover opportunities may use habitats at a more Local scale.

The Duration is predicted to occur over the Long-term, although there may be differences between the habitat guilds depending on the areas and types of reclamation and the time frame for regeneration of vegetation within reclaimed areas. Change in movement patterns is expected to occur during the Construction phase and the residual effect is anticipated to continue each year that Migratory Breeding Birds return to the Project Area to breed or stopover until Project activities cease, Project components are removed, disturbed areas are reclaimed, and vegetation has re-established within reclaimed areas. Regeneration of disturbed areas for the old/mature forest habitat guild is expected to extend beyond the Post-closure phase (i.e., Long-term). Regeneration of disturbed areas for the wetlands and early seral habitat guilds is expected to be achieved by the end of the Post-closure phase (i.e., Medium-term).

The Frequency is predicted to be Frequent. Change in movement patterns is expected to occur during the Construction phase and the residual effect is anticipated to continue each year that Migratory Breeding Birds return to the Project Area to breed or stopover until Project activities cease, Project components are removed, disturbed areas are reclaimed, and vegetation has re-established within reclaimed areas.

The Reversibility is predicted to be Fully Reversible. Progressive and final reclamation are expected to focus on reclaiming disturbed areas; therefore, suitable breeding, foraging, or stopover habitats predicted to be lost or altered within or adjacent to the Project Area are expected to recover over time following reclamation activities. Once disturbed areas are reclaimed, the breeding, foraging, and stopover areas of

Migratory Breeding Birds are expected to progressively include these areas, as dictated by the habitat type that regenerates and its age class.

The Context is predicted to be Moderate. Migratory Breeding Birds have been exposed to historic and ongoing anthropogenic and natural disturbances throughout their ranges, including within the Avian Species RSA. The limited number of individuals displaced by the Project are expected to relocate to areas of suitable breeding or stopover habitat within the Avian Species LSA and RSA, as suitable breeding and stopover habitat is not considered to be limiting. Once new breeding or stopover areas have been established by displaced individuals, the daily or seasonal movement patterns are expected to be similar to those that would occur without the Project being present.

Individual Migratory Breeding Birds may be attracted to Project components that offer new feeding, cover, breeding, or stopover opportunities and could alter their daily and/or seasonal movement patterns to incorporate these components into their selected home ranges, breeding territories, or stopover sites. However, these components are expected to be within the individual's tolerance levels or effectively enhance their life requisites.

Table 5.4-5: Summary of Residual Effect Characteristics for Change in Movement Patterns on Migratory Breeding Birds Subcomponent

Residual Effect Characteristic	Rating	Rationale for Rating
Magnitude	Low	Limited changes to suitable nesting habitat available for Migratory Breeding Birds are expected (i.e., based on baseline waterbird surveys and habitat suitability modelling, Table 5.4-2), which suggests that a limited number of breeding or migrating individuals are expected to interact with the Project and potentially experience altered daily and/or seasonal movement patterns.
Geographic Extent	Regional	Individuals displaced by the Project are expected to relocate to areas of suitable breeding or stopover habitat within the Avian Species LSA and RSA. Individuals attracted to Project components for feeding, cover, breeding, or stopover opportunities may use habitats at a more Local scale.
Duration	Long-term	Change in movement patterns is expected to occur during the Construction Phase and continue each year that Migratory Breeding Birds return to the Project Area to breed or stopover until Project activities cease, Project components are removed, disturbed areas are reclaimed, and vegetation has re-established. Regeneration of old/mature forest habitat is expected to extend beyond the Post-closure phase (i.e., Long-term). Regeneration of wetlands and early seral habitat guilds is expected to be achieved by the end of the Post-closure Phase (i.e., Medium-term).
Frequency	Frequent	Change in movement patterns is expected to occur during the Construction Phase and continue each year that Migratory Breeding Birds return to the Project Area to breed or stopover until Project activities cease, Project components are removed, disturbed areas are reclaimed, and vegetation has re-established.
Reversibility	Fully Reversible	Progressive and final reclamation are expected to focus on reclaiming disturbed areas; therefore, suitable breeding, foraging, or stopover habitats are expected to recover over time following reclamation activities.
Context	Moderate	Migratory Breeding Birds have been exposed to historic and ongoing anthropogenic and natural disturbances throughout their ranges, including within the Avian Species RSA. The limited number of individuals displaced by the Project are expected to relocate to areas of suitable breeding or

Residual Effect Characteristic	Rating	Rationale for Rating
		stopover habitat within the Avian Species LSA and RSA, as suitable breeding and stopover habitat is not considered to be limiting. Project components that may attract individual Migratory Breeding Birds for feeding, cover, breeding, or stopover opportunities could alter daily and/or seasonal movement patterns. However, these components are expected to be within the individual's tolerance levels or effectively enhance their life requisites.

Notes: LSA=Local Study Area; Project=Tenas Project; RSA=Regional Study Area

5.4.2.3.4 Likelihood

The Likelihood of the residual effect occurring is predicted to be Likely. Alteration and/or loss of habitat is predicted to change the amount of suitable breeding and stopover habitat available to support Migratory Breeding Birds within and adjacent to the Project Area (i.e., based on baseline waterbird surveys and habitat suitability modelling, **Table 5.4-2**). This change in habitat is expected to result in limited changes to the daily and/or seasonal movement patterns of a few individual Migratory Breeding Birds. A limited number of individual Migratory Breeding Birds may be attracted to Project components that offer new feeding, cover, breeding, or stopover opportunities and could alter their daily and/or seasonal movement patterns to incorporate these components into their selected home ranges, breeding territories, or stopover sites.

5.4.2.3.5 Significance Determination

The residual effect of change in movement patterns is not expected to result in a change to the Migratory Breeding Birds subcomponent and is not expected to alter its population viability or persistence within the Avian Species RSA beyond an acceptable level. Therefore, the residual effect of change in movement patterns on the Migratory Breeding Birds subcomponent is predicted to be **Not Significant**.

The Level of Confidence in this prediction is Moderate. The extent and degree of the response of Migratory Breeding Birds to Project-related disturbances, including potential changes in movement patterns, is difficult to predict and is expected to vary at the species and individual level due to several factors (refer to the discussion above under Daily Movements for additional details). Uncertainty exists regarding the accuracy of the mapping products used to identify suitable nesting habitat for each habitat guild within the Avian Species LSA and RSA. Baseline waterbird surveys were limited to certain areas of the Avian Species LSA and RSA; therefore, habitat use may not be fully documented for Migratory Breeding Birds. Also, there is limited knowledge on the breeding populations of Migratory Breeding Birds, by habitat guild, within the Avian Species RSA, and whether habitat outside of disturbed areas has the capacity to accommodate individuals displaced by the Project. There is limited knowledge of the numbers of Migratory Breeding Birds that might migrate over the Project Area or use stopover sites within the Avian Species LSA and RSA.

Mitigation measures to avoid, minimize, or rehabilitate onsite the potential effects of change in movement patterns on Migratory Breeding Birds are consistent with recently approved EA projects in BC (e.g., Red Mountain Underground Gold, Blackwater Gold), and are expected to appropriately mitigate the predicted adverse Project effects.

5.4.3 Listed Bird Species Subcomponent

5.4.3.1 Alteration and/or Loss of Habitat

Alteration and/or loss of habitat was assessed quantitatively by considering the residual effect of the Project on the amount of suitable nesting habitat available to support Listed Bird Species, as represented by common nighthawk, olive-sided flycatcher, rusty blackbird, and short-eared owl. The habitat suitability models for common nighthawk, olive-sided flycatcher, and short-eared owl were developed using a four-(4) class rating system (i.e., Nil, Low, Moderate, and High suitability). Suitable nesting habitat for rusty blackbird is represented by the wetlands habitat guild model, which used a two (2)-class rating system (i.e., suitable and unsuitable). Refer to Appendix B, C, D, and E in **Appendix 4.9-A**, for additional details about the habitat suitability modelling completed for common nighthawk, olive-sided flycatcher, short-eared owl, and the wetlands habitat guild.

Habitat suitability modelling was not completed for the remaining species selected to inform the assessment of the Listed Bird Species subcomponent (i.e., bank swallow, barn swallow, and black swift) due to their preference for specific habitat features that are not generally identifiable using available spatial data. These species were assessed qualitatively. Refer to Appendix F of **Appendix 4.9-A**, for additional details about the qualitative habitat assessments completed for bank swallow, barn swallow, and black swift.

5.4.3.1.1 *Common Nighthawk, Olive-sided Flycatcher, Rusty Blackbird, and Short-eared Owl*

Loss of habitat for common nighthawk, olive-sided flycatcher, and short-eared owl was quantified by calculating the amount of suitable nesting habitat (i.e., Moderate and High suitability) expected to be lost within the Project Area during the Construction Phase due to site clearing and the construction and installation of Project components. Loss of habitat for rusty blackbird was quantified according to the methods outlined in **5.4.2.1**.

Alteration of habitat was considered during all Project phases and was quantified for common nighthawk, olive-sided flycatcher, and short-eared owl using a two (2)-step process during model development. First a species-specific ZOI was delineated around the Project Area to consider the extent of indirect effects (e.g., edge effects, sensory disturbance) into the Avian Species LSA. Then suitable nesting habitat (i.e., Moderate and High suitability) was downgraded within the ZOI as appropriate (i.e., by one (1) rating class to a minimum of Low), based on habitat suitability modelling and professional judgement of the EA team, to reflect habitat suitability that may be indirectly altered. The selection of species-specific ZOIs was based on scientific literature, provincial/territorial recommended minimum setback distances for nesting individuals, and professional judgement of the EA team. Alteration of habitat for rusty blackbird was quantified according to the methods outlined in **5.4.2.1**; a larger ZOI was selected for rusty blackbird based on scientific literature, provincial/territorial recommended minimum setback distances for nesting individuals, and professional judgement of the EA team.

No information could be found related to the distance at which nesting common nighthawks, olive-sided flycatchers, or rusty blackbirds respond to anthropogenic disturbance. However, based on studies of other avian species, effect distances associated with industrial activities and/or roads in forested landscapes typically range from 50 to 300 m (Reijnen and Foppen 1994, Reijnen et al. 1995, 1997, Kuitunen et al. 1998, Hanowski et al. 1999, Ortega and Capen 1999, Forman and Deblinger 2000, Habib et al. 2007, Bayne et al. 2008). Recommended minimum setback distances for nesting common nighthawks, olive-sided flycatchers, and rusty blackbirds range from 200 to 500 m (Manitoba Conservation Data Centre 2014, Government of the Northwest Territories 2015, Government of Saskatchewan 2017). Based on Project activities, adjacent habitat types, and professional judgement of the EA team, the ZOI for common

nighthawk, olive-sided flycatcher, and rusty blackbird is expected to extend up to 300 m into the Avian Species LSA from the outer boundary of the Project Area.

Short-eared owls generally avoid intensive agriculture, housing developments, and industrial areas (Herkert et al. 1999). Nesting may occur near some anthropogenic features such as airport runways, parking lots, and roads; however, one (1) study found that nests were a minimum of 250 m and on average 789 m from buildings, suggesting that vertical interference from buildings may reduce habitat suitability (Combs-Beattie 1993, Campbell et al. 1990b). Guidelines in BC suggest that short-eared owls have moderate tolerance to anthropogenic disturbance near nest sites and recommend a minimum 500 m buffer in undeveloped areas plus an additional 100 m 'quiet' buffer during the nesting season (Caskey and Chutter 2013). Based on Project activities, adjacent habitat types, and professional judgement of the EA team, the ZOI for short-eared owl is expected to extend up to 600 m into the Avian Species LSA from the outer boundary of the Project Area.

The spatial extent of the ZOIs for common nighthawk, olive-sided flycatcher, rusty blackbird, and short-eared owl were compared with the results of the predicted spatial extent of noise levels dispersing from Project activities/components. Refer to **S4.0-C1 Atmospheric Environment VC** and **S4.0-C1-Appendix 4.1-C Noise Modelling Report** of the **EAC Application** for additional details about noise modelling completed for the Project. The 40 dBA daytime and nighttime noise thresholds encompass 2,073 ha and 1,072 ha, respectively, around the Project Area. The 300 m and 600 m ZOIs encompass 1,369 ha and 2,735 ha, respectively, around the Project Area. The comparison showed that the 600 m ZOI for short-eared owl fully encompasses the 40 dBA daytime and nighttime noise thresholds. The 300 m ZOI for common nighthawk, olive-sided flycatcher, and rusty blackbird fully encompasses the 40 dBA nighttime noise threshold but does not fully encompass the 40 dBA daytime noise threshold. The 40 dBA daytime noise threshold is largest around the Project Area where the Minesite, quarries, and Rail Loadout components are located. It is expected that the 300 m ZOI does not encompass the 40 dBA daytime noise threshold in the areas where these components are located. However, as outlined in **5.4.3.1.3**, suitable nesting habitat for common nighthawk, olive-sided flycatcher, rusty blackbird, and short-eared owl is not considered to be a limiting factor within the Avian Species LSA and RSA. The comparison between the noise thresholds and ZOI illustrated that the selected ZOIs adequately addressed the Project-related residual effect of alteration of habitat (including noise) on common nighthawk, olive-sided flycatcher, rusty blackbird, and short-eared owl.

A similar comparison was completed for dustfall deposition as it relates to the ZOIs for common nighthawk, olive-sided flycatcher, rusty blackbird, and short-eared owl. Refer to **S4.0-C1 Atmospheric Environment VC** and **S4.0-C1-Appendix 4.1-B Air Quality Modelling Report** of the **EAC Application** for additional details about air quality modelling completed for the Project. Air quality modelling predicts that dustfall deposition could occur up to 800 m from the Project Area with the most likely zone of deposition expected within 100 m of Project components. The predicted effects resulting from high dustfall deposition are within the ZOIs for common nighthawk, olive-sided flycatcher, rusty blackbird, and short-eared owl, demonstrating that the selected ZOIs used to assess the Project-related residual effect of alteration of habitat (including dustfall) on these species were appropriate.

Habitat changes predicted to result from the Project on common nighthawk, olive-sided flycatcher, rusty blackbird (as represented by the wetlands habitat guild model), and short-eared owl are summarized in **Table 5.4-6**. The amount of suitable nesting habitat expected to be lost within the Project Area was added to the amount of suitable nesting habitat expected to be altered within the Avian Species LSA to estimate the total change in suitable nesting habitat available for common nighthawk, olive-sided flycatcher, rusty blackbird, and short-eared owl. These estimates were then compared to the total amount of suitable nesting habitat available within the Avian Species RSA for each species. Suitable nesting habitat for common nighthawk, olive-sided flycatcher, rusty blackbird (as represented by the wetlands habitat guild model), and

short-eared owl is depicted in depicted in **Figure 5.4-4, Figure 5.4-5, Figure 5.4-1 (see 5.4.2.1 above), and Figure 5.4-6**, respectively. The predicted total change in suitable nesting habitat available for all species combined is 2,507 ha (1.3%) of the Avian Species RSA.

Table 5.4-6: Summary of Change in Suitable Nesting Habitat for Listed Bird Species Subcomponent

Listed Bird Species	Loss of Suitable Nesting Habitat (ha) in the Project Area	Alteration of Suitable Nesting Habitat (ha) in the Avian Species LSA	Predicted Total Change in Suitable Nesting Habitat (ha) ¹	Total Suitable Nesting Habitat (ha) in the Avian Species RSA	Predicted Total Change in Suitable Nesting Habitat (%) ²
Common nighthawk	519	74	593	42,435	1.4
Olive-sided flycatcher	514	288	802	91,595	0.9
Rusty blackbird ³	412	437	849	33,165	2.6
Short-eared owl	174	89	263	24,495	1.1
Total	1,619	888	2,507	191,690⁴	1.3

Notes: %=percent; ha=hectare; LSA=Local Study Area; RSA=Regional Study Area

¹ Predicted total change in suitable nesting habitat (ha) in the Project Area and Avian Species LSA.

² Predicted total change in suitable nesting habitat (%) in the Avian Species RSA.

³ Rusty blackbird habitat is represented by the wetlands habitat guild model. A 300 m ZOI was used for rusty blackbird to estimate alteration of suitable nesting habitat (ha) in the Avian Species LSA (compared to the 200 m ZOI used for the wetlands habitat guild for Migratory Breeding Birds).

⁴ The total amount of suitable nesting habitat (ha) in the Avian Species RSA for all species combined. This total may be close to the total area of the Avian Species RSA (i.e., 194,651 ha) because some suitable habitat areas among the four species may overlap.