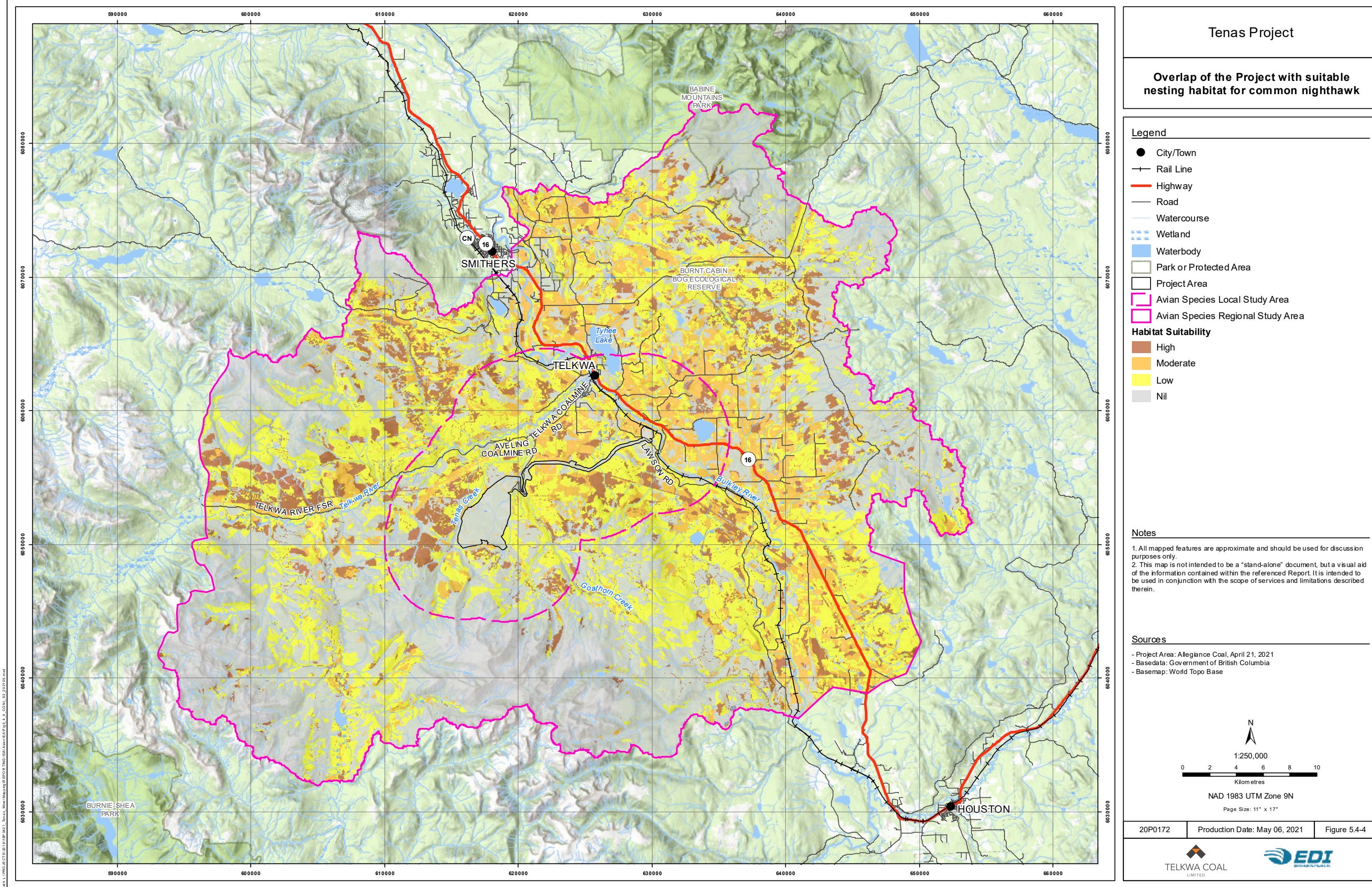
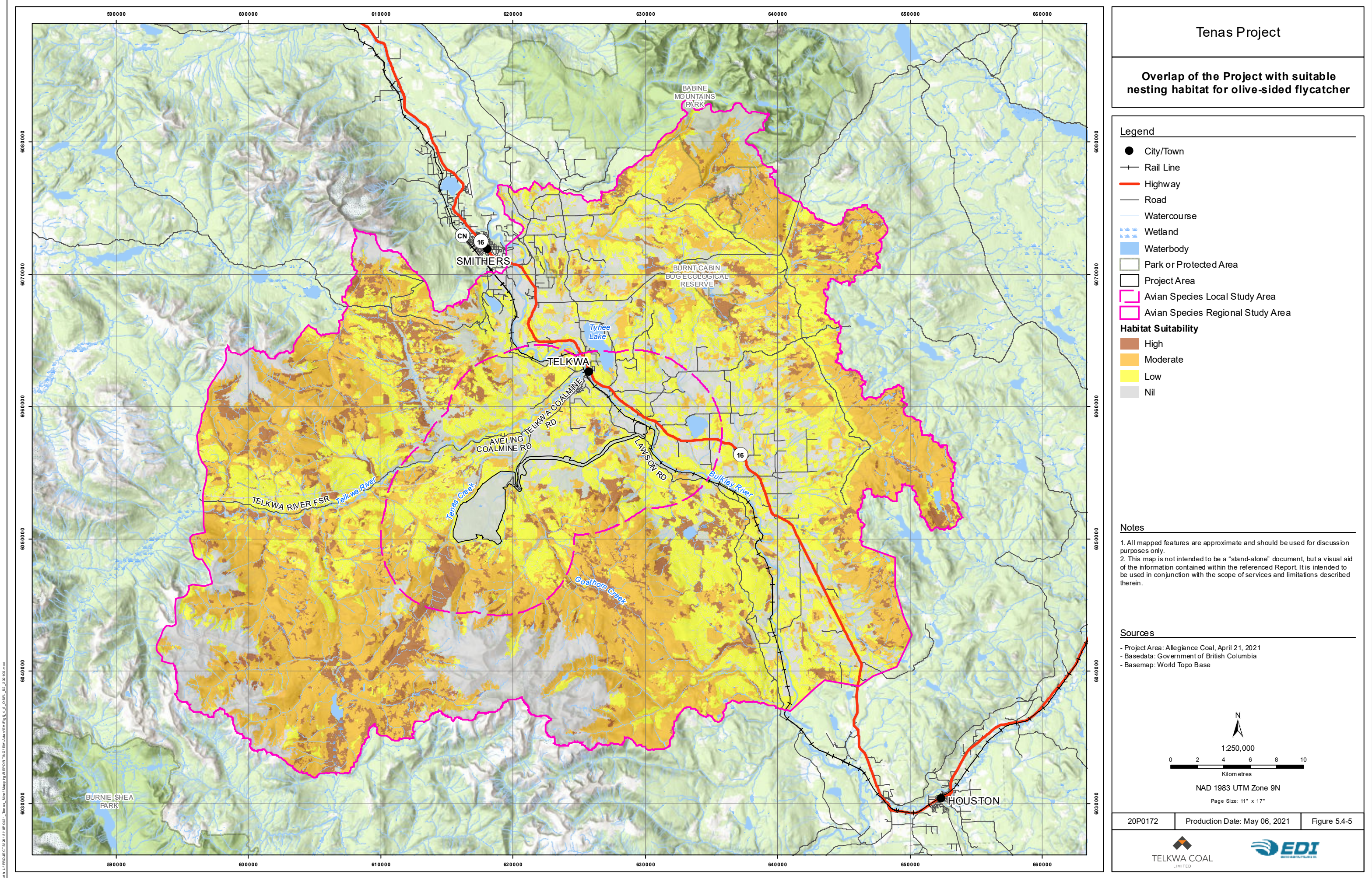
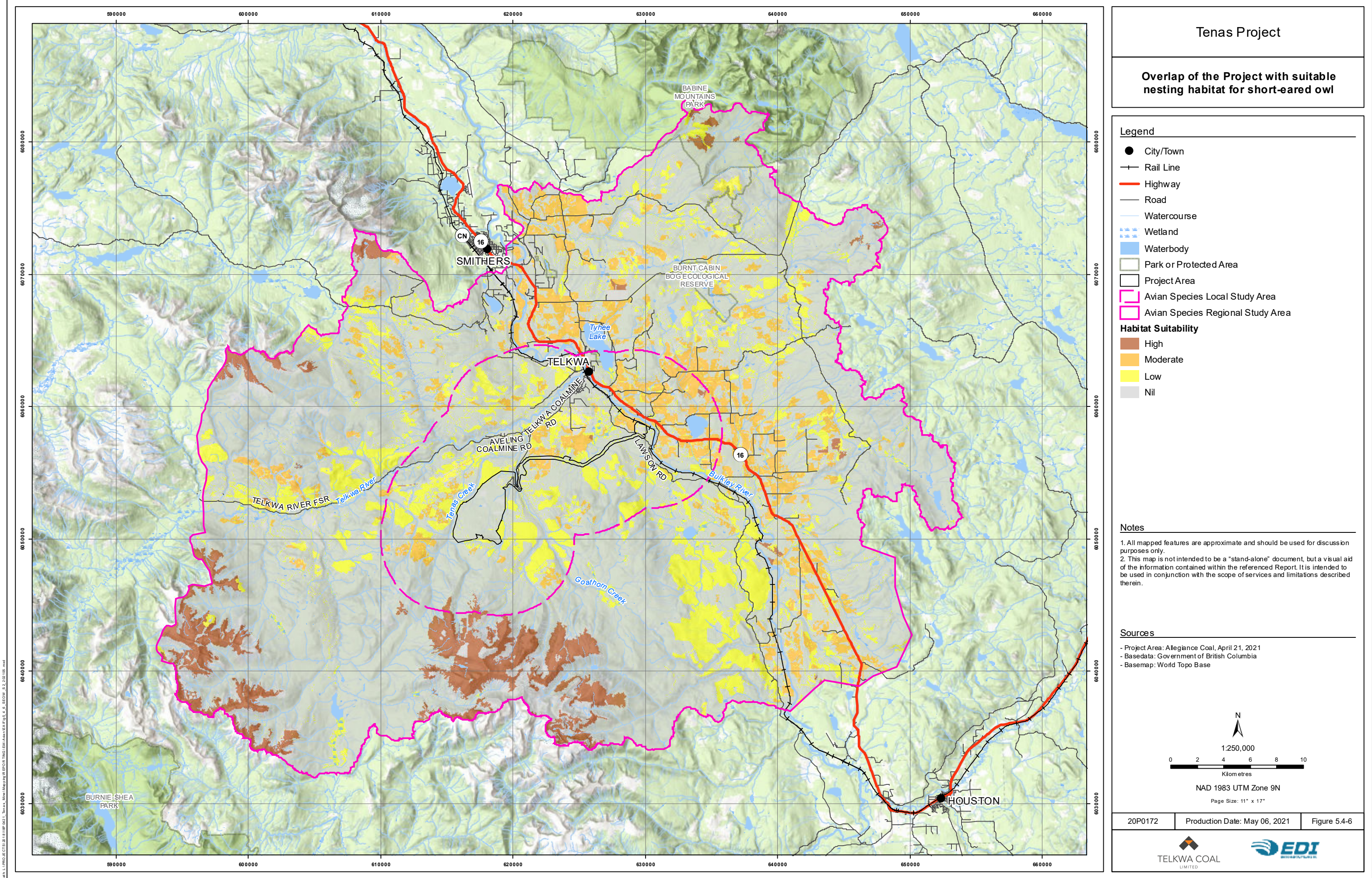








5.4.3.1.2 *Bank Swallow, Barn Swallow, and Black Swift*

Baseline studies did not detect bank swallows within the Avian Species LSA; however, the desktop review noted previous observations within the Avian Species RSA during the nesting season (Howie 2015, eBird 2020). The qualitative habitat assessment identified suitable nesting habitat for bank swallows at several locations within the Avian Species LSA, including along sections of the Bulkley and Telkwa rivers, and Goathorn and Tenas creeks. Given the tendency of this species to nest in colonies ranging in size from approximately 10 to 100+ active nests (Howie 2015, Garrison and Turner 2020), and their association with open habitats (i.e., near open water), active bank swallow colonies tend to be readily detectable. The lack of detections 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 swallows were detected once during baseline studies (i.e., 10 individuals nesting on outbuildings associated with a farm property within the Avian Species LSA, 720 m west of the proposed Rail Infrastructure area). The desktop review noted regular observations in the agricultural areas along the Bulkley River from Smithers to Round Lake within the Avian Species LSA and RSA (Hearne 2015, eBird 2020). The qualitative habitat assessment identified suitable nesting habitat for barn swallows 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).

Baseline studies did not detect black swifts within the Avian Species LSA; however, the desktop review noted previous observations within the Avian Species RSA during the nesting season (Boyd 2015a, eBird 2020). The qualitative habitat assessment did not identify suitable nesting habitat for black swifts (i.e., waterfalls or other rock faces, cliffs, or caves) within the Avian Species LSA. It is expected that suitable nesting habitat for black swifts may be present within the Avian Species RSA.

No information could be found related to the distance at which nesting bank swallows, barn swallows, or black swifts respond to anthropogenic disturbance. 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). A minimum setback distance of 300 m is recommended for nesting bank swallows and barn swallows (Manitoba Conservation Data Centre 2014). No information could be found related to recommended minimum setback distances for black swifts. Based on Project activities, adjacent habitat types, and professional judgement of the EA team, the ZOI for bank swallow, barn swallow, and black swift is expected to extend up to 300 m into the Avian Species LSA from the outer boundary of the Project Area.

The spatial extent of the 300 m ZOI for bank swallow, barn swallow, and black swift 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 dBA daytime and nighttime noise thresholds encompass 2,073 ha and 1,072 ha, respectively, around the Project Area. The 300 m ZOI encompasses 1,369 ha around the Project Area. The comparison showed that the 300 m ZOI for bank swallow, barn swallow, and black swift 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** below, suitable nesting habitat for bank swallow, barn swallow, and black swift 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 ZOI adequately addressed the Project-related residual effect of alteration of habitat (including noise) on bank swallow, barn swallow, and black swift.

A similar comparison was completed for dustfall deposition as it relates to the 300 m ZOI for bank swallow, barn swallow, and black swift. 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 300 m ZOI for bank swallow, barn swallow, and black swift, demonstrating that the selected ZOI used to assess the Project-related residual effect of alteration of habitat (including dustfall) on these species was appropriate.

Based on baseline data and the qualitative habitat assessments for bank swallow, barn swallow, and black swift, limited changes are expected to potentially suitable nesting habitat due to the Project, 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. Compared to the predicted total change in suitable nesting habitat in the Avian Species RSA for species assessed quantitatively (i.e., common nighthawk, olive-sided flycatcher, and short-eared owl), it is expected that a small amount (i.e., less than (<) 1%) of suitable nesting habitat available for bank swallow, barn swallow, and black swift within the Avian Species RSA may be affected by the Project.

5.4.3.1.3 *Residual Effect Characteristics*

The residual effect characteristics for alteration and/or loss of habitat on Listed Bird Species are summarized below and provided in **Table 5.4-7**.

The Magnitude is predicted to be Low. The predicted total change in suitable nesting habitat available for common nighthawk, olive-sided flycatcher, rusty blackbird, and short-eared owl combined is 2,507 ha (1.3%) of the Avian Species RSA (**Table 5.4-6** above). For bank swallow, barn swallow, and black swift, the small amount of suitable nesting habitat affected by the Project is expected to be <1% of the suitable nesting habitat available within the Avian Species RSA. Limited changes are expected to suitable nesting habitat available for Listed Bird Species due to the Project, 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 habitat is expected to 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 predicted to extend into the Avian Species LSA (i.e., up to 600 m for short-eared owl; up to 300 m for the remaining Listed Bird Species).

The Duration is predicted to occur over the Long-term, although differences may occur between habitat types 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 in mature and old growth forests is expected to extend beyond the Post-

closure Phase (i.e., Long-term). Regeneration of disturbed areas in wetland and early seral habitats 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 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 Listed Bird Species 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. Listed Bird Species have been exposed to historic and ongoing anthropogenic and natural disturbances throughout their ranges, including within the Avian Species RSA. Each of the listed species selected to inform the assessment of the Listed Bird Species subcomponent are either endangered or threatened under Schedule 1 of SARA and are sensitive to changes in their environment (COSEWIC 2008, 2011, 2013, 2015, 2017, 2018a, 2018b). However, 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 5.4-7: Summary of Residual Effect Characteristics for Alteration and/or Loss of Habitat on Listed Bird Species

Residual Effect Characteristic	Rating	Rationale for Rating
Magnitude	Low	The predicted total change in suitable nesting habitat available for common nighthawk, olive-sided flycatcher, rusty blackbird, and short-eared owl combined is 2,507 ha (1.3%) of the Avian Species RSA (Table 5.4-6). For bank swallow, barn swallow, and black swift, the small amount of suitable nesting habitat affected by the Project is expected to be less than 1% of the suitable nesting habitat available within the Avian Species RSA. Limited changes to suitable nesting habitat available for Listed Bird Species 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 growth forests is expected to extend beyond the Post-closure Phase (i.e., Long-term). Regeneration of wetland and early seral habitats 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.

Residual Effect Characteristic	Rating	Rationale for Rating
Reversibility	Fully Reversible	Progressive and final reclamation are expected to focus on reclaiming disturbed areas; therefore, suitable nesting habitat for Listed Bird Species predicted to be lost or altered within or adjacent to the Project Area is expected to recover over time following reclamation activities.
Context	Moderate	Listed Bird Species have been exposed to historic and ongoing anthropogenic and natural disturbances throughout their ranges, including within the Avian Species RSA. Each of the listed species selected to inform the assessment of the Listed Bird Species subcomponent are either endangered or threatened under Schedule 1 of SARA and are sensitive to changes in their environment. However, 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; LSA=Local Study Area; Project=Tenas Project; RSA=Regional Study Area

5.4.3.1.4 Likelihood

The Likelihood of the residual effect occurring is predicted to be Likely. Suitable nesting habitat for common nighthawk, olive-sided flycatcher, rusty blackbird, and short-eared owl 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 these species is also situated adjacent to the Project Area (i.e., within the 300 m ZOI for common nighthawk, olive-sided flycatcher, and rusty blackbird; within the 600 m ZOI for short-eared owl) and is expected to be indirectly affected. For the remaining Listed Bird Species (i.e., bank swallow, barn swallow, and black swift), it is expected that a limited amount of suitable nesting habitat may be present within the Avian Species LSA, and that Project activities may interact with these listed species (i.e., within the 300 m ZOI for bank swallow, barn swallow, and black swift) and result in alteration and/or loss of habitat.

5.4.3.1.5 Significance Determination

The residual effect of alteration and/or loss of habitat is not expected to result in a change to the Listed Bird Species 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 alteration and/or loss of habitat on the Listed Bird Species subcomponent is predicted to be **Not Significant**.

The Level of Confidence in this prediction is Moderate. While the direct effects of clearing on Listed Bird Species are well known, uncertainty exists with respect to the extent and degree of habitat alteration through habitat fragmentation, edge effects, and sensory disturbance. Uncertainty also exists regarding the accuracy of the mapping products used to identify suitable nesting habitat for common nighthawk, olive-sided flycatcher, rusty blackbird (i.e., as represented by the wetlands habitat guild model), and short-eared owl within the Avian Species LSA and RSA. Also, limited knowledge exists on the breeding populations of each listed species within the Avian Species RSA, and whether habitat outside of disturbed areas has the capacity to accommodate individuals displaced by the Project. Uncertainty occurs 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 Listed Bird Species 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.

5.4.3.2 Change in Mortality

Change in mortality was assessed qualitatively by considering the residual effect of the Project on the abundance of Listed Bird Species, as represented by bank swallow, barn swallow, black swift, common nighthawk, olive-sided flycatcher, rusty blackbird, and short-eared owl. Potential sources of direct and indirect mortality for bank swallow, barn swallow, black swift, common nighthawk, olive-sided flycatcher, and rusty blackbird are similar to those summarized under **5.4.2.2**. Potential sources of direct and indirect mortality for short-eared owl are similar to those summarized under **5.4.4.2**. Additional information applicable to Listed Bird Species is summarized in the following subsections.

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

5.4.3.2.1 Bank Swallow

Bank swallow nesting colonies are typically characterised by steep embankments with a sand, silt, or clay substrate that can be easily excavated for burrows (COSEWIC 2013, Howie 2015). Nesting colonies are often adjacent to slow-moving or still waterbodies (e.g., low gradient rivers or lakes) and may occur in natural habitats or in anthropogenic features (COSEWIC 2013, Howie 2015, Garrison and Turner 2020). The steep sand, silt, or clay embankments selected for nesting are frequently subject to erosion or slumping (COSEWIC 2013, Garrison and Turner 2020). Nesting colonies established in anthropogenic features are particularly vulnerable to incidental take during anthropogenic activities (e.g., aggregate extraction, blasting) (COSEWIC 2013, Garrison and Turner 2020). Although baseline studies did not detect any bank swallows within the Avian Species LSA, Project components such as the open pit slopes and side cuts created during mine and road construction could attract nesting swallows. Subsequent interactions with Project-related equipment and blasting could result in erosion or slumping, leading to incidental take of individuals at affected locations.

Project roads and Rail Infrastructure that bisect nesting and feeding areas for bank swallows may lead to increased collision risk with Project-related vehicles, mobile equipment, and trains, especially as traffic volumes and/or speed limits increase. Bank swallows are aerial insectivores that forage over a variety of open habitats such as lakes, ponds, rivers, wetlands, grasslands, and agricultural areas (COSEWIC 2013, Garrison and Turner 2020). They are particularly vulnerable to collisions with vehicles (COSEWIC 2013, Garrison and Turner 2020) partly due to the attraction of individuals to intraspecific carcasses; one (1) swallow hit by a vehicle could attract several individuals to a road, potentially resulting in subsequent collisions and large mortality events (COSEWIC 2013). Inexperienced juveniles are more likely to collide with Project-related vehicles, mobile equipment, and trains compared to adults (Garrison and Turner 2020).

Bank swallows may be susceptible to collisions with the Project powerline during aerial hunting activities, which could result in electrocutions caused by contact with powerline infrastructure (APLIC 2006, 2012). Inexperienced juveniles are more likely to collide with the powerline compared to adults (Garrison and Turner 2020). The susceptibility of bank swallows to collisions with other Project components (e.g., buildings, windows) is expected to be low as swallows are not considered to be especially vulnerable to collisions with buildings or other vertical structures (Arnold and Zink 2011).

5.4.3.2.2 Barn Swallow

Barn swallow nesting colonies are located near water, mud, and foraging habitat such as near agricultural areas, wetlands, riparian areas, and cleared ROW (Campbell et al. 1997, COSEWIC 2011, Hearne 2015, Brown and Brown 2020). Nests are typically located on a vertical or horizontal surface that is often enclosed with some form of cover directly overhead (COSEWIC 2011, Brown and Brown 2020). Anthropogenic features such as barns, houses, bridges, and culverts are commonly used nesting sites (COSEWIC 2011, Hearne 2015). Barn swallows typically return to the same nesting sites each year and may reuse old nests (Campbell et al. 1997, Hearne 2015, Brown and Brown 2020). The repeated use of anthropogenic features for nesting makes barn swallow colonies vulnerable to incidental take, especially if the anthropogenic feature requires routine maintenance (COSEWIC 2011). Barn swallows were detected within the Avian Species LSA during baseline studies. Project components such as eaves on buildings and the underside of the Goathorn Creek Bridge could attract nesting swallows. Subsequent interactions with Project maintenance activities could result in nest destruction, leading to incidental take of individuals at affected locations.

Project roads and Rail Infrastructure that bisect nesting and feeding areas for barn swallows may lead to increased collision risk with Project-related vehicles, mobile equipment, and trains, especially as traffic volumes and/or speed limits increase. Barn swallows that may be attracted to nest on the underside of the Goathorn Creek Bridge or inside Project culverts could be particularly vulnerable to collisions with Project-related vehicles and mobile equipment (Brown and Brown 2020).

Barn swallows may be susceptible to collisions with the Project powerline during aerial hunting activities, which could result in electrocutions caused by contact with powerline infrastructure (APLIC 2006, 2012). The susceptibility of barn swallows to collisions with other Project components (e.g., buildings, windows) is expected to be low as swallows are not considered to be especially vulnerable to collisions with buildings or other vertical structures (Arnold and Zink 2011, Brown and Brown 2020). Due to their frequent use of anthropogenic features for nesting, barn swallows may be vulnerable to entrapment in Project components (e.g., buildings, pipes, vents, other enclosed spaces) as they search for potential locations to build a nest (Vancouver Bird Advisory Committee 2015, University of British Columbia 2019).

5.4.3.2.3 Black Swift

Most of the black swift nests discovered in BC have been located on rock ledges behind montane waterfalls, although nests have also been located on ledges of steep rock faces, cliffs, and caves (Boyd 2015a). Recent research demonstrates that black swifts have specific microclimate requirements for nest sites, with mean temperatures between 9.4 degrees Celsius (°C) and 13.4°C and relative humidity between 89.7% and 92.8% (Gunn et al. 2012). Neither baseline studies nor a desktop review of aerial imagery located notable waterfalls or other rocks faces, cliffs, or caves suitable for nesting within the Avian Species LSA. As such, no nesting black swifts are expected to interact with the Project and be affected by incidental take during site clearing and vegetation management.

Information is lacking on the vulnerability of black swifts to collisions with vehicles, powerlines, buildings, and other vertical structures. Black swifts are aerial insectivores that forage over forested and open habitats (e.g., wetlands, lakes) (COSEWIC 2015, Lowther et al. 2020). Project roads and Rail Infrastructure that bisect feeding areas may lead to collisions between swifts and Project-related vehicles, mobile equipment, and trains, especially as traffic volumes and/or speed limits increase. Black swifts may be susceptible to collisions with the Project powerline during aerial hunting activities (APLIC 2012), which could result in electrocutions caused by contact with Powerline infrastructure. The susceptibility of black swifts to collisions with other Project components (e.g., buildings, windows) is expected to be low.

5.4.3.2.4 *Common Nighthawk*

Common nighthawks build inconspicuous nests on the ground in a variety of open areas in natural and anthropogenic environments (e.g., grasslands, open forests, burns, agricultural fields, cutblocks, gravel roads, and rail-sides) (Campbell et al. 2006, Environment Canada 2016a, COSEWIC 2018a, Brigham et al. 2020). Although baseline studies did not detect any common nighthawks within the Avian Species LSA, the Project Area overlaps suitable nesting habitat for the species (**Table 5.4-6**). If present, common nighthawks may be vulnerable to incidental take during Project-related site clearing and vegetation management. Common nighthawks that may nest or roost on Project-related gravel roads and rail-sides could also be vulnerable to incidental take during Project activities.

Common nighthawks are aerial insectivores that forage in open and semi-open areas at dawn and dusk, often in large groups (Campbell et al. 2006, Environment Canada 2016a, COSEWIC 2018a, Brigham et al. 2020). Project roads and Rail Infrastructure that bisect feeding areas may lead to increased collision risk with Project-related vehicles, mobile equipment, and trains, especially as traffic volumes and/or speed limits increase. Collision risk may also increase for common nighthawks that nest or roost along Project-related gravel roads and rail-sides.

Collisions with vehicles are a known source of mortality for common nighthawks in southern BC. This is likely due to high densities of nighthawks and roads in southern British Columbia (BC) coupled with high traffic volumes (Campbell et al. 2006). Although common nighthawks are distributed widely across BC, they become less common and more localised as latitude and elevation increases (Campbell et al. 2006, 1990b, Boyd 2015b). The highest nighthawk mortalities from vehicle collisions have been reported in the Okanagan Valley and East Kootenay regions (Campbell et al. 2006). Traffic volumes are considerably higher throughout these regions (i.e., approximately 11,350 and 4,500 vehicles per day, respectively) (British Columbia Ministry of Transportation and Infrastructure [BC MOTI] 2020) compared to expected traffic volumes for the TAC (i.e., between four (4) and eight (8) trucks per hour, which equates to between 96 and 192 trucks per day). Since traffic volumes on the TAC are expected to be considerably less than traffic volumes in the Okanagan Valley and East Kootenay regions, and the density of common nighthawks is expected to be lower in the Project Area compared to southern BC, the risk of collisions between Project-related vehicles and nighthawks is anticipated to be low.

Although collision risk with powerlines has not been quantified for common nighthawk, it is presumed to be limited; however, adult males may collide with the Project powerline during aerial courtship displays (Environment Canada 2016a, COSEWIC 2018a), which could result in electrocutions caused by contact with powerline infrastructure. Common nighthawks may nest along the powerline ROW if the habitat includes open areas with short vegetation or rock outcroppings (Campbell et al. 2006, Hausleitner and Wallace 2012), which could increase collision and electrocution risk with powerline infrastructure. The susceptibility of common nighthawks to collisions with other Project components (e.g., buildings, windows) is expected to be low as nighthawks are not considered to be especially vulnerable to collisions with buildings or other vertical structures (Environment Canada 2016a, COSEWIC 2018a).

5.4.3.2.5 *Olive-sided Flycatcher*

Olive-sided flycatchers nest in coniferous, mixed, and riparian forests typically along high contrast edges between two (2) distinct habitat types (COSEWIC 2018b, Altman and Sallabanks 2020). These habitat types may include open mature and old growth forests, burns, cutblocks, wetlands, and waterbodies (COSEWIC 2018b, Altman and Sallabanks 2020). Nests are typically located in coniferous trees (COSEWIC 2018b, Altman and Sallabanks 2020). Baseline studies and the desktop review documented olive-sided flycatchers at several locations within the Avian Species LSA and RSA, including within and adjacent to the Project Area. The Project Area also overlaps suitable nesting habitat for olive-sided

flycatcher (**Table 5.4-6**). As such, olive-sided flycatchers may be vulnerable to incidental take during Project-related site clearing and vegetation management (Environment Canada 2016b).

Information is limited on the vulnerability of olive-sided flycatchers to collisions with vehicles, powerlines, buildings, and other vertical structures. Although they use disturbed habitats for nesting and foraging, species distribution models predict lower flycatcher densities near linear features and anthropogenic disturbances (COSEWIC 2018b). This prediction suggests that olive-sided flycatchers may be sensitive to Project-related disturbances and could show reduced use or avoidance of the Project Area, which may limit the potential for interactions and subsequent mortality risk.

Several studies have demonstrated that passerines are particularly susceptible to collisions with vehicles; however, collision risk for olive-sided flycatchers has not been quantified (Environment Canada 2016b). Olive-sided flycatchers are aerial insectivores that typically forage in open areas or along forest edges at heights near or above the adjacent forest canopy; however, they may forage at lower heights during inclement weather (COSEWIC 2018b, Altman and Sallabanks 2020). Project roads and Rail Infrastructure that bisect feeding areas may lead to collisions between flycatchers and Project-related vehicles, mobile equipment, and trains, especially as traffic volumes and/or speed limits increase.

Collision risk with powerlines has not been quantified for olive-sided flycatchers (Environment Canada 2016b); however, passerines have been known to collide with powerlines (e.g., during aerial hunting activities or courtship displays; during low-altitude flights between nesting and feeding areas), and electrocutions have been documented (APLIC 2006, 2012). As such, olive-sided flycatchers may be susceptible to collisions with the Project powerline during aerial hunting activities, courtship displays, or low altitude flights, which could result in electrocutions caused by contact with powerline infrastructure.

The susceptibility of olive-sided flycatchers to collisions with other Project components (e.g., buildings, windows) is expected to be low. Relative to other avian species, olive-sided flycatchers have an average collision risk across all building types, with collision risk increasing for tall buildings (Environment Canada 2016b).

5.4.3.2.6 *Rusty Blackbird*

Breeding habitat for rusty blackbirds is generally characterised by wet coniferous and mixed forests adjacent to wetlands, beaver ponds, and riparian areas along slow-moving streams and swampy lakeshores (Campbell et al. 2001, Di Corrado 2015, COSEWIC 2017, Avery 2020). The nest site is almost always located over or close to water (<75 m) within 1 m of the ground (Powell et al. 2010, Avery 2020). Baseline studies and the desktop review did not detect any rusty blackbirds within the LSA; if present, the species is likely uncommon within the Avian Species LSA. Given their breeding habitat requirements, rusty blackbirds may be less vulnerable to incidental take during Project-related site clearing and vegetation management as disturbance in wetlands and riparian areas will be avoided (**5.3.1**). However, they may be vulnerable to changes in surface hydrology that alter wetland and riparian habitats due to Project activities (Environment Canada 2015, COSEWIC 2017).

Information is lacking on the vulnerability of rusty blackbirds to collisions with vehicles, powerlines, buildings, and other vertical structures. Rusty blackbirds are opportunistic foragers that typically feed on the ground, particularly in wetland and riparian areas, but also in open areas (e.g., agricultural fields) (COSEWIC 2017, Avery 2020). Project roads and Rail Infrastructure that bisect feeding areas may lead to collisions between blackbirds and Project-related vehicles, mobile equipment, and trains, especially as traffic volumes and/or speed limits increase. Rusty blackbirds may be susceptible to collisions with the Project powerline during low-altitude flights between nesting and feeding areas, which could result in electrocutions caused by contact with powerline infrastructure (APLIC 2006, 2012). The susceptibility of

rusty blackbirds to collisions with other Project components (e.g., buildings, windows) is expected to be low.

5.4.3.2.7 *Short-eared Owl*

Short-eared owls nest and forage in open habitats (e.g., grasslands, wetlands, agricultural areas, cleared and regenerating forest) with a reliable source of small mammal prey (COSEWIC 2008, Cannings 2015, ECCC 2018, Wiggins et al. 2020). Nest sites are typically a simple scrape in the ground on dry areas in clumps of dense, high grass or shrubby thickets (COSEWIC 2008, Cannings 2015, ECCC 2018, Wiggins et al. 2020). Short-eared owls are susceptible to incidental take, particularly in agricultural areas when mowing or harvesting occurs prior to young fledging (COSEWIC 2008, ECCC 2018). Although baseline studies did not detect any short-eared owls within the Avian Species LSA, the Project Area overlaps suitable nesting habitat for the species (**Table 5.4-6**). If present, short-eared owls may be vulnerable to incidental take during Project-related site clearing and vegetation management.

Collisions with vehicles, powerlines, buildings, and other vertical structures (e.g., fences) have resulted in mortality of short-eared owls; however, quantitative data is lacking and the extent of mortality resulting from these sources is unknown (COSEWIC 2008, ECCC 2018, Wiggins et al. 2020). Project roads and Rail Infrastructure that bisect nesting and feeding areas may lead to collisions between short-eared owls and Project-related vehicles, mobile equipment, and trains, especially as traffic volumes and/or speed limits increase. Short-eared owls may be susceptible to collisions with the Project powerline during low-level flights, which could result in electrocutions caused by contact with powerline infrastructure (APLIC 2006, 2012). The susceptibility of short-eared owls to collisions with other Project components (e.g., buildings, windows) is expected to be low.

5.4.3.2.8 *Residual Effect Characteristics*

The residual effect characteristics for change in mortality on Listed Bird Species are summarized below and provided in **Table 5.4-8**.

The Magnitude is predicted to be Low. Mitigation measures are expected to limit but not fully mitigate the potential for interactions between Listed Bird Species and potential sources of direct and indirect mortality. Limited changes are expected to suitable nesting habitat available for Listed Bird Species due to the Project (**Table 5.4-6**), 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 types. Regeneration of disturbed areas in mature and old growth forests is

expected to extend beyond the Post-closure Phase (i.e., Long-term). Regeneration of disturbed areas in wetland and early seral habitats 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 Listed Bird Species, 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 High. Listed Bird Species have been exposed to historic and ongoing anthropogenic and natural disturbances throughout their ranges, including within the Avian Species RSA. Each of the listed species selected to inform the assessment of the Listed Bird Species subcomponent are either endangered or threatened under Schedule 1 of SARA and are sensitive to changes in their environment (COSEWIC 2008, 2011, 2013, 2015, 2017, 2018a, 2018b). Although 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, local populations of listed species may be less resilient to changes in 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 5.4-8: Summary of Residual Effect Characteristics for Change in Mortality on Listed Bird Species Subcomponent

Residual Effect Characteristic	Rating	Rationale for Rating
Magnitude	Low	Mitigation measures are expected to limit the potential for interactions between Listed Bird Species and potential sources of direct and indirect mortality. Limited changes to suitable nesting habitat available for Listed Bird Species are expected (Table 5.4-6), 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 types. Regeneration of mature and old growth forests is expected to extend beyond the Post-closure Phase (i.e., Long-term). Regeneration of wetland and early seral habitats 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 Listed Bird Species, occurrences of mortality are expected to be isolated and infrequent events with the implementation of mitigation measures.

Residual Effect Characteristic	Rating	Rationale for Rating
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	High	Listed Bird Species have been exposed to historic and ongoing anthropogenic and natural disturbances throughout their ranges, including within the Avian Species RSA. Each of the listed species in the Listed Bird Species subcomponent are either endangered or threatened under Schedule 1 of SARA and are sensitive to changes in their environment (COSEWIC 2008, 2011, 2013, 2015, 2017, 2018a, 2018b). Although 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, local populations of listed species may be less resilient to changes in 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; RSA=Regional Study Area; SARA=Species at Risk Act, SC 2002, c 29 (Government of Canada [GovCan] 2002)

5.4.3.2.9 Likelihood

The Likelihood of the residual effect occurring is predicted to be Likely. Suitable nesting habitat for common nighthawk, olive-sided flycatcher, rusty blackbird, and short-eared owl is present within and adjacent to the Project Area; therefore, it is possible that Project activities may interact with these species and result in direct and/or indirect mortality. For the remaining Listed Bird Species (i.e., bank swallow, barn swallow, and black swift), it is expected that a limited amount of suitable nesting habitat may be present within the Avian Species LSA, and it is possible that Project activities may interact with these species and result in direct and/or indirect mortality.

5.4.3.2.10 Significance Determination

The residual effect of change in mortality is not expected to result in a change to the Listed Bird Species 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 mortality on the Listed Bird Species 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 bank swallow, barn swallow, black swift, common nighthawk, olive-sided flycatcher, rusty blackbird, and short-eared owl, and the extent and degree of effects resulting from different sources of mortality.

Mitigation measures to avoid, minimize, and or rehabilitate onsite the potential effects of change in mortality on Listed Bird Species 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.

5.4.3.3 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 Listed Bird Species, as represented by bank swallow, barn swallow, black swift, common nighthawk, olive-sided flycatcher, rusty blackbird, and short-eared owl. 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 Listed Bird Species.

After completing a literature review, it was clear that discussing specific daily and seasonal movements by the seven species selected to inform the assessment of the Listed Bird Species subcomponent would not be practical due to the range of behaviours between species and individuals. Considering this, the residual effects of the Project on change in daily and seasonal movement patterns addresses all listed species jointly in the following subsections. Species-specific examples are provided for additional context, as appropriate.

5.4.3.3.1 *Daily Movements*

Alteration and/or loss of habitat is predicted to change the amount of suitable nesting habitat available to support Listed Bird Species within and adjacent to the Project Area (i.e., based on baseline studies and habitat suitability modelling, **Table 5.4-6**). 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 feeding area) 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).

Listed Bird Species 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 Listed Bird Species include artificial light that attracts flying insects (e.g., foraging opportunities for insectivorous birds such as bank swallows, barn swallows, black swifts, common nighthawks, or olive-sided flycatchers); the powerline infrastructure (e.g., hunting, feeding, resting, or roosting opportunities for short-eared owls) and associated cleared ROW (e.g., hunting or nesting opportunities for short-eared owls; nesting opportunities for common nighthawk); eaves of buildings (e.g., nesting opportunities for barn swallows); and the channels and ponds that are part of the Surface Water Management Infrastructure (e.g., feeding or breeding opportunities for bank swallows, barn swallows, black swifts, common nighthawks, olive-sided flycatchers, or rusty blackbirds). Listed Bird Species (e.g., barn swallows) 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). As such, species that nest on or close to the ground (e.g., common nighthawks, short-eared owls), particularly in wetlands (e.g., rusty blackbirds), may be more likely to respond to Project components/activities and alter their daily movement patterns compared to species that nest above ground (e.g., barn swallows, black swifts, olive-sided flycatchers). 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). Therefore, open cup nesters (e.g., barn swallows, black swifts, common nighthawks, olive-sided flycatchers, rusty blackbirds, short-eared owls) may be more likely to respond to Project components/activities and alter their daily movement patterns compared to cavity nesters (e.g., bank swallows). 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). This suggests that aerial insectivores (e.g., bank swallows, barn swallows, black swifts, common nighthawks, olive-sided flycatchers) and aerial predators (e.g., short-eared owls) may be more likely to respond to Project components/activities and alter their daily movement patterns compared to ground foragers (e.g., rusty blackbirds).

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). Therefore, migrant species such as bank swallows, barn swallows, black swifts, common nighthawks, and rusty blackbirds may be more likely to respond to Project components/activities and alter their daily movement patterns. 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). As such, short-eared owls may be more likely to respond to Project components/activities and alter their daily movement patterns. 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). This suggests that species that use more forested habitats (e.g., black swifts, olive-sided flycatchers, rusty blackbirds) may be more likely to respond to Project components/activities and alter their daily movement patterns compared to species that use more open habitats (e.g., bank swallows, barn swallows, common nighthawks, short-eared owls).

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); these findings are more applicable to waterfowl species such as ducks, geese, and swans. 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). This suggests that short-eared owls may be less likely to respond to Project components/activities and alter their daily movement

patterns compared to the other representative species for the Listed Bird Species subcomponent, which are smaller in size.

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, Listed Bird Species 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 Listed Bird Species 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 Listed Bird Species 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.

5.4.3.3.2 Seasonal Movements

The Project is located within the Pacific Flyway, which spans over 21 million 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 Listed Bird Species in the Pacific Flyway; therefore, it is expected that a small percentage of Listed Bird Species may pass over and potentially interact with Project components and activities. This also considers natural variation in the seasonal flight paths of Listed Bird Species, 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 such as bank swallows, barn swallows, olive-sided flycatcher, and rusty blackbirds) (Kerlinger 1983), and long distance migrants (e.g., bank swallows, barn swallows, black swifts, common nighthawks, olive-sided flycatchers) typically migrate at higher altitudes than short distance migrants (e.g., rusty blackbirds, short-eared owls) (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 migrating Listed Bird Species; therefore, the Project is not expected to interfere with the migratory routes or flight paths that might be used by Listed Bird Species passing over the Project Area. The potential effects of artificial light on seasonal movements are discussed further below as an attractant.

Stopover sites are locations where migrating birds stop to rest, feed, and drink during spring and fall migration (Warnock 2010). Lowland habitats and open areas (e.g., wetlands, lakes, sloughs, riparian areas, agricultural fields) provide stopover habitat for migrating bank swallows, barn swallows, black swifts, common nighthawks, olive-sided flycatchers, and rusty blackbirds (COSEWIC 2011, 2013, 2015, 2017, 2018a, 2018b, Altman and Sallabanks 2020, Avery 2020, Brigham et al. 2020, Brown and Brown 2020, Cornell Lab of Ornithology 2020, Garrison and Turner 2020, Lowther et al. 2020). The short-eared owl is a partial migrant with individuals in the northern part of its range considered highly migratory; however, little information is available on migratory behavior with no indication of habitat types used as stopover sites during migration (Wiggins et al. 2020).

No baseline data are available that identifies potential stopover sites within and adjacent to the Project Area for Listed Bird Species; therefore, potential Project-related effects (i.e., direct and indirect) on stopover sites used by Listed Bird Species are unknown. However, if individuals were displaced by the Project, it is expected that they would 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 could tolerate some degree of disturbance (e.g., avoiding vehicles or buildings in flight; flushing off a feeding area). 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).

Listed Bird Species 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 migrating Listed Bird Species include the channels and ponds that are part of the Surface Water Management Infrastructure (e.g., resting and/or feeding opportunities for bank swallows, barn swallows, or rusty blackbirds). Artificial light may attract and disorient nocturnal migrating Listed Bird Species (e.g., black swifts, common nighthawks) 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). The attraction of nocturnal migrants to artificial light may subsequently attract Raptors (e.g., short-eared owls) for hunting opportunities (Wiggins et al. 2020). Any interaction between migrating Listed Bird Species and Project components is expected to be isolated and brief considering the behaviour of migrating Listed Bird Species (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, Listed Bird Species 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 Listed Bird Species 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 Listed Bird Species 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.

5.4.3.3.3 *Residual Effect Characteristics*

The residual effect characteristics for change in movement patterns on Listed Bird Species are summarized below and provided in **Table 5.4-9**.

The Magnitude is predicted to be Low. Limited changes are expected to suitable nesting habitat available for Listed Bird Species due to the Project (i.e., based on baseline studies and habitat suitability modelling, **Table 5.4-6**), 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 habitat within the Avian Species LSA and RSA. Suitable breeding 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). Although baseline data did not identify stopover sites used by Listed Bird Species, if individuals were displaced by the Project, it is expected that they would relocate to other areas of suitable stopover habitat within the Avian Species RSA.

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 migrating Listed Bird Species. As such, the percentage of Listed Bird species that may pass over, and potentially interact with the Project, is expected to be small. With respect to Listed Bird Species 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 habitat types 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 Listed Bird Species 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 in mature or old growth forests, which may provide suitable habitat for black swifts, olive-sided flycatchers, and/or rusty blackbirds, is expected to extend beyond the Post-closure Phase (i.e., Long-term). Regeneration of disturbed areas in wetland and early seral habitats, which may provide suitable habitat for bank swallows, barn swallows, common nighthawks, rusty blackbirds, and/or short-eared owl, 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 Listed Bird Species

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 Listed Bird Species 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. Listed Bird Species have been exposed to historic and ongoing anthropogenic and natural disturbances throughout their ranges, including within the Avian Species RSA. Each of the listed species selected to inform the assessment of the Listed Bird Species subcomponent are either endangered or threatened under Schedule 1 of SARA and are sensitive to changes in their environment (COSEWIC 2008, 2011, 2013, 2015, 2017, 2018a, 2018b). However, 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 Listed Bird Species 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 5.4-9: Summary of Residual Effect Characteristics for Change in Movement Patterns on Listed Bird Species Subcomponent

Residual Effect Characteristic	Rating	Rationale for Rating
Magnitude	Low	Limited changes to suitable nesting habitat available for Listed Bird Species are expected (i.e., based on baseline studies and habitat suitability modelling, Table 5.4-6), 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 Listed Bird Species 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 mature or old growth forests, which may provide suitable habitat for black swifts, olive-sided flycatchers, and/or rusty blackbirds, is expected to extend beyond the Post-closure Phase (i.e., Long-term). Regeneration of wetland and early seral habitats, which may provide suitable habitat for bank swallows, barn swallows, common nighthawks, rusty blackbirds, and/or short-eared owl, is expected to be achieved by the end of the Post-closure Phase (i.e., Medium-term).

Residual Effect Characteristic	Rating	Rationale for Rating
Frequency	Frequent	Change in movement patterns is expected to occur during the Construction Phase and continue each year that Listed Bird Species 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	Listed Bird Species have been exposed to historic and ongoing anthropogenic and natural disturbances throughout their ranges, including within the Avian Species RSA. Each of the listed species selected to inform the assessment of the Listed Bird Species subcomponent are either endangered or threatened under Schedule 1 of SARA and are sensitive to changes in their environment. However, 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. Project components that may attract individual Listed Bird Species 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; SARA=Species at Risk Act, SC 2002, c 29 (Government of Canada [GovCan] 2002)

5.4.3.3.4 *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 habitat available to support Listed Bird Species within and adjacent to the Project Area (i.e., based on baseline studies and habitat suitability modelling, **Table 5.4-6**). This change in habitat is expected to result in limited changes to the daily and/or seasonal movement patterns of a few individual Listed Bird Species. A limited number of individual Listed Bird Species 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.

5.4.3.3.5 *Significance Determination*

The residual effect of change in movement patterns is not expected to result in a change to the Listed Bird Species 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 Listed Bird Species subcomponent is predicted to be **Not Significant**.

The Level of Confidence in this prediction is Moderate. The extent and degree of the response of Listed Bird Species 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 common nighthawk, olive-sided flycatcher, rusty blackbird (as represented by the wetlands habitat guild model), and short-eared owl within

the Avian Species LSA and RSA. Baseline studies were limited to certain areas of the Avian Species LSA and RSA; therefore, habitat use may not be fully documented for Listed Bird Species. Baseline studies did not identify potential stopover sites used by Listed Bird Species within the Avian Species LSA and RSA. Also, there is limited knowledge on the breeding populations of Listed Bird Species 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 Listed Bird Species that might migrate over the Project Area or use stopover sites within the Avian Species LSA and RSA.

Mitigation measures to avoid, minimize, and or rehabilitate onsite the potential effects of change in movement patterns on Listed Bird Species 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.

5.4.4 Raptors Subcomponent

5.4.4.1 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 Raptors, as represented by northern goshawk and short-eared owl. The habitat suitability model for northern goshawk was based on the habitat suitability index (HSI) methodology with HSI ratings categorised into a four (4)-class rating system (i.e., Nil, Low, Moderate, and High suitability). The habitat suitability model for short-eared owl had the same four (4)-class rating system. Refer to Appendix A and D of **Appendix 4.9-A** for additional details about the habitat suitability models for northern goshawk and short-eared owl.

5.4.4.1.1 Northern Goshawk and Short-eared Owl

The HSI methodology has been used in several northern goshawk habitat mapping and supply analyses in BC (Mahon and Doyle 2003, BC MAL 2007, Mahon 2009, Stuart-Smith et al. 2012). Edge distances, similar to the ZOI concept used in the Listed Bird Species habitat suitability models, were incorporated into the HSI for northern goshawk to represent alteration of habitat adjacent to the Project Area. Data from coastal and interior studies in BC indicates that goshawks avoid nesting near abrupt or ‘hard’ edges (i.e., where mature forest meets non-forested or early seral habitats) (Mahon and Doyle 2003, McClaren et al. 2015). A height difference of greater than 10 m between adjacent stands, with the shorter stand less than 14 m, was used in the HSI to define a hard edge. The effect of a hard edge on the suitability of adjacent stands within the Avian Species LSA was assessed based on proximity to the edge. A stronger edge effect was applied to habitats within 0 to 50 m of an edge compared to habitats within 50 to 100 m of an edge. An edge effect was not applied to habitats greater than 100 m from an edge.

Loss of habitat for northern goshawk 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. Alteration of habitat was considered during all Project phases and was quantified for northern goshawk by calculating the amount of suitable nesting habitat (i.e., Moderate and High suitability) influenced by edge effects within the edge distances (i.e., 0 to 50 m, 50 to 100 m) that extend into the Avian Species LSA from the outer boundary of the Project Area. Loss and alteration of habitat for short-eared owl were quantified according to the methods outlined in **5.4.3.1**.

Habitat changes predicted to result from the Project on northern goshawk and short-eared owl are summarized in **Table 5.4-10**. 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 northern goshawk 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 northern goshawk and short-eared owl is depicted in **Figure 5.4-7** and **Figure 5.4-6** (in **5.4.3.1.1**), respectively. The predicted total change in suitable nesting habitat available for both species combined is 367 ha (0.8%) of the Avian Species RSA.

Table 5.4-10: Summary of Change in Suitable Nesting Habitat for Raptors Subcomponent

Raptor 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
Northern goshawk	70	34	104	18,730	0.6
Short-eared owl	174	89	263	24,495	1.1
Total	244	123	367	43,225³	0.8

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, in the baseline condition Suitable habitat areas between the raptor species may overlap.

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 for northern goshawk indicate that the closest predicted active breeding territory is likely located approximately 10 km west of the Avian Species LSA (**Figure 5.4-7**) (Doyle 2020). This modelling assumption is supported by baseline studies, with no indication (i.e., repeated territorial calling or sightings) that an active breeding territory is located within or adjacent to the Avian Species LSA (Doyle 2020). A single report of a calling goshawk in June 2018 was subsequently followed up by call playback surveys throughout the detection area; however, no support for an active breeding territory was observed (Doyle 2020).

5.4.4.1.2 *Residual Effect Characteristics*

The residual effect characteristics for alteration and/or loss of habitat on Raptors are summarized below and provided in **Table 5.4-11**.

The Magnitude is predicted to be Low. The predicted total change in suitable nesting habitat for northern goshawk and short-eared owl combined is 367 ha (0.8%) of the Avian Species RSA (**Table 5.4-10**). Limited changes are expected to suitable nesting habitat available for Raptors due to the Project, 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). Based on the habitat requirements of northern goshawk breeding territories (Doyle et al. 2020), it is unlikely that an active breeding territory is currently located within or adjacent to the Avian Species LSA (Doyle 2020); therefore, no nesting goshawks are expected to interact with the Project.

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 into the Avian Species LSA (i.e., up to 100 m for northern goshawk; up to 600 m for short-eared owl).

The Duration is predicted to occur over the Long-term, although there may be differences between habitat types 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 in mature and old growth forests is expected to extend beyond the Post-closure Phase (i.e., Long-term). Regeneration of disturbed areas in wetland and early seral habitats 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 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 Raptors 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. Raptors have been exposed to historic and ongoing anthropogenic and natural disturbances throughout their ranges, including within the Avian Species RSA. The *atricapillus* subspecies of northern goshawk is blue-listed (i.e., special concern) in BC and the short-eared owl is listed as special concern under Schedule 1 of SARA; both species are sensitive to changes in their environment (Demarchi and Bentley 2005, COSEWIC 2008, Stuart-Smith et al. 2012, Zevit et al. 2012, Caskey and Chutter 2013). However, 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 5.4-11: Summary of Residual Effect Characteristics for Alteration and/or Loss of Habitat on Raptors Subcomponent

Residual Effect Characteristic	Rating	Rationale for Rating
Magnitude	Low	The predicted total change in suitable nesting habitat for northern goshawk and short-eared owl combined is 367 ha (0.8%) of the Avian Species RSA (Table 5.4-10). Limited changes to suitable nesting habitat available for Raptors 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 mature and old growth forests is expected to extend beyond the Post-closure Phase (i.e., Long-term). Regeneration of wetland and early seral habitats 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 Raptors predicted to be lost or altered within or adjacent to the Project Area is expected to recover over time following reclamation activities.
Context	Moderate	Raptors have been exposed to historic and ongoing anthropogenic and natural disturbances throughout their ranges, including within the Avian Species RSA. The <i>atricapillus</i> subspecies of northern goshawk is blue-listed (i.e., special concern) in BC and the short-eared owl is listed as special concern under Schedule 1 of SARA; both species are sensitive to changes in their environment. However, 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; Project=Tenas Project; RSA=Regional Study Area; SARA=Species at Risk Act, SC 2002, c 29 (Government of Canada [GovCan] 2002)

5.4.4.1.3 Likelihood

The Likelihood of the residual effect occurring is predicted to be Likely. Suitable nesting habitat for northern goshawk and short-eared owl 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 northern goshawk and short-eared owl is also situated adjacent to the Project Area (i.e., within the 100 m edge distance for northern goshawk; within the 600 m ZOI for short-eared owl) and is expected to be indirectly affected.

5.4.4.1.4 *Significance Determination*

The residual effect of alteration and/or loss of habitat is not expected to result in a change to the Raptors 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 alteration and/or loss of habitat on the Raptors subcomponent is predicted to be **Not Significant**.

The Level of Confidence in this prediction is Moderate. While the direct effects of clearing on Raptors are well known, uncertainty exists with respect to the extent and degree of habitat alteration through habitat fragmentation, edge effects, and sensory disturbance. Uncertainty also exists regarding the accuracy of the mapping products used to identify suitable nesting habitat for northern goshawk and short-eared owl within the Avian Species LSA and RSA, and how well the habitat suitability models for these species represent nesting habitat for other Raptor species within the Avian Species LSA and RSA. Also, there is limited knowledge on the breeding populations of each Raptor 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. There is uncertainty 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 Raptors 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.

5.4.4.2 *Change in Mortality*

Change in mortality was assessed qualitatively by considering the residual effect of the Project on the abundance of Raptors, as represented by northern goshawk and short-eared owl. Additional information for short-eared owl is summarized under **5.4.3.2.7**.

Potential sources of direct mortality on Raptors include incidental take during Project-related site clearing and vegetation management; collisions with Project-related vehicles, mobile equipment, trains, and components (e.g., buildings or windows); and collisions with the Project powerline and electrocution caused by contact with powerline infrastructure.

All Raptor species are vulnerable to incidental take during Project-related site clearing and vegetation management, particularly those that nest on the ground (e.g., short-eared owls). Compared to other avian species (e.g., passerines), raptors are considered to be less susceptible to collisions with Project-related vehicles, mobile equipment, trains, and buildings/windows (Erickson et al. 2005). However, several studies have documented raptor collisions with vehicles and buildings/windows (Deem et al. 1998, Wendell et al. 2002, Hager 2009, Neese et al. 2010, Molina-López et al. 2011, Smith et al. 2018), and low-flying species such as owls (e.g., short-eared owls) may be particularly vulnerable to collisions with Project-related vehicles, mobile equipment, and trains (Bishop and Brogan 2013). Low-flying movements between nesting and feeding habitats may also increase collision risk with fences (Wendell et al. 2002, Hager 2009, Molina-López et al. 2011), particularly for raptor species that use open areas (e.g., short-eared owls).

Raptors are strong fliers and can quickly maneuver in flight, making them less vulnerable to collisions with the Project powerline compared to other avian species (e.g., ducks, geese, and swans). However, inexperienced juvenile raptors or raptors distracted by territorial or courtship displays or aerial hunting activities may be at greater risk of collision with the powerline (APLIC 2006, 2012). Raptors are susceptible to electrocution caused by contact with powerline infrastructure because their large physical size easily spans the distance between energized equipment (Erickson et al. 2005, APLIC 2006). The use of utility

poles for hunting, feeding, resting, and/or roosting may increase collision and/or electrocution risk for raptors (APLIC 2006). Low-flying movements between nesting and feeding habitats may also increase collision and/or electrocution risk for raptors (APLIC 2012). Raptors are short distance migrants and may be at greater risk of collision with the powerline because they tend to travel at lower altitudes and stop to feed and rest more frequently compared to long distance migrants (e.g., passerines) (APLIC 2012).

Potential sources of indirect mortality on Raptors include nest failure or abandonment caused by sensory disturbance from Project activities; 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; and contamination of avian habitats and food resources caused by Project-related spills of fuels and other hazardous materials, malfunctions, and other accidents.

Compared to other bird groups, raptors are typically more sensitive to sensory disturbance with the degree of sensitivity generally increasing during the nesting season (BC MFLNRO 2014a). Response to disturbance may vary depending on the species, individual, and type, level, frequency, and timing of disturbance. Guidelines in BC suggest that northern goshawks have low tolerance to anthropogenic disturbance near nest sites while short-eared owls have moderate tolerance (Caskey and Chutter 2013). The effects of sensory disturbance on northern goshawks and short-eared owls (e.g., elevated stress levels; interference with communication or predator detection; interference with incubation or nestling provisioning) may lead to nest failure or abandonment, which could have implications for reproductive output and survival.

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 raptor 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). Aquatic habitats (e.g., wetlands, lakes, streams) that raptors may use for feeding and/or drinking purposes 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 Raptors and potential sources of direct and indirect mortality, thereby limiting the residual effect of change in mortality during the various Project phases.

5.4.4.2.1 Northern Goshawk

Northern goshawks nest and forage in large patches of contiguous mature and old growth coniferous stands (Cooper and Stevens 2000, Penteriani 2002, McGrath et al. 2003, Zevit et al. 2012, McClaren et al. 2015, Squires et al. 2020). Breeding activities occur within a 50 to 200 ha breeding area that typically contains multiple above-ground nests that may be reused for several years (Stuart-Smith et al. 2012, Zevit et al. 2012, McClaren et al. 2015, Squires et al. 2020). Given their breeding habitat requirements, northern goshawks are susceptible to incidental take during timber harvesting activities (Squires et al. 2020). However, based on the habitat requirements of goshawk breeding territories (Doyle et al. 2020), it is unlikely that an active breeding territory is currently located within or adjacent to the Avian Species LSA (Doyle 2020); therefore, no nesting goshawks are expected to interact with the Project and be affected by incidental take during site clearing.

Northern goshawks are sensitive to sensory disturbance from industrial activities (e.g., Project-related site clearing, road building, and mining activities), which may result in nest failure or abandonment, especially during incubation (Zevit et al. 2012, Squires et al. 2020). Collisions with Project-related vehicles, mobile equipment, trains, and buildings/windows may result in goshawk mortalities (Dick and Plumpton 1999, Hager 2009, Stone 2013, Squires et al. 2020). Although northern goshawks typically capture live prey, they

have been known to feed off animal carcasses left out during scavenging experiments (Doyle and Smith 2001, Selva et al. 2005, 2019, Wikenros et al. 2013, Peers et al. 2020). As such, they may be attracted to animal carcasses along Project roads and the Rail Loop, which could lead to collisions with Project-related vehicles, mobile equipment, and trains. Northern goshawks are expected to be less susceptible to collisions with the Project powerline and electrocutions caused by contact with powerline infrastructure because they are a forest-dwelling species capable of quick maneuverability in flight. However, collisions with the powerline and electrocution caused by contact with powerline Infrastructure may occur when goshawks are distracted during high-speed aerial hunting pursuits (APLIC 2006, 2012).

5.4.4.2.2 *Short-eared Owl*

Refer to **5.4.3.2.7** for a qualitative mortality assessment specific to short-eared owl.

5.4.4.2.3 *Residual Effect Characteristics*

The residual effect characteristics for change in mortality on Raptors are summarized below and provided in **Table 5.4-12**.

The Magnitude is predicted to be Low. Mitigation measures are expected to limit the potential for interactions between Raptors and potential sources of direct and indirect mortality. Limited changes are expected to suitable nesting habitat available for Raptors due to the Project (**Table 5.4-10**), 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 types. Regeneration of disturbed areas in mature and old growth forests is expected to extend beyond the Post-closure Phase (i.e., Long-term). Regeneration of disturbed areas in wetland and early seral habitats 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 Raptors, 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 High. Raptors have been exposed to historic and ongoing anthropogenic and natural disturbances throughout their ranges, including within the Avian Species RSA. The *atricapillus* subspecies of northern goshawk is blue-listed (i.e., special concern) in BC and the short-eared owl is listed as special concern under Schedule 1 of SARA; both species are sensitive to changes in their environment (Demarchi and Bentley 2005, COSEWIC 2008, Stuart-Smith et al. 2012, Zevit et al. 2012, Caskey and Chutter 2013). Although 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, local populations of listed species may be less resilient to changes in 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 5.4-12: Summary of Residual Effect Characteristics for Change in Mortality on Raptors Subcomponent

Residual Effect Characteristic	Rating	Rationale for Rating
Magnitude	Low	Mitigation measures are expected to limit the potential for interactions between Raptors and potential sources of direct and indirect mortality. Limited changes to suitable nesting habitat available for Raptors are expected (Table 5.4-10), 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 types. Regeneration of mature and old growth forests is expected to extend beyond the Post-closure Phase (i.e., Long-term). Regeneration of wetland and early seral habitats 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 Raptors, 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	High	Raptors have been exposed to historic and ongoing anthropogenic and natural disturbances throughout their ranges, including within the Avian Species RSA. The <i>atricapillus</i> subspecies of northern goshawk is blue-listed (i.e., special concern) in BC and the short-eared owl is listed as special concern under Schedule 1 of SARA; both species are sensitive to changes in their environment. Although 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, local populations of listed species may be less resilient to changes in mortality. Individuals displaced by the Project are expected to relocate to areas of suitable nesting habitat within the Avian

Residual Effect Characteristic	Rating	Rationale for Rating
		Species LSA and RSA (as suitable nesting habitat is not considered to be limiting), thereby limiting the potential for interactions with the Project.

Notes: BC=British Columbia; LSA=Local Study Area; Project=Tenas Project; RSA=Regional Study Area; SARA=Species at Risk Act, SC 2002, c 29 (Government of Canada [GovCan] 2002))

5.4.4.2.4 Likelihood

The Likelihood of the residual effect occurring is predicted to be Likely. Suitable nesting habitat for northern goshawk and short-eared owl is present within and adjacent to the Project Area; therefore, it is possible that Project activities may interact with Raptors and result in direct and/or indirect mortality.

5.4.4.2.5 Significance Determination

The residual effect of change in mortality is not expected to result in a change to the Raptors 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 mortality on the Raptors 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 northern goshawks and short-eared owls, and the extent and degree of effects resulting from different sources of mortality.

Mitigation measures to avoid, minimize, and or rehabilitate onsite the potential effects of change in mortality on Raptors 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.

5.4.4.3 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 Raptors, as represented by northern goshawk and short-eared owl. Daily movements include those related to daily activities such as hunting, 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, breeding, migration) for Raptors.

5.4.4.3.1 Daily Movements

Alteration and/or loss of habitat is predicted to change the amount of suitable nesting habitat available to support Raptors within and adjacent to the Project Area (i.e., based on habitat suitability modelling, **Table 5.4-10**). 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 hunting perch) 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).

Raptors that return to the Project Area to breed may be attracted to Project components that offer new feeding 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 Raptors include the powerline infrastructure (e.g., hunting, feeding, resting, or roosting opportunities for northern goshawks and short-eared owls) and associated cleared ROW (e.g., hunting or nesting opportunities for short-eared owls). Northern goshawks may also be attracted to animal carcasses along Project roads or the Rail Loop for scavenging opportunities.

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 and individual level (Price 2008).

Northern goshawks are sensitive to sensory disturbance from industrial activities (e.g., timber harvesting, road building, mining), which may result in nest failure or abandonment, especially during incubation (Zevit et al. 2012, Squires et al. 2020). Short-eared owls are sensitive to anthropogenic disturbance during the egg laying and incubation stages, which may result in nest failure or abandonment (COSEWIC 2008). The results of one (1) study showed that anthropogenic disturbance during pre-laying resulted in nest abandonment, with female owls re-nesting a short distance away (Wiggins et al. 2020). Guidelines in BC suggest that northern goshawks have low tolerance to anthropogenic disturbance near nests while short-eared owls have moderate tolerance (Caskey and Chutter 2013).

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). As such, species that nest on or close to the ground (e.g., short-eared owls) may be more likely to respond to Project components/activities and alter their daily movement patterns compared to species that nest above ground (e.g., northern goshawk). 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). Therefore, open cup nesters such as northern goshawks and short-eared owls may be more likely to respond to Project components/activities and alter their daily movement patterns. 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). This suggests that aerial predators such as northern goshawks and short-eared owls may be more likely to respond to Project components/activities and alter their daily movement patterns.

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). As such, northern goshawks and short-eared owls may be more likely to respond to Project components/activities and alter their daily movement patterns. 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). This suggests that northern goshawks, which use forested habitats, may be more likely to respond to Project components/activities and alter their daily movement patterns compared to short-eared owls, which use open habitats.

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). As raptors are typically strong fliers with the ability to quickly maneuver in flight, it is expected that they are capable of adequate avoidance responses to disturbances. 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). This suggests that northern goshawks and short-eared owls may be less likely to respond to Project components/activities and alter their daily movement patterns.

Response to disturbance, including changes in movement patterns, depends on an individual's assessment of risk, which could be influenced by timing (e.g., raptors 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, Raptors 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 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 Raptors 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 Raptors 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.

5.4.4.3.2 Seasonal Movements

Northern goshawks are usually year-round residents throughout most of their range, including the BC interior (Cooper and Stevens 2000, Stuart-Smith et al. 2012, Zevit et al. 2012, Chytyk and Fraser 2015). A pair's non-breeding home range may overlap portions of their breeding home range, depending on prey abundance and availability on the breeding range during winter (Stuart-Smith et al. 2012, McClaren et al.

2015, Squires et al. 2020). Migratory behaviour may be triggered when prey abundance and availability on breeding ranges is not sufficient to sustain goshawks through the winter (Cooper and Stevens 2000, Squires et al. 2020). Migration movements may range from short movements to lower elevations or more open habitats, to long distance irruptions to southern latitudes (Cooper and Stevens 2000, Chytyk and Fraser 2015, Squires et al. 2020). Long distance movements are generally less than 600 km (Squires et al. 2020); however, distances between 2,250 to 2,400 km have been documented for goshawks banded during winter in Minnesota and observed in northeast BC during summer (Squires et al. 2020).

Short-eared owls are considered partial migrants (Wiggins et al. 2020). They generally display a high degree of nomadism seasonally and annually, wandering widely in search of prey, sometimes at distances greater than 1,000 km (COSEWIC 2008, ECCC 2018). In the northern part of the species' range, short-eared owls are considered highly migratory, moving with the seasons in search of sufficient prey (Wiggins et al. 2020). Observations of short-eared owls banded in BC suggest that many individuals winter in open coastal habitats in the Lower Mainland and grassland habitats in the southern interior (COSEWIC 2008, ECCC 2018). Individuals satellite tagged in Alaska during summer were tracked more than 3,205 km south, from central Montana to southern Texas and into Mexico during winter (ECCC 2018, Wiggins et al. 2020).

The Project is located within the Pacific Flyway, which spans over 21 million 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 potential migratory routes of Raptors in the Pacific Flyway; therefore, it is expected that a small percentage of Raptors may pass over and potentially interact with Project components and activities. This also considers natural variation in the seasonal flight paths of Raptors, 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). Raptors are typically diurnal migrants that travel at lower altitudes over shorter distances (Kerlinger 1983, Lincoln et al. 1998) compared to other species (e.g., passerines and shorebirds). Most avian 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). Hawks are known to migrate at altitudes ranging from less than 100 m to greater than 1,000 m (Kerlinger 1983). All Project components and activities are expected to be constructed or conducted below the heights flown by migrating Raptors; therefore, the Project is not expected to interfere with the migratory routes or flight paths that might be used by Raptors passing over the Project Area. The potential effects of artificial light on seasonal movements are discussed further below as an attractant.

Stopover sites are locations where migrating birds stop to rest, feed, and drink during spring and fall migration (Warnock 2010). Potential spring and fall migration movements are poorly understood for northern goshawks in North America and few data are available on habitat types used as stopover sites (Squires et al. 2020). Similarly, little information is available on the migratory behavior of short-eared owls with no indication of habitat types used as stopover sites during migration (ECCC 2018, Wiggins et al. 2020).

No baseline data are available that identifies potential migration routes or stopover sites within and adjacent to the Project Area for Raptors; therefore, potential Project-related effects (i.e., direct and indirect) on stopover sites used by Raptors are unknown. However, if individuals were displaced by the Project, it is expected that they would 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 could tolerate some degree of disturbance (e.g., avoiding vehicles or buildings in flight; flushing off a hunting perch). 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).

Raptors 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 migrating Raptors include the Powerline infrastructure (e.g., hunting, feeding, or resting opportunities for northern goshawks and short-eared owls) and associated cleared ROW (e.g., hunting opportunities for short-eared owls). Artificial light may attract nocturnal migrating passerines, which in turn may attract Raptors (e.g., short-eared owls) for hunting opportunities (Wiggins et al. 2020). Any interaction between Raptors 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, Raptors 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 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 Raptors 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 Raptors 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.

5.4.4.3.3 *Residual Effect Characteristics*

The residual effect characteristics for change in movement patterns on Raptors are summarized below and provided in **Table 5.4-13**.

The Magnitude is predicted to be Low. Limited changes are expected to suitable nesting habitat available for Raptors due to the Project (i.e., based on habitat suitability modelling, **Table 5.4-10**), 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 habitat within the Avian Species LSA and RSA. Suitable breeding 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). Although limited information is available on the habitat types used by Raptors as stopover sites during migration, if individuals were displaced by the Project, it is expected that they would relocate to other areas of suitable stopover habitat within the Avian Species RSA.

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 migrating Raptors. As such, the percentage of Raptors that may pass over, and potentially interact with the Project, is expected

to be small. With respect to Raptors that may be attracted to Project components for feeding, breeding, or stopover opportunities, 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, 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 habitat types 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 Raptors 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 in mature or old growth forests, which may provide suitable habitat for northern goshawks, is expected to extend beyond the Post-closure Phase (i.e., Long-term). Regeneration of disturbed areas in wetland and early seral habitats, which may provide suitable habitat for short-eared owls, 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 Raptors 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 Raptors 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. Raptors have been exposed to historic and ongoing anthropogenic and natural disturbances throughout their ranges, including within the Avian Species RSA. The *atricapillus* subspecies of northern goshawk is blue-listed (i.e., special concern) in BC and the short-eared owl is listed as special concern under Schedule 1 of SARA; both species are sensitive to changes in their environment (Demarchi and Bentley 2005, COSEWIC 2008, Stuart-Smith et al. 2012, Zevit et al. 2012, Caskey and Chutter 2013). However, 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 Raptors may be attracted to Project components that offer new feeding, 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 5.4-13: Summary of Residual Effect Characteristics for Change in Movement Patterns on Raptors Subcomponent

Residual Effect Characteristic	Rating	Rationale for Rating
Magnitude	Low	Limited changes to suitable nesting habitat available for Raptors are expected (i.e., based on habitat suitability modelling, Table 5.4-10), 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, 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 Raptors 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 mature or old growth forests, which may provide suitable habitat for northern goshawks, is expected to extend beyond the Post-closure Phase (i.e., Long-term). Regeneration of wetland and early seral habitats, which may provide suitable habitat for short-eared owls, 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 Raptors 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 (i.e., Fully Reversible).
Context	Moderate	Raptors have been exposed to historic and ongoing anthropogenic and natural disturbances throughout their ranges, including within the Avian Species RSA. The <i>atricapillus</i> subspecies of northern goshawk is blue-listed (i.e., special concern) in BC and the short-eared owl is listed as special concern under Schedule 1 of SARA; both species are sensitive to changes in their environment. However, 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. Project components that may attract individual Raptors for feeding, 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: BC=British Columbia; LSA=Local Study Area; Project=Tenas Project; RSA=Regional Study Area; SARA=Species at Risk Act, SC 2002, c 29 (Government of Canada [GovCan] 2002)

5.4.4.3.4 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 habitat available to support Raptors within and adjacent to the Project Area (i.e., based on habitat suitability modelling, **Table 5.4-10**). This change in

habitat is expected to result in limited changes to the daily and/or seasonal movement patterns of a few individual Raptors. A limited number of individual Raptors may be attracted to Project components that offer new feeding, 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.

5.4.4.3.5 *Significance Determination*

The residual effect of change in movement patterns is not expected to result in a change to the Raptors 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 Raptors subcomponent is predicted to be **Not Significant**.

The Level of Confidence in this prediction is Moderate. The extent and degree of the response of Raptors 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 northern goshawk and short-eared owl within the Avian Species LSA and RSA, and limited information is available on the habitat types potentially used by Raptors as stopover sites during migration. Baseline studies were limited to certain areas of the Avian Species LSA and RSA; therefore, habitat use may not be fully documented for Raptors. Also, there is limited knowledge on the breeding populations of Raptors 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 Raptors 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 Raptors 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.

5.5 Summary of Project-related Residual Adverse Effects and Significance

The following potential adverse effects of the Project were identified as residual adverse effects on the Avian Species VC subcomponents through the assessment process:

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

The residual effect characteristics for each subcomponent are summarized in **Table 5.5-1**. The residual adverse effects of the Project on Migratory Breeding Birds, Listed Bird Species, and Raptors were predicted to be **Not Significant**. Considering this, the Project-related residual effects are not expected to result in a change to the Avian Species VC and are not expected to alter its 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) and are predicted to be **Not Significant**. All Project-related residual effects were carried forward into the CEA.

Table 5.5-1: Summary of Residual Adverse Effects on the Avian Species Valued Component (VC)

Residual Adverse Effects	Contributing Activities within the Project Phases (C, O, D, P)	Proposed Mitigation Measures	Subcomponent	Residual Effect Characteristics								
				Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Context	Likelihood	Significance	Level of Confidence
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 Building; 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 Building; powerline and substation; Rail	- Avoid sensitive environments - Minimize Project footprint and Project Area - Reclamation measures - Project footprint boundaries - Transport measures - Project component design - Blasting measures - Coal processing measures - Seepage management measures - Water capture measures - Management of ML/ARD - Timing considerations - Establish no-activity buffers around nests - Wildlife education program - Wildlife protection protocols	Migratory Breeding Birds	L	LSA	LT	CF	FR	M	L	NS	M
			Listed Bird Species	L	LSA	LT	CF	FR	M	L	NS	M

Residual Adverse Effects	Contributing Activities within the Project Phases (C, O, D, P)	Proposed Mitigation Measures	Subcomponent	Residual Effect Characteristics								
				Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Context	Likelihood	Significance	Level of Confidence
	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)		Raptors	L	LSA	LT	CF	FR	M	L	NS	M
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 Building; powerline and substation; Rail Infrastructure; water discharge infrastructure; and material handling systems (C)	- Avoid sensitive environments - Minimize Project footprint and Project Area - Project footprint boundaries - Transport measures - Project component design - Blasting measures - Coal processing measures	Migratory Breeding Birds	L	LSA	LT	IF	FR	M	L	NS	M

Residual Adverse Effects	Contributing Activities within the Project Phases (C, O, D, P)	Proposed Mitigation Measures	Subcomponent	Residual Effect Characteristics								
				Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Context	Likelihood	Significance	Level of Confidence
	▪ 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 Building; 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)	▪ Seepage management measures ▪ Water capture measures ▪ Management of ML/ARD ▪ People, employees, contractors, and onsite policies ▪ Powerline design and siting ▪ Timing considerations ▪ Establish “no activity” buffers around nests ▪ Wildlife education program ▪ Wildlife protection protocols ▪ Manage chemical hazards ▪ Manage potential attractants	Listed Bird Species	L	LSA	LT	IF	FR	H	L	NS	M
			Raptors	L	LSA	LT	IF	FR	H	L	NS	M

Residual Adverse Effects	Contributing Activities within the Project Phases (C, O, D, P)	Proposed Mitigation Measures	Subcomponent	Residual Effect Characteristics								
				Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Context	Likelihood	Significance	Level of Confidence
Change in Movement	- 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 Building; powerline and substation; Rail Infrastructure; water discharge infrastructure; and material handling systems (C) - Improvements to existing private road and Forest Service Roads (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 Building; powerline and substation; Rail	- Avoid sensitive environments - Minimize Project footprint and Project Area - Reclamation measures - Project footprint boundaries - Transport measures - Project component design - Blasting measures - Coal processing measures - Seepage management measures - Water capture measures - Management of ML/ARD - Powerline design and siting - Timing considerations - Establish “no activity” buffers around nests - Wildlife education program - Wildlife protection protocols - Manage chemical hazards	Migratory Breeding Birds	L	RSA	LT	FF	FR	M	L	NS	M
			Listed Bird Species	L	RSA	LT	FF	FR	M	L	NS	M

Residual Adverse Effects	Contributing Activities within the Project Phases (C, O, D, P)	Proposed Mitigation Measures	Subcomponent	Residual Effect Characteristics								
				Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Context	Likelihood	Significance	Level of Confidence
	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)	▪ Manage potential attractants	Raptors	L	RSA	LT	FF	FR	M	L	NS	M

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

ML/ARD=metal leaching/acid rock drainage; Project=Tenas Project

Magnitude: Low (L), Moderate (M), High (H)

Geographic Extent: Project Area (PA), Local (LSA), Regional (RSA)

Duration: Short-term (ST), Medium-term (MT), Long-term (LT)

Frequency: Infrequent (IF), Frequent (FF), Continuous (CF)

Reversibility: Fully reversible (FR), Partially reversible (PR), Irreversible (IR)

Context: Low (L), Moderate (M), High (H)

Likelihood: Unlikely (UL), Likely (L)

Significance: Not-Significant (NS), Significant (S)

Level of Confidence: High (H), Moderate (M), or Low (L)

See **Table 5.1-2** for list of applicable activities for each listed Project phase, unless otherwise noted in this table.

6. CUMULATIVE EFFECTS ASSESSMENT (CEA)

This subsection presents an assessment of the cumulative effects on the Avian Species VC. Cumulative effects are the overall effects on the Avian Species VC due to the Project's residual effects overlapping both spatially and temporally with those of other projects and activities. The approach to determining cumulative effects is described in **S3.0-C1-8 Cumulative Effects Assessment** of the **EAC Application**.

The CEA does not separate the anticipated cumulative effects on the Avian Species VC by subcomponents (i.e., Migratory Breeding Birds, Listed Bird Species, and Raptors) because the cumulative effects are expected to be similar for all avian species. As such, the anticipated cumulative effects are described in the following subsections at the Avian Species VC level.

As described in **6.1**, the spatial boundary of the CEA for the Avian Species VC is defined as the Avian Species RSA. Projects and activities that are located outside of the Avian Species RSA but may have potential effects that extend into the Avian Species RSA were also considered. The temporal boundaries within which cumulative effects were considered include past, present, and reasonably foreseeable future projects and activities, including the Construction, Operation, Decommissioning and Reclamation, and Post-closure phases of the Project (**3.2.4.2**).

The environmental effects of past and present projects and activities were captured in the baseline conditions in **4.0 Existing Conditions**. Thus, the likelihood of cumulative effects due to ongoing and reasonably foreseeable future projects and activities is the focus of the CEA.

All projects and activities listed in the Project and Activity Inclusion List in **S3.0 Assessment Methodology** of the **EAC Application** that are not listed in **Table 6.1-1** are not considered in the CEA for the Avian Species VC as the residual effects of these developments are not anticipated to overlap spatially with the residual effects of the Project and are not located in proximity to the Avian Species RSA.

6.1 Potential Cumulative Effects

Ongoing and reasonably foreseeable future projects and activities with likely overlapping residual effects on the Avian Species VC are identified in **Table 6.1-1**, followed by text that provides supporting rationale.

As outlined in **5.4** the following Project-related residual effects were considered for their potential to interact cumulatively with the residual effects of ongoing and reasonably foreseeable future projects and activities identified within, or extending into, the Avian Species RSA:

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

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

Project/Activity Name	Interacts with Project-related Effects on the Avian Species Valued Component (VC) as a Past, Present, or Future Project/Activity	
	Past and Present	Future ¹
Agricultural activities	Yes	Yes
Big Onion Project	Yes	Yes
Bulbous Toe	Yes	Yes
Forestry Activities	Yes	Yes
Harvesting Activities (i.e., fishing, hunting, trapping)	Yes	Yes
Hudson Bay Mountain Estates	Yes	Yes
Infrastructure Maintenance Activities	Yes	Yes
Maple Leaf Cannabis Production Facility	Yes	Yes
Pacific Northern Gas Looping Pipeline	No	Yes
Prince George to Terrace Capacitors Project	No	Yes
Recreation Activities	Yes	Yes
Telkwa to Smithers Bike Trail	No	Yes
Urban Development	Yes	Yes

¹Future projects and activities include present projects and activities that are expected to have ongoing disturbance into the future and reasonably foreseeable projects and activities that are expected to occur (i.e., proposed new disturbance) in the future.

The following projects and activities are expected to have residual effects on the Avian Species VC, within or extending into the Avian Species RSA, that act cumulatively with the residual effects of the Project (**Figure 6.1-1** depicts projects included in the CEA):

- ▶ **Agricultural Activities:** Agricultural land uses (e.g., cultivation, tame pasture/hay) are present throughout the eastern portion of the Avian Species RSA. The current spatial extent of agricultural activities within the Avian Species RSA is not expected to change (i.e., new agricultural disturbance is not known or foreseeable). However, ongoing agricultural activities (e.g., cultivation, haying, crop harvesting, vegetation management along farm roads and trails) within existing areas of agricultural disturbance are expected to continue;
- ▶ **Big Onion Project:** This mine exploration project is located within the Avian Species RSA approximately 17 km east of Smithers. The project is currently in the exploration phase with the most recent exploration activities completed between 2006 and 2009. The current spatial extent of activities on the property may change in the reasonably foreseeable future with the continuation of exploration activities and possible advancement of the project into the development stage;
- ▶ **Bulbous Toe:** This slow-moving landslide is located within the Avian Species RSA approximately 22 km southwest of Telkwa. A major transmission line traverses the landslide and as a result, one (1) of the towers requires periodic maintenance. Access to the tower overlaps the Avian Species RSA;

- ▶ Forestry Activities: Forestry activities are ongoing throughout the Avian Species RSA (e.g., silviculture activities, vegetation management along access roads/trails) and new forestry-related disturbances (e.g., establishing new cutblocks and access roads/trails) are expected to occur;
- ▶ Harvesting Activities (i.e., fishing, hunting, trapping): Improved access throughout the Avian Species RSA may result in increased levels of ongoing harvesting activities and new harvesting opportunities into previously unreachable areas;
- ▶ Hudson Bay Mountain Estates: This resort development includes a new chairlift, 10 ski runs, and a 148-lot residential component to the existing Hudson Bay Mountain Resort located approximately 5 km west of Smithers. Part of the development is located within the Avian Species RSA and several lots have already been developed;
- ▶ Infrastructure Maintenance Activities: Existing infrastructure (e.g., roads, transmission lines, railways) within the Avian Species RSA is expected to require ongoing maintenance such as vegetation management for safety and line-of-sight, patching and resurfacing of paved roads, grading and gravelling of unpaved roads, maintenance of crossing structures (e.g., bridges, culverts), and other repairs;
- ▶ Maple Leaf Cannabis Production Facility: This project is located within the Avian Species RSA approximately 3 km southeast of Telkwa on land previously developed as a tree nursery. Construction of a new facility on this brownfield site has been initiated but is not yet complete. The current spatial extent of activities on this brownfield site is not expected to change (i.e., new habitat disturbance is not known or foreseeable);
- ▶ Pacific Northern Gas Looping Pipeline: This proposed project involves constructing and operating a natural gas pipeline from Summit Lake to Kitimat parallel to the proponent's existing pipeline, which crosses a portion of the Avian Species RSA. The project entered the EA process in July 2013 and is currently in the pre-application phase;
- ▶ Prince George to Terrace Capacitors Project: This proposed project involves constructing and operating three (3) new capacitor stations along an existing transmission line between Prince George and northwest BC. One (1) of the capacitor stations would be located near Telkwa within the Avian Species RSA. Two (2) options currently exist for the location of this station: one (1) approximately 14 km southwest of Telkwa and the other approximately 27 km southwest of Telkwa. The station would consist of an outdoor fenced facility located on flat land adjacent to or near the existing transmission line;
- ▶ Recreation Activities: Improved access throughout the Avian Species RSA may result in increased levels of ongoing recreation activities and new recreation opportunities into previously unreachable areas;
- ▶ Telkwa to Smithers Bike Trail: The proposed bike trail is situated along a 12 km section of Highway 16 within the Avian Species LSA between Smithers and Telkwa. The proposed bike trail would be located off the highway along the existing ROW. Total trail width would be 3 m with either a paved or gravel surface; and
- ▶ Urban Development: All of Telkwa and part of Smithers are located within the Avian Species RSA. Existing urban developments are expected to require ongoing maintenance such as municipal works, infrastructure maintenance, and vegetation management in green spaces and along municipal roads. One (1) proposed urban development project (i.e., a new subdivision in Telkwa in the Tower Street neighbourhood east of Highway 16) is anticipated within the Avian Species RSA.

The anticipated residual effects associated with the ongoing and reasonably foreseeable future projects and activities discussed above include habitat loss during site clearing, vegetation management, timber harvesting, cultivation, haying, crop harvesting, or off-road vehicle use; habitat alteration caused by habitat fragmentation, edge effects, and sensory disturbance; and change in movement patterns caused by the displacement of individuals due to direct and indirect habitat effects or the attraction of individuals to project/activity components that may support life requisites (e.g., avian species that prefer more open habitats may be attracted to cleared areas or edge habitats for nesting or foraging; swallows nesting on eaves of buildings). Change in mortality via direct sources may occur, including incidental take during site clearing, vegetation management, timber harvesting, silviculture activities, cultivation, haying, crop harvesting, off-road vehicle use, or infrastructure maintenance (e.g., barn swallows nesting on buildings, bridges, or in culverts; Raptors nesting on transmission line infrastructure); or collisions with vehicles and mobile equipment. Change in mortality via indirect sources may occur, including nest failure or abandonment caused by sensory disturbance; changes in predator-prey dynamics caused by edge effects; or exposure to herbicides used during agricultural activities, silviculture activities, or invasive plant management. Considering the spatial and temporal overlap of these residual effects with those of the Project, cumulative effects on the Avian Species VC from each of the described projects/activities are predicted to occur.

6.2 Additional Mitigation Measures

Additional mitigation measures to those considered in the assessment of potential Project-related effects (5.3) are not considered to be necessary to avoid and/or limit the potential cumulative effects on the Avian Species VC. It is expected that ongoing and reasonably foreseeable future projects and activities will have appropriate mitigation measures in place as required by laws and regulations, and will comply with the goals and objectives of the following documents, as appropriate:

- ▶ *Migratory Birds Convention Act*, S.C. 1994, c. 22 (GovCan 1994a) and associated regulations;
- ▶ *SARA* and associated Regulations;
- ▶ *Forest and Range Practices Act*, SBC 2002, c 69 (GovBC 2002b) and associated regulations;
- ▶ *Wildlife Act*, RSBC 1996, c 488 (GovBC 1996d) and associated regulations;
- ▶ Bulkley LRMP (GovBC 1998);
- ▶ Bulkley Valley Sustainable Resource Management Plan (BC MAL 2005); and,
- ▶ Morice Land and Resource Management Plan (BC MAL 2007).

Refer to **0. Regulatory Context** for additional information on federal and provincial legislation and regulations, land use plans, and strategies, guidelines, plans, and BMPs applicable to the Avian Species VC. Implementation of the mitigation guidance within these documents is expected to reduce the potential for cumulative effects on the Avian Species VC.

6.3 Cumulative Effects Characterisation of Significance

The interactions between the Project-related residual effects and the potential effects of other projects and activities (**Table 6.1-1**) were reviewed to identify anticipated cumulative effects on the Avian Species VC (refer to project/activity descriptions in **6.1**). As spatial information is not available for ongoing or reasonably foreseeable future projects and activities, nor the extent of anticipated residual effects, the cumulative effects were assessed qualitatively based on available information.

As noted above, the CEA does not separate the anticipated cumulative effects on the Avian Species VC by subcomponents (i.e., Migratory Breeding Birds, Listed Bird Species, and Raptors) because the cumulative effects are expected to be similar for all avian species. As such, the anticipated cumulative effects are described in the following subsections at the Avian Species VC level.

Cumulative effects on the Avian Species VC have been characterised in terms of Magnitude, Geographic Extent, Duration, Frequency, Reversibility, and Context. Likelihood was assessed, and a Significance determination and associated Level of Confidence rating have been provided for each cumulative effect. Characterisation criteria and Significance definitions for the CEA are consistent with those presented in **5.4**.

6.3.1 Alteration and/or Loss of Habitat

The landscapes within the Avian Species RSA are primarily native but have experienced historic and ongoing anthropogenic disturbance, including agricultural, forestry, harvesting (i.e., fishing, hunting, trapping), and recreation activities, and industrial, infrastructure, and urban developments (e.g., roads, transmission lines, pipelines, railways). Natural disturbances caused by fires and forest pests have historically occurred on the landscapes within the Avian Species RSA and are expected to continue. The amount of disturbance caused by fires and forest pests within the Avian Species RSA is anticipated to be limited based on historical levels. Historic and ongoing anthropogenic and natural disturbances, in combination with the residual effects of the Project and reasonably foreseeable future projects and activities, are expected to act cumulatively to affect the Avian Species VC through alteration and/or loss of habitat.

Of the ongoing and reasonably foreseeable future projects and activities identified in **Table 6.1-1**, most are expected to occur within existing areas of disturbance (e.g., cultivation on existing agricultural areas; forestry activities on existing cutblocks and access roads/trails; infrastructure maintenance on previously disturbed sites; traffic on existing roads; Telkwa to Smithers Bike Trail within an existing ROW) and are anticipated to result in limited cumulative effects on the Avian Species VC through alteration and/or loss of habitat within the Avian Species RSA. Alteration and/or loss of habitat caused by new disturbances (e.g., Big Onion Project, Hudson Bay Mountain Estates, Pacific Northern Gas Looping Pipeline, Prince George to Terrace Capacitors Project) is expected to act cumulatively on the Avian Species VC. However, the extent of the cumulative effect is predicted to be limited when considered in the context of suitable habitat available for the Avian Species VC within the Avian Species RSA (i.e., suitable habitat is not considered to be limiting). Improved access throughout the Avian Species RSA may result in new harvesting (i.e., fishing, hunting, trapping) and recreation opportunities into previously unreachable areas, which could act cumulatively resulting in limited cumulative effects on the Avian Species VC through alteration and/or loss of habitat within the Avian Species RSA.

It is anticipated that reasonably foreseeable future forestry activities will be the largest contributor acting cumulatively to affect the Avian Species VC through alteration and/or loss of habitat within the Avian Species RSA. Future forestry activities are expected to occur within areas of commercially merchantable timber (i.e., mature and old growth forest). For the CEA, it is expected that future forestry activities will be evenly distributed across the productive timber land base. As such, the amount of timber harvesting over the next 52 years (i.e., the Project's lifespan) is expected to be relative to the current distribution of mature and old growth forest within the Avian Species RSA in each landscape unit and BEC subzone/variant. The total estimated area of future forestry activities is 36,578 ha (19%) of the Avian Species RSA (**S4.0-C7 Vegetation VC** of the **EAC Application**), assuming future timber harvesting activity has an equivalent probability of occurring within any portion of the harvestable land base within the Bulkley and Morice Timber Supply Areas (TSA). It must be noted that this estimate is conservative in nature and does not consider reforestation or natural forest succession over time, where young and mature forests are expected to transition to mature and old growth forests, respectively, over the course of the Project's lifespan. In

addition, this value overestimates the extent of disturbance as future forestry activities are expected to comply with provincial and regional biodiversity and old growth forest management objectives under the Provincial Non-spatial Old Growth Forest Order (GovBC 2004) and applicable land use plans (0). It is expected that following timber harvesting activities, cutblocks will be reforested in accordance with provincial stocking standards (BC MFLNRO 2014b). Refer to **S4.0-C7 Vegetation VC** of the **EAC Application** for additional details.

It is expected that ongoing and reasonably foreseeable future projects and activities will have appropriate mitigation measures in place that limit the potential for interactions with the Avian Species VC, thereby limiting the cumulative effect of alteration and/or loss of habitat within the Avian Species RSA. Mitigation measures implemented through the Project (5.3) are expected to limit the potential for interactions with the Avian Species VC, thereby limiting the Project's contribution to the cumulative effect. The Project-related residual effect of alteration and/or loss of habitat on the Avian Species VC was predicted to be **Not Significant (5.5)**.

Given the above summary, the cumulative effect of alteration and/or loss of habitat on the Avian Species VC is expected to be localised and limited within the Avian Species RSA.

6.3.1.1 Cumulative Effect Characteristics

The cumulative effect characteristics for alteration and/or loss of habitat on the Avian Species VC are summarized below and provided in **Table 6.3-1**.

The Magnitude is predicted to be Low. Although most of the ongoing and reasonably foreseeable future projects and activities are predicted to result in limited cumulative effects through direct and/or indirect changes to suitable habitat available for the Avian Species VC within the Avian Species RSA, future forestry activities are expected to disturb mature and old growth forest within the Avian Species RSA. However, provincial and regional biodiversity and old growth forest management objectives under the Provincial Non-spatial Old Growth Forest Order (GovBC 2004) and applicable land use plans (0) are expected to maintain habitat for Avian Species within the Avian Species RSA at appropriate levels, thereby limiting contribution by future forestry activities to the cumulative effect of alteration and/or loss of habitat. The amount of natural disturbance caused by fires and forest pests within the Avian Species RSA is anticipated to be limited.

The Geographic Extent is predicted to be Local. The cumulative effect of alteration and/or loss of habitat is expected to occur throughout the Avian Species LSA.

The Duration is predicted to occur over the Long-term, although differences may occur between habitat types depending on the areas and types of reclamation and the time frame for regeneration of vegetation within reclaimed areas. The cumulative effect of alteration and/or loss of habitat is expected to occur during Construction of the Project, coinciding with other ongoing and reasonably foreseeable future projects and activities; the effect is expected to persist until projects/activities cease, components are removed, disturbed areas are reclaimed, and vegetation has re-established within reclaimed areas. Regeneration of disturbed areas in mature and old growth forests is expected to take longer (i.e., Long-term) than regeneration of disturbed areas in wetland and early seral habitats (i.e., Medium-term).

The Frequency is predicted to be Continuous. The cumulative effect of alteration and/or loss of habitat is expected to occur during the Construction Phase of the Project coinciding with other ongoing and reasonably foreseeable future projects and activities, and the effect is expected to persist until projects/activities cease, components are removed, disturbed areas are reclaimed, and vegetation has re-established within reclaimed areas.

The Reversibility is predicted to be Partially Reversible. Most suitable habitat predicted to be affected cumulatively has the potential to regenerate over time after the source of the disturbance has ceased, components are removed, disturbed areas are reclaimed, and vegetation has re-established within reclaimed areas. Once disturbed areas are reclaimed, habitat use by avian species is expected to progressively include these areas, as dictated by the habitat type that regenerates and its age class. However, certain existing features and activities on the landscape (e.g., roads, railways, transmission lines, pipelines, urban developments, agricultural areas) are not expected to revert back to native vegetation within the Project's lifespan (i.e., 52 years) and may therefore continue to act cumulatively through direct and/or indirect habitat effects on the Avian Species VC.

The Context is predicted to be Moderate. Avian species have been exposed to historic and ongoing anthropogenic and natural disturbances throughout their ranges, including within the Avian Species RSA. The Avian Species VC includes federally and/or provincially listed species (**Table 3.2-2**) that are sensitive to changes in their environment. However, the cumulative effect of alteration and/or loss of habitat on the Avian Species VC is expected to be limited. Individuals displaced by the cumulative effect are expected to relocate to areas of suitable habitat within the Avian Species RSA, as suitable habitat is not considered to be limiting.

The Likelihood of the residual effect occurring is predicted to be Likely. Suitable habitat for the Avian Species VC is present within the Avian Species RSA and is expected to be cumulatively affected (through loss and/or alteration) by the Project and other ongoing and reasonably foreseeable future projects and activities.

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

The Level of Confidence in this prediction is Moderate. While the direct effects of clearing on avian species are well known, uncertainty exists with respect to the extent and degree of habitat alteration through habitat fragmentation, edge effects, and sensory disturbance. Uncertainty also exists regarding the spatial extent of reasonably foreseeable future projects and activities, and the extent of anticipated cumulative effects from ongoing and reasonably foreseeable future projects and activities. Also, there is limited knowledge 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 projects/activities. There is uncertainty regarding the resilience of undisturbed suitable habitat to withstand potential anthropogenic change, and the regeneration of vegetation within reclaimed areas.

Mitigation measures to avoid, minimize, or rehabilitate onsite the potential Project-related effects of alteration and/or loss of habitat on the Avian Species VC 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. However, uncertainty exists regarding the application of appropriate design measures and mitigation measures for other ongoing and reasonably foreseeable future projects and activities within the Avian Species RSA.

Table 6.3-1: Summary of the Cumulative Effects Characterisation for Alteration and/or Loss of Habitat on the Avian Species Valued Component (VC)

Cumulative Effects	Contributing Projects and Activities within the Project Phases (C, O, D, P)	Cumulative Effects Characterisation								
		Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Context	Likelihood	Significance	Level of Confidence
Alteration and/or Loss of Habitat	▪ Ongoing projects and activities¹, including agricultural activities, Big Onion Project, Bulbous Toe, forestry activities, harvesting activities (i.e., fishing, hunting, trapping), Hudson Bay Mountain Estates, infrastructure maintenance activities, Maple Leaf Cannabis production facility, recreation activities, and urban development (Table 6.1-1) (C, O ,D, P). ▪ Reasonably foreseeable future projects and activities², including Big Onion Project, forestry activities, harvesting activities (i.e., fishing, hunting, trapping), Hudson Bay Mountain Estates, Pacific Northern Gas Looping Pipeline, Prince George to Terrace Capacitors Project, recreation activities, and Telkwa to Smithers Bike Trail (Table 6.1-1) (C, O, D, P). ▪ Project-related activities as outlined in Table 5.5-1 (C, O, D, P).	L	LSA	LT	CF	PR	M	L	NS	M

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

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

¹Present projects and activities that are expected to have ongoing disturbance into the future.

²Projects and activities that are expected to occur (i.e., proposed new disturbance) in the future.

See **Table 5.1-2** for list of applicable activities for each listed Project phase, unless otherwise noted in this table. Includes all existing and reasonably foreseeable projects as outlined in **Table 6.1-1**.

6.3.2 Change in Mortality

Historic and ongoing anthropogenic disturbance, in combination with the residual effects of the Project and reasonably foreseeable future projects and activities, are expected to act cumulatively to affect the Avian Species VC through change in mortality via direct and indirect effects.

Limited changes are expected to suitable habitat available for the Avian Species VC within the Avian Species RSA due to the Project and most ongoing and reasonably foreseeable future projects and activities (6.3.1), which suggests that a limited number of individuals are expected to interact with these projects/activities and potentially be affected by the cumulative effect of change in mortality. Furthermore, it is expected that ongoing and reasonably foreseeable future projects and activities will have appropriate mitigation measures in place that limit the potential for interactions with the Avian Species VC, thereby limiting the cumulative effect of change in mortality within the Avian Species RSA. Mitigation measures implemented through the Project (5.3) are expected to limit the potential for interactions with the Avian Species VC, thereby limiting the Project's contribution to the cumulative effect.

Future forestry activities are anticipated to be the largest contributor to habitat change within the Avian Species RSA and are expected to act cumulatively to affect the Avian Species VC through change in mortality. Direct sources of mortality include incidental take during timber harvesting, silviculture activities, and vegetation management, or collisions with forestry-related vehicles and mobile equipment. Indirect sources of mortality include nest failure or abandonment caused by sensory disturbance, changes in predator-prey dynamics caused by edge effects, or exposure to herbicides used during silviculture activities or invasive plant management. However, provincial and regional biodiversity and old growth forest management objectives under the Provincial Non-spatial Old Growth Forest Order (GovBC 2004) and applicable land use plans(2.4) are expected to maintain habitat for avian species within the Avian Species RSA at appropriate levels. This is expected to limit the potential for interactions with the Avian Species VC, thereby limiting future forestry activities' contribution to the cumulative effect. The Project-related residual effect of change in mortality on the Avian Species VC was predicted to be **Not Significant (5.5)**.

Given the above summary, the cumulative effect of change in mortality on the Avian Species VC is expected to be localized and limited within the Avian Species RSA.

6.3.2.1 Cumulative Effect Characteristics

The cumulative effect characteristics for change in mortality on the Avian Species VC are summarized below and provided in **Table 6.3-2**.

The Magnitude is predicted to be Low. Limited changes are expected to suitable habitat available for the Avian Species VC within the Avian Species RSA due to most ongoing and reasonably foreseeable future projects and activities (6.3.1), which suggests that a limited number of individuals are expected to interact with these project/activities and potentially be affected by direct and/or indirect sources of mortality. Although future forestry activities are anticipated to result in cumulative effects through additional habitat change within the Avian Species RSA, provincial and regional biodiversity and old growth forest management objectives under the Provincial Non-spatial Old Growth Forest Order (GovBC 2004) and applicable land use plans(2.4) are expected to maintain habitat for avian species within the Avian Species RSA at appropriate levels. This is expected to limit the potential for interactions with the Avian Species VC, thereby limiting future forestry activities' contribution to the cumulative effect of change in mortality.

It is expected that ongoing and reasonably foreseeable future projects and activities will have appropriate mitigation measures in place that limit the potential for interactions with the Avian Species VC, thereby limiting the cumulative effect of change in mortality within the Avian Species RSA. Mitigation measures

implemented through the Project (5.3) are expected to limit the potential for interactions with the Avian Species VC, thereby limiting the Project's contribution to the cumulative effect.

The Geographic Extent is predicted to be Local. The cumulative effect of change in mortality is expected to occur throughout 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 construction of the Project coinciding with other ongoing and reasonably foreseeable future projects and activities, and the resulting cumulative effect is expected to persist over the Medium-term until projects/activities cease and components are removed. Indirect sources of mortality related to edge effects are also expected to occur during construction; however, the resulting cumulative effect is 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 types. Regeneration of disturbed areas in mature and old growth forests is expected to take longer (i.e., Long-term) than regeneration of disturbed areas in wetland and early seral habitats (i.e., Medium-term).

The Frequency is predicted to be Infrequent. Although the Avian Species VC may be affected cumulatively through change in mortality, occurrences of mortality are expected to be isolated and infrequent events following the implementation of appropriate design measures and mitigation measures by the Project and other ongoing and reasonably foreseeable future projects and activities.

The Reversibility is predicted to be Partially Reversible. Direct and indirect sources of mortality resulting from the Project and other projects and activities are expected to be Fully Reversible once projects/activities cease, project components are removed, disturbed habitats are reclaimed, and vegetation has re-established within reclaimed areas. However, certain existing features and activities on the landscape (e.g., roads, railways, transmission lines, pipelines, urban developments, agricultural activities, forestry activities) are expected to persist beyond the Project's lifespan (i.e., 52 years) and may therefore continue to act cumulatively through change in mortality on the Avian Species VC.

The Context is predicted to be High. Avian species have been exposed to historic and ongoing anthropogenic and natural disturbances throughout their ranges, including within the Avian Species RSA. The Avian Species VC includes federally and/or provincially listed species (**Table 3.2-2**) that are sensitive to changes in their environment. Although the cumulative effect of change in mortality is expected to interact with a limited number of individuals, local populations of listed species may be less resilient to changes in mortality. Individuals displaced by the cumulative effect of alteration and/or loss of habitat are expected to relocate to areas of suitable habitat within the Avian Species RSA (as suitable habitat is not considered to be limiting), thereby limiting the potential for interactions with potential sources of mortality.

The Likelihood of the residual effect occurring is predicted to be Likely. Suitable habitat for the Avian Species VC is present within the Avian Species RSA; therefore, it is possible that the Project and other ongoing and reasonably foreseeable projects and activities may interact with the Avian Species VC and result in the cumulative effect of change in mortality.

The cumulative effect of change in mortality is not expected to result in a change to the Avian Species VC and is not expected to alter its population viability or persistence within the Avian Species RSA beyond an acceptable level. Therefore, the cumulative effect of change in mortality on the Avian Species VC 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 different avian species and/or individuals, and the extent and degree of effects resulting from different sources of mortality.

Mitigation measures to avoid, minimize, or rehabilitate onsite the potential Project-related effects of change in mortality on the Avian Species VC 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. However, uncertainty exists regarding the application of appropriate design measures and mitigation measures for other ongoing and reasonably foreseeable future projects and activities within the Avian Species RSA.

Table 6.3-2: Summary of the Cumulative Effects Characterisation for Change in Mortality on the Avian Species Valued Component (VC)

Cumulative Effects	Contributing Projects and Activities within the Project Phases (C, O, D, P)	Cumulative Effects Characterisation								
		Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Context	Likelihood	Significance	Level of Confidence
Change in Mortality	- Ongoing projects and activities¹, including agricultural activities, Big Onion Project, Bulbous Toe, forestry activities, harvesting activities (i.e., fishing, hunting, trapping), Hudson Bay Mountain Estates, infrastructure maintenance activities, Maple Leaf Cannabis production facility, recreation activities, and urban development (Table 6.1-1) (C, O, D, P). - Reasonably foreseeable future projects and activities², including Big Onion Project, forestry activities, harvesting activities (i.e., fishing, hunting, trapping), Hudson Bay Mountain Estates, Pacific Northern Gas Looping Pipeline, Prince George to Terrace Capacitors Project, recreation activities, and Telkwa to Smithers Bike Trail (Table 6.1-1) (C, O, D, P). - Project-related activities as outlined in Table 5.5-1 (C, O, D, P).	L	LSA	LT	IF	PR	H	L	NS	M

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

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

¹Present projects and activities that are expected to have ongoing disturbance into the future.

²Projects and activities that are expected to occur (i.e., proposed new disturbance) in the future.

See **Table 5.1-2** for list of applicable activities for each listed Project phase, unless otherwise noted in this table. Includes all existing and reasonably foreseeable projects as outlined in **Table 6.1-1**.

6.3.3 Change in Movement Patterns

Historic and ongoing anthropogenic disturbance, in combination with the residual effects of the Project and reasonably foreseeable future projects and activities, are expected to act cumulatively to affect the Avian Species VC through change in movement patterns caused by the displacement of individuals due to direct and indirect habitat effects or the attraction of individuals to project/activity components that may support life requisites.

Of the ongoing and reasonably foreseeable future projects and activities identified in **Table 6.1-1**, most are expected to occur within existing areas of disturbance and are anticipated to result in limited habitat changes within the Avian Species RSA that could subsequently alter the movement patterns of a few individuals or small groups via displacement or attraction. Change in movement patterns caused by new disturbances is expected to act cumulatively on the Avian Species VC. However, the extent of the cumulative effect is predicted to be limited when considered in the context of suitable habitat available within the Avian Species RSA (i.e., suitable habitat is not considered to be limiting). As such, it is anticipated that a limited number of individuals may experience altered movement patterns within the Avian Species RSA resulting from displacement or attraction.

Future forestry activities are anticipated to be the largest contributor to habitat change within the Avian Species RSA and are expected to act cumulatively to affect the Avian Species VC through change in movement patterns. Individuals may be displaced due to direct or indirect habitat effects. Other individuals may be attracted to project/activity components that may support life requisites (e.g., avian species that prefer more open habitats may be attracted to recently cleared areas or edge habitats for nesting or foraging). However, provincial and regional biodiversity and old growth forest management objectives under the Provincial Non-spatial Old Growth Forest Order (GovBC 2004) and applicable land use plans (0) are expected to maintain habitat for avian species within the Avian Species RSA at appropriate levels. This is expected to limit the potential for interactions with the Avian Species VC, thereby limiting future forestry activities' contribution to the cumulative effect.

It is expected that ongoing and reasonably foreseeable future projects and activities will have appropriate mitigation measures in place that limit the potential for interactions with the Avian Species VC, thereby limiting the cumulative effect of change in movement patterns within the Avian Species RSA. Mitigation measures implemented through the Project (5.3) are expected to limit the potential for interactions with the Avian Species VC, thereby limiting the Project's contribution to the cumulative effect. The Project-related residual effect of change in movement patterns on the Avian Species VC was predicted to be **Not Significant** (see 5.5).

Given the above summary, the cumulative effect of change in movement patterns on the Avian Species VC is expected to be localised and limited within the Avian Species RSA.

6.3.3.1 Cumulative Effect Characteristics

The cumulative effect characteristics for change in movement patterns on the Avian Species VC are summarized below and provided in **Table 6.3-3**.

The Magnitude is predicted to be Low. Limited changes are expected to suitable habitat available for the Avian Species VC within the Avian Species RSA due to most ongoing and reasonably foreseeable future projects and activities (6.3.1), which suggests that a limited number of individuals are expected to interact with these projects/activities and potentially experience altered movement patterns. Although future forestry activities are anticipated to result in cumulative effects through habitat change and subsequent alterations in movement patterns within the Avian Species RSA, provincial and regional biodiversity and old growth

forest management objectives under the Provincial Non-spatial Old Growth Forest Order (GovBC 2004) and applicable land use plans (2.4) are expected to maintain habitat for avian species within the Avian Species RSA at appropriate levels, thereby limiting the potential for interactions with the Avian Species VC and subsequent alterations in movement patterns.

It is expected that ongoing and reasonably foreseeable future projects and activities will have appropriate mitigation measures in place that limit the potential for interactions with the Avian Species VC, thereby limiting the cumulative effect of change in movement patterns within the Avian Species RSA. Mitigation measures implemented through the Project (5.3) are expected to limit the potential for interactions with the Avian Species VC, thereby limiting the Project's contribution to the cumulative effect.

The Geographic Extent is predicted to be Regional. Individuals displaced by cumulative direct and indirect habitat effects are expected to relocate to other areas of suitable habitat available within the Avian Species RSA. Cumulative effects through attraction to project/activity components that may support life requisites could occur throughout the Avian Species RSA.

The Duration is predicted to occur over the Long-term, although there may be differences between habitat types depending on the areas and types of reclamation and the time frame for regeneration of vegetation within reclaimed areas. The cumulative effect of change in movement patterns is expected to occur during construction of the Project coinciding with other ongoing and reasonably foreseeable projects and activities, and the effect is anticipated to continue each year that avian species return to the Avian Species RSA until projects/activities cease, components are removed, disturbed areas are reclaimed, and vegetation has re-established within reclaimed areas. Regeneration of disturbed areas in mature and old growth forests is expected to take longer (Long-term) than regeneration of disturbed areas in wetland and early seral habitats (i.e., Medium-term).

The Frequency is predicted to be Frequent. The cumulative effect of change in movement patterns is expected to occur during construction of the Project coinciding with other ongoing and reasonably foreseeable projects and activities, and the effect is anticipated to continue each year that avian species return to the Avian Species RSA until projects/activities cease, components are removed, disturbed areas are reclaimed, and vegetation has re-established within reclaimed areas.

The Reversibility is predicted to be Partially Reversible. Most suitable habitat predicted to be affected cumulatively (and subsequently affecting movement patterns) has the potential to regenerate over time after the source of the disturbance has ceased, components are removed, disturbed areas are reclaimed, and vegetation has re-established within reclaimed areas. Once disturbed areas are reclaimed, habitat use (and associated movement patterns) is expected to progressively include these areas, as dictated by the habitat type that regenerates and its age class. However, certain existing features and activities on the landscape (e.g., roads, railways, transmission lines, pipelines, urban developments, agricultural areas) are not expected to revert back to native vegetation within the Project's lifespan (i.e., 52 years) and may therefore continue to act cumulatively through change in movement patterns on the Avian Species VC.

The Context is predicted to be Moderate. Avian species have been exposed to historic and ongoing anthropogenic and natural disturbances throughout their ranges, including within the Avian Species RSA. The Avian Species VC includes federally and/or provincially listed species (Table 3.2-2) that are sensitive to changes in their environment. However, the limited number of individuals displaced by the cumulative effect of change in movement patterns are expected to relocate to areas of suitable breeding or stopover habitat within the Avian Species 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, daily or seasonal movement patterns are expected to be similar to those that would occur without the projects/activities being present.

Individuals may be attracted to project/activity 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.

The Likelihood of the residual effect occurring is predicted to be Likely. The cumulative effect of alteration and/or loss of habitat is predicted to change the amount of suitable habitat available to support the Avian Species VC within the Avian Species RSA. This change in habitat is expected to cumulatively affect the Avian Species VC through changes to the movement patterns of a few individuals or small groups. A limited number of individuals may be attracted to project/activity components that offer new feeding, cover, breeding, or stopover opportunities and could alter their movement patterns to incorporate these components into their selected home ranges, breeding territories, or stopover sites.

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

The Level of Confidence in this prediction is Moderate. The extent and degree of the response of avian species to project/activity disturbances, including potential changes in movement patterns, is difficult to predict and is expected to vary at the species and individual level (refer to **5.4.2.3** under Daily Movements for additional details). There is limited knowledge on the breeding populations of avian species within the Avian Species RSA, and whether habitat outside of disturbed areas has the capacity to accommodate individuals displaced by the Project and other ongoing and reasonably foreseeable future projects and activities. There is limited knowledge of the numbers of avian species that might migrate over the Avian Species RSA or use stopover sites within the Avian Species RSA. There is also limited knowledge on the location of potential stopover sites used by avian species within the Avian Species RSA.

Mitigation measures to avoid, minimize, or rehabilitate onsite the potential Project-related effects of change in movement patterns on the Avian Species VC 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. However, uncertainty exists regarding the application of appropriate design measures and mitigation measures for other ongoing and reasonably foreseeable future projects and activities within the Avian Species RSA.

Table 6.3-3: Summary of the Cumulative Effects Characterisation for a Change in Movement Patterns on the Avian Species Valued Component (VC)

Cumulative Effects	Contributing Projects and Activities within the Project Phases (C, O, D, P)	Cumulative Effects Characterisation								
		Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Context	Likelihood	Significance	Level of Confidence
Change in Movement Patterns	- Ongoing projects and activities¹, including agricultural activities, Big Onion Project, Bulbous Toe, forestry activities, harvesting activities (i.e., fishing, hunting, trapping), Hudson Bay Mountain Estates, infrastructure maintenance activities, Maple Leaf Cannabis production facility, recreation activities, and urban development (Table 6.1-1) (C, O, D, P). - Reasonably foreseeable future projects and activities², including Big Onion Project, forestry activities, harvesting activities (i.e., fishing, hunting, trapping), Hudson Bay Mountain Estates, Pacific Northern Gas Looping Pipeline, Prince George to Terrace Capacitors Project, recreation activities, and Telkwa to Smithers Bike Trail (Table 6.1-1) (C, O, D, P). - Project-related activities as outlined in Table 5.5-1 (C, O, D, P).	L	RSA	LT	FF	PR	M	L	NS	M

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

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

¹Present projects and activities that are expected to have ongoing disturbance into the future.

²Projects and activities that are expected to occur (i.e., proposed new disturbance) in the future.

See **Table 5.1-2** for list of applicable activities for each listed Project phase, unless otherwise noted in this table. Includes all existing and reasonably foreseeable projects as outlined in **Table 6.1-1**.

6.4 Summary of Cumulative Effects Assessment (CEA)

The following Project-related residual effects on the Avian Species VC were carried forward to the CEA:

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

The residual effects of the Project, in conjunction with the comparable residual effects of other past, present, and reasonably foreseeable future projects and activities within the Avian Species RSA, are not expected to result in a change to the Avian Species VC and are not expected to alter its 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 under the Provincial Non-spatial Old Growth Forest Order (GovBC 2004) and applicable land use plans (2.4). As such, the cumulative effects on the Avian Species VC are predicted to be **Not Significant (Table 6.4-1)**.

Table 6.4-1: Summary of Cumulative Effects on the Avian Species Valued Component (VC)

VC Subcomponent	Potential Cumulative Effect	Contributing Activities within the Project Phases (C, O, D, P)	Cumulative Effect (Yes/No)	Significant (Yes/No)
▪ Migratory Breeding Birds ▪ Listed Birds ▪ Raptors	Alteration and/or Loss of Habitat	▪ Ongoing projects and activities¹, including agricultural activities, Big Onion Project, Bulbous Toe, forestry activities, harvesting activities (i.e., fishing, hunting, trapping), Hudson Bay Mountain Estates, infrastructure maintenance activities, Maple Leaf Cannabis production facility, recreation activities, and urban development (Table 6.1-1) (C, O, D, P). ▪ Reasonably foreseeable future projects and activities², including Big Onion Project, forestry activities, harvesting activities (i.e., fishing, hunting, trapping), Hudson Bay Mountain Estates, Pacific Northern Gas Looping Pipeline, Prince George to Terrace Capacitors Project, recreation activities, and Telkwa to Smithers Bike Trail (Table 6.1-1) (C, O, D, P). ▪ Project-related activities as outlined in Table 5.5-1 (C, O, D, P).	Yes	No
▪ Migratory Breeding Birds ▪ Listed Birds ▪ Raptors	Change in Mortality	▪ Ongoing projects and activities¹, including agricultural activities, Big Onion Project, Bulbous Toe, forestry activities, harvesting activities (i.e., fishing, hunting, trapping), Hudson Bay Mountain Estates, infrastructure maintenance activities, Maple Leaf Cannabis production facility, recreation activities, and urban development (Table 6.1-1) (C, O, D, P). ▪ Reasonably foreseeable future projects and activities², including Big Onion Project, forestry activities, harvesting activities (i.e., fishing, hunting, trapping), Hudson Bay Mountain Estates, Pacific Northern Gas Looping Pipeline, Prince George to Terrace Capacitors Project, recreation activities, and Telkwa to Smithers Bike Trail (Table 6.1-1) (C, O, D, P). ▪ Project-related activities as outlined in Table 5.5-1 (C, O, D, P).	Yes	No
▪ Migratory Breeding Birds ▪ Listed Birds ▪ Raptors	Change in Movement Patterns	▪ Ongoing projects and activities¹, including agricultural activities, Big Onion Project, Bulbous Toe, forestry activities, harvesting activities (i.e., fishing, hunting, trapping), Hudson Bay Mountain Estates, infrastructure maintenance activities, Maple Leaf Cannabis production facility, recreation activities, and urban development (Table 6.1-1) (C, O, D, P). ▪ Reasonably foreseeable future projects and activities², including Big Onion Project, forestry activities, harvesting activities (i.e., fishing, hunting, trapping), Hudson Bay Mountain Estates,	Yes	No

VC Subcomponent	Potential Cumulative Effect	Contributing Activities within the Project Phases (C, O, D, P)	Cumulative Effect (Yes/No)	Significant (Yes/No)
		Pacific Northern Gas Looping Pipeline, Prince George to Terrace Capacitors Project, recreation activities, and Telkwa to Smithers Bike Trail (Table 6.1-1) (C, O, D, P). ▪ Project-related activities as outlined in Table 5.5-1 (C, O, D, P).		

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

Project=Tenas Project

¹Present projects and activities that are expected to have ongoing disturbance into the future.

²Projects and activities that are expected to occur (i.e., proposed new disturbance) in the future.

See **Table 5.1-2** for list of applicable activities for each listed Project phase, unless otherwise noted in this table. Includes all existing and reasonably foreseeable projects as outlined in **Table 6.1-1**.

7. SUMMARY OF EFFECTS ASSESSMENT FOR THE AVIAN SPECIES VALUED COMPONENT (VC)

The following potential adverse effects of the Project on the Avian Species VC and associated subcomponents (i.e., Migratory Breeding Birds, Listed Bird Species, and Raptors) are predicted to occur due to the Project:

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

Mitigation measures employed during all Project phases are expected to avoid, minimize, or rehabilitate onsite the potential adverse Project effects on the Avian Species VC; however, these effects are not anticipated to be fully mitigated and residual effects are anticipated.

The Project-related residual effects on the 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 its 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) 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 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. The cumulative effects of all Project-related residual effects are not expected to result in a change to the Avian Species VC and are not expected to alter its 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**.

8. FOLLOW-UP STRATEGY

Adaptive management is a structured decision-making approach to reduce uncertainty over time via system monitoring. The purpose of monitoring and adaptive management is to further quantify and qualify Project effects (if/where necessary), assess the effectiveness of mitigation measures, provide a mechanism for modification and/or adaptation, identify new problems (should they arise), and implement additional mitigation (if/where applicable), including triggers, corrective actions, and regulatory implications. This process is intended to demonstrate compliance with commitments made in the EAC Application, and that appropriate actions are identified and implemented in a timely manner. This chapter of the EAC Application has characterised the residual adverse effects of the Project and the cumulative effects on the Avian Species VC as being **Not Significant** with a Moderate Level of Confidence.

Targeted monitoring and inspection will be undertaken during the Construction and Operation phases to verify that the mitigation measures implemented to avoid, minimize, or rehabilitate onsite the potential adverse effects of the Project on the Avian Species VC have been appropriately applied and maintained, where necessary. Environmental Inspectors (i.e., onsite monitors) will be present during the Construction and Operation phases to verify compliance and evaluate the success of mitigation measures outlined in **5.3**, the **WMP**, and other management plans in **S13.0 Management Plans** of the **EAC Application**, and applicable approval conditions.

As indicated in **5.3** and the **WMP**, any site clearing activities or other works that involve disturbance to vegetation (e.g., vegetation management along Project roads) will be conducted outside of the nesting season (i.e., approximately May 1 to July 31), whenever practicable. Variations in nesting season dates for different species in the Avian Species VC will be considered. If site clearing and other works that involve disturbance to vegetation must occur during the nesting season, a 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 risk that new nests are established before works commence.

Active nests or suspected nest locations will be protected with a “no activity” buffer consistent with guidelines, the level of the disturbance, and the landscape context until the young 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). 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 even when the nests are unoccupied. For such nests, a QP will provide guidance on appropriate “no activity” buffers for unoccupied nests.

Where mitigation measures are not deemed to be successful, appropriate techniques will be designed and implemented through the adaptive management process. Findings during monitoring, as well as revised BMPs, improved scientific methods, and regulatory changes, will be incorporated into the management plans for the Project, including the **WMP** to reduce effects on the Avian Species VC during the lifetime of the Project to the extent practicable. Stakeholders, Indigenous groups, and government agencies will be involved in developing adaptive management measures, where applicable.

No additional monitoring or follow-up is proposed for the Avian Species VC at this time. If issues involving avian species are observed throughout the Project (e.g., barn swallows nesting on the eaves of Project buildings or the underside of the Goathorn Creek Bridge), mitigation measures identified in **5.3** and the **WMP** will be reviewed and adapted to reduce effects on the Avian Species VC.

In consideration of the findings of the EA and the proposed management plans, monitoring, and adaptive management approach, it was deemed that 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 were not warranted at this time.

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