25. SUMMARY AND CONCLUSIONS

25.1 INTRODUCTION

Environmental assessment (EA) in Canada and BC is a regulatory approval process as well as a planning tool for development. The process promotes sustainable development in BC through consideration of environmental, economic, social, heritage and health effects (referred to as the five pillars) in order to avoid and mitigate potential adverse effects. This Application addresses the requirements of EA in Canada under the *Canadian Environmental Assessment Act*, 2012 (CEAA 2012) and in BC under the *Environmental Assessment Act* (2002b; BC EAA) by assessing the effects of the Project on valued components (VC) relevant to the five pillars. The effects assessments include consideration of issues and concerns about the Project raised through engagement with Aboriginal groups, stakeholders, the public, local government and regulatory agencies. AuRico, in conducting these assessments, has been supported by a team of technical specialists who have applied rigorous analytical procedures and expert professional judgement to the assessment analysis.

25.2 SUMMARY OF ABORIGINAL AND PUBLIC CONSULTATION

AuRico has conducted consultations with Aboriginal groups, namely the Tse Keh Nay (collectively includes the Takla Lake First Nation, Tsay Keh Dene Nation, Kwadacha Nation), Gitxsan Wilp Nii Kyap, Treaty 8 First Nations (Doig River First Nation, Halfway River First Nation, Prophet River First Nation, Saulteau First Nations, West Moberly First Nations, Fort Nelson First Nation, Blueberry River First Nations and McLeod Lake Indian Band), and Métis Nation of British Columbia as directed by the section 11 order issued by the BC EAO on May 14, 2014 and section 13 order issued on June 13, 2014. AuRico has also conducted consultations with the public.

Comments provided by Aboriginal groups, and AuRico's responses to the comments, are captured in Appendix 3-E of Chapter 3, Information Distribution and Consultation. Comments provided by the public and stakeholders are captured in Appendix 3-M of Chapter 3.

AuRico will continue to consult Aboriginal groups, local communities, government agencies, stakeholders and the public throughout the Application review stage on the potential adverse effects of the Project.

25.3 SUMMARY OF RESIDUAL EFFECTS AND MITIGATION MEASURES

Table 25.3-1 provides a summary of the potential residual effects of the Project and mitigation measures for the VCs considered in the assessment. Brief summaries of the effects assessments are provided in Sections 25.3.1 through 25.3.12.

25.3.1 Hydrogeology

The hydrogeology of the Project is discussed in Chapter 9, Hydrogeology. The Project will mine the deposit using panel caving techniques which will create a subsidence zone at surface that will be

underlain by a mass of highly fractured bedrock. A three-dimensional groundwater model has been used to assess potential effects resulting from development of the underground mine. The model has been further integrated with a geochemical and water quality prediction model to predict contact water chemistry. Mine construction and operations will draw down water levels and reduce groundwater base flow contributions to the Central Cirque and East Cirque creeks situated above the cave footprint. Due to the changes in physical hydraulic properties of the rock mass, the cave zone will act as a groundwater sump and permanently divert groundwater from the Central Cirque to East Cirque Creek. In the far-future (post-closure), the rebounding water level in the cave zone will cause gradients to reverse, and groundwater discharge to East Cirque creek will increase above baseline levels. Base flow in Central Cirque Creek will stabilize below baseline levels and as a result, produce a negligible reduction in surface water contributions to Amazay Lake. No other hydraulic interactions between Amazay Lake and the Project are expected. Changes in East Cirque Creek and Central Cirque Creek base flow resulting from the Project are considered **not significant**, primarily due to their discrete geographical extent.

The conceptual model for groundwater flow, including precipitation infiltration, during operations and closure (e.g., re-flooding of the cave zone) is that flow will pass through the overlying gossan, into and through the Takla unit and the Black Lake Intrusive monzonite unit. As such, the ultimate groundwater quality signature will be a function of the geochemical reactivity of the three primary rock units within the cave zone. Deep groundwater is predicted to have a minor contribution to East Cirque Creek with the majority of groundwater flow to the catchment derived from shallow groundwater in the Gossan. East Cirque Creek is naturally affected by geochemical reactivity within the gossan, which in turn, has influenced background groundwater quality in the gossan. Since the changes to groundwater quality within the gossan are negligible, changes to surface water quality within East Cirque Creek are minor and therefore the groundwater quality residual effects are considered to be **not significant.**

The KUG TSF will ultimately act like a groundwater source, a reversal from the groundwater sink that it is today. Seepage predictions have been estimated through the development of a two-dimensional groundwater model. The seepage will ultimately report as increased base flow in downgradient streams (Kemess Creek and Waste Rock Creek). The changes in groundwater quantity from the KUG TSF are discrete and **not significant**. The bedrock groundwater quality downgradient of the KUG TSF is expected to be altered due to seepage from the KUG TSF south wall and KUG TSF dam. The extent of the alteration is also discrete and the residual effects are determined to be **not significant**.

25.3.2 Surface Hydrology

Project residual effects on surface hydrology are discussed in Chapter 10. The Project has been designed to limit the impacts of mine development on surface hydrology to the greatest extent possible. Mining the deposit using panel caving techniques minimizes surface disturbance in this area of the Project, and the primary impacts expected are to base flows in two small headwater catchments. Use of the KS open pit (i.e., KUG TSF) for mine waste storage will similarly limit impacts to surface hydrology that would otherwise be expected from the construction, operation and closure of a new tailings storage facility. Impacts in this regard are limited to a short to medium-term duration, seasonally-staged discharge to Attichika Creek that will cease in early operations, and flow modifications to the Waste Rock Creek catchment, which is already subject to substantial flow modifications from the closed KS Mine.

Table 25.3-1. Summary of Potential Residual Effects and Mitigation Measures

Subject Area	Valued Component	Residual Effect	Project Phase	Proposed Mitigation	Significance	
					Project	Cumulative
Environment						
Hydrogeology	Groundwater Quantity	Decrease in groundwater level in and around the underground development	All phases	None proposed during Construction or Operations Installation of hydraulic bulkheads along underground declines during Closure	Not significant	None identified
		Decrease in groundwater contributions to East Cirque Creek (until ~Project year 60)	All phases	None proposed during Construction or Operations Installation of hydraulic bulkheads along underground declines during Closure	Not significant	None identified
		Decrease in groundwater contributions to Central Cirque Creek	All phases	None proposed during Construction or Operations Installation of hydraulic bulkheads along underground declines during Closure	Not significant	None identified
		Increase in groundwater contributions to East Cirque Creek (Project Year 60 onwards)	Post-Closure	None proposed	Not significant	None identified
		Groundwater seepage to Kemess Creek from KUG TSF	Late Operations into Post-Closure	None proposed	Not significant	None identified
	Groundwater Quality	Change in groundwater quality in the subsidence zone	Closure and Post-Closure	Installation of hydraulic bulkheads approximately midway along decline to promote re-flooding of subsidence zone and reduce metal leaching/acid rock drainage (ML/ARD) risk	Not significant	None identified
		Changes in groundwater quality in the fractured bedrock in the area of the KUG TSF	Late Operations through Post-Closure	None proposed	Not significant	None identified
Surface Hydrology	Surface Hydrology	Seasonal increases in Attichika Creek discharge	Construction	Stage discharge of KUG TSF water to the natural hydrograph and limit discharge to open water season (May – Oct)	Not Significant	None identified
		Decrease in base flow in East Cirque and Central Cirque Creek	Operations	Underground mining limits impacts to surface hydrology	Not Significant	None identified
		Decrease in base flow East Cirque Creek (until Project Year 60)	Closure and Post-Closure	Installation of hydraulic bulkhead in underground declines at Closure	Not Significant	None identified
		Increase in base flow in East Cirque Creek (after Project Year 60)	Post-Closure	None proposed	Not Significant	None identified
		Decrease in base flow in Central Cirque Creek	Closure and Post-Closure	None proposed	Not Significant	None identified
		Increase in discharge in Waste Rock Creek	Closure and Post-Closure	None proposed	Not Significant	None identified
Surface Water Quality	Surface Water Quality – Mine Site Area	Change in total cadmium (Cd) concentrations in Attichika Creek due to KUG TSF discharge	Construction	Manage ML/ARD by submerging waste rock in KUG TSF Direct contact runoff to KUG TSF Divert non-contact water away from KUG TSF highwall; Stage discharge of KUG TSF water to natural hydrograph and limit discharge to open water season (May – Oct) Implement Fish and Aquatics Effects Monitoring Plan, Mine Waste, Tailings and ML/ARD Management Plan, Surface Water Management Plan, and Water Treatment Plan.	Not significant	None identified
		Change in nitrate concentrations in Waste Rock Creek due to KUG TSF discharge	Closure, Post-Closure	Continue treatment of KUG TSF discharge until discharge water quality no longer requires active treatment to meet receiving environment objectives. Implement Fish and Aquatic Effects Monitoring Plan, Surface Water Management Plan, and Water Treatment Plan.	Not significant	None identified

(continued)

Table 25.3-1. Summary of Potential Residual Effects and Mitigation Measures (continued)

Subject Area	Valued Component	Residual Effect	Project Phase	Proposed Mitigation	Significance	
					Project	Cumulative
Environment *(cont'd)*						
Surface Water Quality *(cont'd)*	Surface Water Quality – Mine Site Area *(cont'd)*	Change in total aluminum (Al), copper (Cu), and molybdenum (Mo) concentrations in Waste Rock Creek due to KUG TSF discharge	Post-Closure	Continue treatment of KUG TSF discharge until discharge water quality no longer requires active treatment to meet receiving environment objectives. Implement Fish and Aquatic Effects Monitoring Plan, Surface Water Management Plan, and Water Treatment Plan.	Not significant	None identified
		Change in total selenium (Se) concentrations in Waste Rock Creek due to KUG TSF discharge	Closure, Post-Closure	Continue treatment of KUG TSF discharge until discharge water quality no longer requires active treatment to meet receiving environment objectives. Implement Fish and Aquatic Effects Monitoring Plan, Surface Water Management Plan, and Water Treatment Plan	Not significant	None identified
		Change in total suspended solids (TSS) and turbidity of the receiving environment due to erosion and sedimentation	Construction, Operations, Closure	Implement best management practices to minimize erosion and control sediment Direct non-contact runoff to sedimentation pond (portal area) and KUG TSF (mine site area) Implement Surface Erosion Prevention and Sediment Control Plan and Surface Water Management Plan.	Not significant	None identified
	Surface Water Quality – Underground Mine Area	Change in total Co, chromium (Cr), Cu, iron (Fe), and zinc (Zn) concentrations in East Cirque Creek due to seepage of underground contact water	Post-Closure	Install hydraulic bulkheads approximately midway along decline to promote re-flooding of subsidence zone and reduce ML/ARD risk Implement Groundwater Monitoring Plan and Mine Waste, Tailings, and ML/ARD Management Plan.	Not significant	None identified
		Change in total and dissolved Al and total Fe concentrations in Central Cirque Creek due to seepage of underground contact water	Post-Closure	Install hydraulic bulkheads approximately midway along decline to promote re-flooding of subsidence zone and reduce ML/ARD risk Implement Groundwater Monitoring Plan and Mine Waste, Tailings, and ML/ARD Management Plan.	Not significant	None identified
		Change in TSS and turbidity of the receiving environment due to erosion and sedimentation	Construction, Operations, Closure	Implement best management practices to minimize erosion and control sediment, Implement Surface Erosion Prevention and Sediment Control Plan (Section 24.15); Surface Water Management Plan (Section 24.16).	Not significant	None identified
Terrain and Soils	Soil Quantity	Loss of ecologically functional soil area	All Phases	Minimize land clearing to areas necessary for mine footprint development Undertake soil salvage, storage, and progressive reclamation Implement Soil Handling Management Plan.	Not significant	Not significant
	Soil Quality	Degradation of soil	All Phases	Design facilities to control chemical /fuel/oil spillage, and regular maintenance of equipment to avoid leaks Remediate contaminated soil Utilize dust suppression techniques Maintain engines and use low-sulphur fuel where possible to reduce NOx and SOx emissions Engage qualified soil specialist to guide stripping and stockpiling operations Utilize soil stockpiling techniques that conserve soil quality Reduce vehicle traffic over the stockpile surface and soil movement, and avoid handling soils when they are too dry or too wet Progressive reclamation and re-vegetation of stockpiles Implement Soil Handling and Management Plan, Environmental Emergency, Spill and Hazardous Materials Plan, and Surface Erosion Prevention and Sediment Control Plan	Not significant	Not significant

(continued)

Table 25.3-1. Summary of Potential Residual Effects and Mitigation Measures (continued)

Subject Area	Valued Component	Residual Effect	Project Phase	Proposed Mitigation	Significance	
					Project	Cumulative
Environment *(cont'd)*						
Terrestrial Ecology	Alpine and Parkland Ecosystems, Forested Ecosystems, Wetland Ecosystems, Red and Blue-listed Ecosystems, Harvestable Plants, Rare Plants and lichens and associated habitat	Loss and alteration of alpine and parkland ecosystem function due to subsidence	Operation through Post-Closure	None proposed	Not significant	Not significant
		Alteration of alpine and parkland ecosystem extent and function due to dust, acidification, eutrophication and invasive plants	All Phases	Underground mining reduces amount of surface disturbance Dust suppression Maintain engines and use of low-sulphur fuel where possible to reduce NOx and SOx emissions Implement Ecosystem Management Plan and Invasive Plant Management Plan.	Not significant	Not significant
		Loss and alteration of forested ecosystems	All Phases	Minimize land clearing to areas necessary for mine footprint development Dust suppression Implement Ecosystem Management Plan	Not significant	Not significant
Fish and Fish Habitat	Surface Water Quantity	Increase in Attichika Creek flows	Construction	Stage discharge of KUG TSF water to the natural hydrograph, and limit discharge period to open water season (May – Oct) Implement Surface Water Management Plan and Water Treatment Plan	Not significant	None identified
		Increase in discharge in Waste Rock Creek	Closure and Post-Closure	None proposed	Not significant	None identified
	Surface Water Quality	Change in total Cd concentrations in Attichika Creek	Construction	Manage waste rock for ML/ARD Direct contact runoff to KUG TSF Stage discharge of KUG TSF water to the natural hydrograph, and limit discharge period to open water season (May – Oct) Implement Fish and Aquatic Effects Monitoring Plan, Surface Water Management Plan and Water Treatment Plan	Not significant	None identified
		Change in nitrate and total aluminium, copper and selenium concentrations in Waste Rock Creek	Closure, Post-Closure	Continue treatment of KUG TSF discharge until discharge water quality no longer requires active treatment to meet receiving environment objectives. Implement Fish and Aquatic Effects Monitoring Plan	Not significant	None identified
Wildlife	Woodland Caribou	Disruption of movement	All Phases	Create gravel ramps over proposed discharge waterline in order to facilitate movement Create escape pathways (i.e., gaps) in snowbanks to allow wildlife to exit the road area Control access to Project area Apply and monitor speed limit of Project traffic Yield to wildlife observed along roads Implement Access Management Plan and Wildlife Management Plan	Not Significant	None identified
	Moose	Disruption of movement	All Phases	Create gravel ramps over the proposed discharge waterline in order to facilitate movement Create escape pathways (i.e., gaps) in snowbanks to allow wildlife to exit the road area Control access to Project area Apply and monitor speed limit of Project traffic Yield to wildlife observed along roads Implement Access Management Plan and Wildlife Management Plan	Not Significant	None identified

(continued)

Table 25.3-1. Summary of Potential Residual Effects and Mitigation Measures (continued)

Subject Area	Valued Component	Residual Effect	Project Phase	Proposed Mitigation	Significance	
					Project	Cumulative
Environment *(cont'd)*						
Wildlife *(cont'd)*	Grizzly Bear	Disruption of movement Attractants	All Phases	Create gravel ramps over the proposed discharge waterline in order to facilitate movement Create escape pathways (i.e., gaps) in snowbanks to allow wildlife to exit the road area Control access to Project area Apply and monitor speed limit of Project traffic; Yield to wildlife observed along roads; cut vegetation low along mine site access road to increase wildlife visibility Remove carrion from Project roads Record wildlife fatalities due to traffic incidents Manage waste Proper handling and storage of chemicals to prevent access by wildlife Implement Access Management Plan, Waste Management Plan, Wildlife Management Plan and Environmental Emergency, Spill and Hazardous Materials Plan	Not Significant	None identified
	Furbearers (Wolverine and American Marten)	Disruption of movement Attractants	All Phases	Create gravel ramps over the proposed discharge waterline in order to facilitate movement Create escape pathways (i.e., gaps) in snowbanks to allow wildlife to exit the road area; control access to Project area Apply and monitor speed limit of Project traffic Yield to wildlife observed along roads Cut vegetation low along mine site access road to increase wildlife visibility Remove carrion from Project roads Record wildlife fatalities due to traffic incidents Manage waste Proper handling and storage of chemicals to prevent access by wildlife Implement Access Management Plan, Waste Management Plan, Wildlife Management and Monitoring Plan, and Environmental Emergency, Spill, and Hazardous Materials Plan	Not Significant	None identified
	Hoary Marmot	Habitat loss and alteration Mortality	Construction	Underground mining reduces surface disturbance Conduct pre-construction surveys for active hoary marmot dens within subsidence zone and 250 m buffer area Monitor progression of surface subsidence Manage access to Project area Prohibit hunting and trapping by employees Implement Subsidence Effects and Terrain Monitoring Plan and Wildlife Management Plan	Not Significant	None identified
	Migratory Landbirds (Olive-sided Flycatcher	Habitat loss and alteration	Construction	Avoid vegetation clearing during the bird breeding season (April 1 to July 31) or conduct pre-clearing surveys to identify and avoid active nest sites if clearing occurs during April 1 to July 31 Monitor infrastructure for evidence of nesting and implement adaptive management as necessary based on species; and adhere to noise mitigations measures Implement Wildlife Management Plan	Not Significant	None identified
	Amphibians (Western toad)	Disruption of movement (due to proposed discharge waterline to Attichika Creek)	All Phases	None proposed	Not Significant	None identified

(continued)

Table 25.3-1. Summary of Potential Residual Effects and Mitigation Measures (completed)

Subject Area	Valued Component	Residual Effect	Project Phase	Proposed Mitigation	Significance	
					Project	Cumulative
Economic						
Economic	Aboriginal labour market conditions	Change in employment	Closure	Implement Workforce Transition Plan. Communication with communities	Not Significant	None identified
		Competition for labour and wage inflation	Construction, Operations	Implement training policy Support specialized skill training and on-the-job training Support apprenticeship program for trades training. Hire TKN on priority basis	Not Significant	Not Significant
	Non-Aboriginal labour market conditions	Change in employment	Closure	Implement Workforce Transition Plan Communication with communities	Not Significant	None identified
		Competition for labour and wage inflation	Construction, Operations	Implement Training policy. Support specialized skill training and on-the-job training. Support apprenticeship program for trades training	Not Significant	Not Significant
Social						
Social	Community Well-being	No residual effects anticipated				
	Aboriginal Community Well-being	No residual effects anticipated				
Health						
Human Health	Human Health	No residual effects anticipated				
Heritage						
Heritage Resources	Physical and cultural heritage resources (including any structure, site or thing of historical, archaeological, paleontological or architectural significance)	No residual effects anticipated				
Environment, Economic, Social, Health, Heritage						
Effects of Changes to the Environment on Aboriginal Peoples	Current Use of Lands and Resources for Traditional Purposes	Decrease in wildlife availability	Construction, Operations, Closure	Control access to the Project area and prohibition of hunting and trapping by staff, contractors and suppliers while on site Implement Wildlife Management and Monitoring Plan	Not significant	N/A

All permanent changes to the surface water quantity VC occur in the smallest headwater basins (i.e., <10 km^2), and in all cases the impact of the residual streamflow alterations is negligible at the next downstream node. Waste Rock Creek is already heavily impacted, and it is important to note that the predicted changes are relative to the existing (and permitted) condition in this creek. While the residual effect to surface hydrology in Waste Rock Creek is High Magnitude and Significant, this drainage is relatively small and the alterations are not distinguishable at the next downstream node, and are therefore considered to be n**ot significant**.

The dewatering of the underground cave zone is predicted to result in reduced base flows in East Cirque Creek and Central Cirque Creek throughout operations and into the post-closure period. The balance shifts in post-closure once the underground fills and a combination of diverted recharge from the Central Cirque catchment and increased recharge through the subsidence zone results in increased base flows in East Cirque Creek. These changes in base flows are expected to be permanent, but discrete in extent and thus are considered to be not s**ignificant**.

The only high magnitude change predicted to occur in a larger basin is the temporary and seasonal increase in flows in Attichika Creek resulting from KUG TSF dewatering during the Construction phase. This residual effect is considered to be local in extent, as the watershed lies entirely within the surface hydrology LSA. The duration of this effect is short- to medium-term (six month seasonally over four years), and is completely reversible. Therefore, the residual effect is rated as moderate magnitude, and n**ot significant**.

Following this assessment, the impact of Project construction, operation and closure is rated as being of moderate magnitude on a watershed scale, and therefore the residual effects are **not significant**.

25.3.3 Surface Water Quality

Surface water quality is a key indicator of environmental health as it is linked to other important ecosystem components and identified VCs, including fish and aquatic habitat, terrestrial ecology, wildlife, and human health. The effects assessment for surface water quality (Chapter 11) included several different pathways through which surface water quality indicators can be affected by Project activities and components. These included:

- discharges, including direct discharge from the KUG TSF to the receiving environment and management of contact water;
- groundwater seepage from Project components to the receiving environment;
- ML/ARD generated from excavating or exposing material with the potential for ML/ARD, or in runoff from temporary stockpiles;
- erosion and sedimentation during site clearing, construction, and maintenance activities;
- nitrogen loading from explosives use (leaching of nitrogen residues generated from blasting); and
- atmospheric deposition of dust generated by Project activities.

The surface water quality effects assessment was developed to incorporate quantitative data from baseline reports, as well as predictive water quality modelling. Effects on indicators of surface water quality were either assessed quantitatively by predictive water quality modelling or qualitatively based on geochemical characterization studies and professional judgement and experience. The goals were to remove as much subjectivity as possible from the assessment and to increase certainty in the predictions of alteration of surface water quality, residual effects, and the determination of significance.

The assessment incorporated mitigation and management plans for Project effects as included in the proposed Project design and described in Chapter 24, Environmental Management Plans. However, the proposed mitigations cannot eliminate the Project-related residual effect on water quality, and the following residual effects were identified:

- change in concentrations of total and dissolved metals, anions, and nutrients, and conductivity in the receiving environment due to direct discharge, groundwater interactions and seepage, and ML/ARD;
- change in nutrient concentrations in the receiving environment due to nitrogen loading from explosives; and
- change in turbidity and TSS in the receiving environment due to erosion and sedimentation.

Predictive water quality modelling into the far-future has an inherent level of uncertainty. To address this uncertainty, different model sensitivities considered the range of possible variation in surface hydrology and water quality, groundwater hydrology and water quality, and geochemical loadings. Further, the water quality monitoring program as per the Fish and Aquatic Effects Monitoring Plan (Section 24.7) will verify accuracy of the predictions of the environmental assessment, ensure detection of measureable alterations in surface water quality, allow for identification of potential causes, and include the provision of additional mitigation or adaptive management strategies.

Residual effects were identified in the surface water quality local study area (LSA) due to changes in predicted water quality parameters and due to erosion and sedimentation effects. Parameters with predicted concentrations greater than model background concentrations and water quality guidelines were identified in Attichika Creek during the Construction phase, in Waste Rock Creek during Closure and Post-Closure phases, and in East and Central Cirque Creeks during the Post-Closure phase. However, as these results were within the range of natural variation for the site, of short duration, and/or a result of substantial model conservatism, in addition to being local in geographic extent and not measureable past the boundaries of the LSA, the overall potential Project-related effect on surface water quality in the LSA is assessed as **not significant** for all residual effects. No residual effects were identified for the surface water quality regional study area (RSA), and no cumulative effects beyond those with the KS Mine that were integrated with the Project's residual effects are expected.

25.3.4 Terrain and Soils

Project residual effects on terrain and soils are discussed in Chapter 12, Terrain and Soils. Project development has the potential to affect three VCs: terrain stability, soil quantity, and soil quality. Development of Project infrastructure will avoid unstable terrain and overlap a small portion of highly erodible soils. Construction of Project components in alpine terrain and the subsidence zone may affect terrain stability in the terrain and soils LSA. Loss of soil quantity within the mine footprint will reduce the area and volume of ecologically functional soil, while changes in site drainage patterns, soil compaction, and contamination will potentially affect soil quality characteristics.

As a result of Project development, the incidence and magnitude of geomorphic processes will temporarily increase beyond the range of natural variation within the LSA. The geomorphological changes will be permanent; the duration of the increased instability period is expected to be medium term (2-30 years), after which it is expected to reverse to baseline levels. In view of the long history of terrain instability in the LSA, it is expected that the receiving environment will be able to adapt to these effects. The overall effect of Project development on terrain stability is expected to be **not significant.** Cumulative effects on terrain stability are expected to have low magnitude, and minimal effect on land and resource management plan objectives, and are rated as **not significant**.

The permanent loss of soil within the Project footprint after closure will result in a detectable change beyond the range of natural variation and is characterized as high magnitude. While the spatial extent of this effect will remain local, the duration of this loss will extend into the far future. The effect is considered irreversible as the listed areas will be permanently lost. In consideration of small size of the lost area, as well as the relatively poor productivity of local soils, the effect of permanent soil loss associated with the proposed Project is expected to be **not significant**. While cumulative effects on soil quantity are expect to be high magnitude and of long-term duration, the overall proportion of affected land is small (local) and the receiving environment is characterized to have high resilience. Land resource management plan objectives will likely be met, although some management objectives may be impaired. Overall, the cumulative effect of soil loss is expected to be **not significant**.

Degradation of soil quality associated with the KUG Project is expected to approach the limits of natural variation and is characterized as medium magnitude. The predicted geographical extent of these effects will be concentrated around the Project footprint and within areas of soil acidification caused by previous human activity. Some of the effects, adjacent to Project components retained after closure, will last beyond the Post-Closure phase but most are considered reversible in the long-term. Considering the generally low productivity and limited buffering capacity of the affected soils and the climate and terrain condition at the site, the resilience of the receiving environment in response to Project-related soil degradation is expected to be low. Nevertheless, in consideration of the relatively small area (< 100 ha) of soils affected and generally low land use capacity of local soils, degradation of soil quality around the Project infrastructure is predicted to be **not significant**.

Cumulative effects on soil quality have low to medium magnitude and are partially reversible in the long term. The receiving environment is expected to adapt to most stresses within the medium to long term. Cumulative effects of the degradation of soil quality is expected to be **not significant**.

25.3.5 Terrestrial Ecology

Chapter 13, Terrestrial Ecology discusses Project residual effects on terrestrial ecology. Project-related residual loss and alteration on alpine and parkland ecosystems function and extent is expected to result in **not significant** effects. The magnitude of the effect of the loss and alteration of alpine and parkland ecosystem function is low, affecting 1.3% of the alpine and parkland ecosystems in the terrestrial ecology LSA. The majority of the alpine and parkland vegetation communities affected are adapted to disturbance. Vegetation or lichens are expected to re-establish over time and will continue to provide ecological functions typical of those within the Alpine Group.

Project-related residual effects on the loss and alteration of forested ecosystem function and extent are **not significant.** The magnitude of the effects is expected to be low, affecting 1.9% of the forested ecosystems within the LSA. The forested ecosystems are expected to recover over the medium to long-term and the viability of the resource will not be impacted at any scale.

Blue-listed ecosystems and rare plants and lichens and associated habitat were considered as candidate VCs but were not selected for the effects assessment because Project components and activities are not expected to interact with any of the blue-listed ecosystems or rare plant and lichen populations identified within the LSA.

The proposed management and mitigation measures are considered adequate to avoid residual effects to wetlands and harvestable plants and thus these valued components were not carried forward into the cumulative effects assessment. The direct and indirect Project-related effects on alpine and parkland ecosystems and forested ecosystems cannot be fully mitigated and thus residual effects are predicted and evaluated in the cumulative effects section.

Management and mitigation measures will help avoid and minimize adverse cumulative effects to alpine and parkland ecosystems and forest ecosystems; however, residual cumulative effects are predicted for the loss and alteration of alpine and parkland ecosystems and forested ecosystems, which can be minimized, but not avoided altogether.

The residual cumulative effects of incremental removal of alpine and parkland ecosystem extent and function, and the physical-chemical transport of invasive plants into alpine and parkland areas are considered not significant. The magnitude of the effect is negligible, affecting 0.6% of the alpine and parkland ecosystems within the terrestrial ecology RSA.

Cumulative effects of incremental removal of forested ecosystems, the growth inducing, and synergistic effects due to the creation of edges, fragmentation, and altered hydrology and the physical-chemical transport of invasive plants are considered **not significant**. The magnitude of the effect is low, affecting <10% of the forested ecosystems within the RSA. Forested ecosystems are expected to recover over the long term and will continue to provide ecological functions over this duration.

25.3.6 Fish and Aquatic Habitat

The fish and aquatic habitat studies reported in Chapter 14 indicate that significant populations of bull trout move up from Thutade Lake into Attichika Creek and its tributary Kemess Creek to

spawn and for juvenile rearing, and that Dolly Varden are widespread throughout the watersheds, with core spawning areas located in headwater reaches well upstream from the Project area. Rainbow trout populations are mainly associated with lakes in the Project area including Kemess, Thutade and Amazay Lakes. Aquatic habitat in the Project area varies from creeks with high benthic and algal species richness and diversity (i.e., Attycelley and Attichika creeks) to creeks with very low primary and secondary productivity (i.e., East and Central Cirque creeks).

The design of the Project has successfully mitigated potential fish and aquatic habitat effects, such as realignment of the access corridor from its original location along El Condor Creek and Kemess Lake to previously disturbed areas with no significant aquatic value, and underground mining will minimize surface disturbance. Potential effects are predicted to base flows in two small headwater catchments that do not support fish or other significant aquatic resources due to existing unsuitable water quality. Additionally, the use of the pre-existing KS open pit as the KUG TSF and the development of water treatment facilities for staged seasonal discharge to Attichika Creek will limit impacts to surface hydrology and water quality that would otherwise be expected from the construction, operation and subsequent closure of a new tailings storage facility.

As far as surface water quantity is concerned, residual effects of increases in streamflow in Attichika Creek and discharge into Waste Rock Creek are regarded as **not significant**. Regarding surface water quality, the changes in concentrations of cadmium in Attichika Creek and nitrate, aluminium, copper and selenium in Waste Rock Creek are regarded as **not significant**. No cumulative residual effects are anticipated and the Project will not result in fish habitat loss, thus no fisheries offsetting plan is required.

25.3.7 Wildlife

Chapter 15, Wildlife, assesses the effects to 11 wildlife VCs. Five potential residual effects were identified, namely habitat loss and alteration, sensory disturbance, disruption of movement, mortality, and attractants. Habitat loss and alteration was identified as a residual effect for hoary marmot and the migratory landbird, olive-sided flycatcher. Sensory disturbance was also identified as a residual effect for olive-sided flycatcher. Disruption of movement was identified as a residual effect for woodland caribou, moose, grizzly bear, furbearers (American marten and wolverine), and western toad. Mortality was identified as a residual effect for hoary marmot. Attractants were identified as a residual effect for grizzly bears and wolverine.

All of the residual wildlife effects were assessed as **not significant** after the application of mitigation measures and no cumulative residual effects were identified.

25.3.8 Economics

Project residual effects on economics are discussed in Chapter 16, Economic. Potential residual effects were identified on Aboriginal labour market conditions VC, and non-Aboriginal labour market conditions VC. Closure of the Project will result in a change in employment as the workforce is progressively reduced over the Closure phase; this loss of employment may affect the labour market of the potentially affected communities and the region. Additionally during the Construction

and Operations phases, the Project's need for skilled workers could lead to competition for skilled labour and wage inflation. Residual effects on the two VCs are predicted to be **not significant**.

Effects of the change in employment were excluded from the cumulative effects assessment as there are no past, present or future projects that are expected to overlap temporally with the Project, and consequently would not contribute to the loss of employment opportunities. Cumulative residual effects of the competition for skilled labour and wage inflation on the Aboriginal labour market conditions VC and the non-Aboriginal labour market conditions VC was assessed as **not significant** given the uncertainty surrounding the occurrence of future projects.

The Project will provide benefits to potentially affected communities, including TKN First Nations, and the region in terms of employment, training, income, and tax revenues. The economic benefits of the Project are described in Chapter 1 (Section 1.11, Project Benefits).

25.3.9 Social

Chapter 17, Social, assesses potential effects on two VCs, namely community well-being and Aboriginal community well-being. Ultimately, the Project's social effects (i.e., "changes to family dynamics and family/community stress" and "changes to worker stress and lifestyle choices") will largely be determined by individuals and their families who are engaged in Project employment. For the majority of Project employees, it is reasonable to assume employment and income will have a lasting positive effect. However, for a smaller group, particularly those who already struggle with social issues, there may be an adverse effect on worker stress and lifestyle choices, and/or family dynamics and family/community stress.

Potential effects on community well-being are linked to three factors of employment: the high incomes typical of mining jobs, the fly-in/fly-out work schedule, and the nature of the on-site work environment. The prescribed mitigation and monitoring measures are designed to address these factors.

AuRico is committed to minimizing the potential for adverse effects and will implement the appropriate plans and programs to ensure that workers have access to the tools, resources, and information required to ensure the best outcomes for worker, family, and community well-being during the Construction and Operations phases of the Project. As a result, residual social effects during the Construction and Operations phases are not anticipated.

Similarly, potential effects related to the Closure phase of the Project will also be effectively reduced through the development of a Workforce Transition Plan to help employees identify and secure new employment and prepare for the end of Project employment. Previously, the closure of the KS Mine was guided by a similar transition program, which was reported to be successful and appreciated by KS employees during the transition. As a result, no residual effects on community well-being and Aboriginal community well-being are anticipated after mining activities are terminated.

25.3.10 Human Health

Human health was identified as a VC and the potential for change in human health due to the Project was evaluated, as discussed in Chapter 18. A baseline human health risk assessment (HHRA) was conducted (Appendix 18-A) to determine the current risk to human health from exposure to contaminants of potential concern (COPCs) from within the human health LSA. This baseline HHRA found that several COPCs had hazard quotients (HQs) that were between 0.2 and 1.0 (i.e., aluminum, chromium, mercury, and methylmercury for toddlers; aluminum and mercury for adults, and methylmercury for sensitive adults). This suggests that current conditions in the LSA could pose a risk to human health under the conservative exposure conditions used in the assessment (e.g., a human receptor present 100% of the time with all drinking water, air, soil contact, and country foods coming from within the human health LSA). The assessment is highly conservative since there are no known permanent full-time residents of the human health LSA.

The potential interactions between human health and Project activities, or components were identified. Project activities that could affect air quality, water quality, soil or vegetation quality, country foods quality, or noise levels also have the potential to cause a change in human health. Predictive models were developed to estimate future noise levels and concentrations of COPCs in air, water, soil, vegetation, country foods. The results of the predictive modelling were used as inputs into the Project-related HHRA (Appendix 18-B), which used the same methodologies, approaches, study area, and assumptions as the baseline HHRA.

Mitigation measures were considered and incorporated into the predictive modelling and risk assessments. Based on comparison of the results of the baseline HHRA (Appendix 18-A) and the Project-related HHRA (Appendix 18-B), the incremental change in the HQs is small and would not result in changes to human health. Therefore, no residual effects to human health were identified.

25.3.11 Heritage Resources

Chapter 19, Heritage Resources, discusses the residual effects of the Project on heritage resources. There is one known archaeological site documented in the Archaeology Branch's Archaeological Site Inventory database located within the heritage LSA. This is a small lithic scatter consisting of three basalt flakes and has been previously disturbed by the construction and maintenance of the existing exploration road. Shovel testing conducted in the area did not locate any additional cultural material and no further work was recommended at the site. A Site Alteration Permit in accordance with Section 12 of the *Heritage Conservation Act* (1996; HCA) will be sought and Archaeological Impact Assessments will be undertaken in areas not previously subjected to such assessments, such as the discharge pipeline route, prior to construction commencing.

Potential effects of the Project on heritage resources will be mitigated and managed through site avoidance, Project personnel education, and implementation of the Heritage Management Plan and Chance Find Procedure, and if necessary, additional archaeological inspection and/or investigation. With the application of site avoidance and/or other mitigation and management measures prior to Project impacts, no residual effects on known heritage resources are anticipated. Similarly, implementation of the Project's Chance Find Procedure and Heritage Management Plan will facilitate the protection of any as-yet undiscovered heritage resources within the Project footprint, which may

be identified during both the Construction and Operations phases. Therefore, as-yet undiscovered heritage resources will be avoided and/or properly mitigated and managed, and residual effects are not anticipated. No residual effects to protected heritage sites were identified.

25.3.12 Effects of Changes to the Environment on Aboriginal Peoples

Chapter 20, Effects of Changes to the Environment on Aboriginal Peoples, addresses three VCs with respect to Aboriginal peoples: the current use of land and resources for traditional purposes; health and socio-economic conditions; and physical and cultural heritage. Potential effects were considered for all Aboriginal groups identified by the BC EAO and CEA Agency, namely the TKN (jointly representing the Takla Lake First Nation, Tsay Keh Dene Nation, and Kwadacha Nation), Gitxsan Wilp Nii Kyap, the Treaty 8 First Nations (Saulteau First Nations, McLeod Lake Indian Band, Blueberry River First Nations, Doig River First Nation, Fort Nelson First Nation, Halfway River First Nation, Prophet River First Nation, and West Moberly First Nations), and the Métis Nation BC. After considering the nature and extent of the Project's potential environmental impacts, and the available information regarding each Aboriginal groups' respective communities, traditional territories, cultural heritage, and land use practices, potential effects were identified for the TKN, Gitxsan Wilp Nii Kyap, West Moberly First Nation, and Métis Nation BC. No potential effects were identified for Saulteau First Nations, McLeod Lake Indian Band, Blueberry River First Nations, Doig River First Nation, Fort Nelson First Nation, Halfway River First Nation, or Prophet River First Nation.

The assessment examined various pathways by which environmental effects (including those described in other chapters of the Application) could affect Aboriginal peoples' use of land and resources, health and socio-economic conditions, and/or physical or cultural heritage. Considering the environmental effects of the Project and the implementation of mitigation measures, one potential residual effect was identified for the TKN in regard to the current use of lands and resources for traditional purposes VC, as changes to wildlife resources in the LSA could affect hunting and trapping in close proximity to the mine site. The residual effect was rated as not significant, due to the fact that the magnitude of impact on wildlife was considered minor and localized in extent. The Project is located on a brownfield mine site with most of the activity occurring underground. No residual effects are anticipated for Gitxsan Wilp Nii Kyap, West Moberly First Nations, or MNBC, and no residual effects were identified in regard to the health and socio-economic conditions VC or physical and cultural heritage VC.

Since the only potential residual effect (i.e., to the current use of land and resources for traditional purposes by the TKN) is due to changes to the availability of wildlife, and no cumulative residual effects to wildlife are predicted, no cumulative interaction between these effects and other projects and activities is identified. All residual Project and cumulative effects were thus assessed as not significant.

25.4 ENVIRONMENTAL MITIGATION AND MANAGEMENT

25.4.1 Mitigation Measures

A summary of mitigation measures identified in Appendix 25-A. The implementation of the proposed mitigation measures will substantive reduce or eliminate potential project related adverse environmental, economic, social, heritage, and health effects. However, a number of residual

adverse effects, following implementation of the proposed mitigation measures are anticipated as summarized in Section 25.3. Mitigation measures are also summarized per relavant to each residual in Table 25.3-1.

25.4.2 Environmental Management Plans

AuRico has a corporate Sustainability Management System in place that provides a performance standard for managing the Health and Safety, Environment Management System and Corporate Social Responsibility components for the proposed Project in a sustainable manner, as described in Section 24.1 of the Application. The Environmental Management Plans (EMP) identified in this section are consistent with AuRico's Sustainability Management System and the plans will be further developed to support AuRico's permit applications. AuRico's existing EMPs and onsite procedures for the KS Mine have informed the development of these plans and have been expanded to cover KUG Project components. The existing closure and reclamation plan for the KS Mine will complement the closure and reclamation plan for the KUG Project.

The EMPs each identify the regulatory and policy framework, performance objectives, environmental protection measures, monitoring, scheduling, and reporting. Proposed EMPs include:

- Access Management Plan (Section 24.2);
- Air Quality Management Plan (Section 24.3);
- Ecosystems Management Plan (Section 24.4);
- Emergency Response Plan (Section 24.5);
- Environmental Emergency, Spill, and Hazardous Materials Plan (Section 24.6);
- Fish and Aquatics Effects Monitoring Plan (Section 24.7) ;
- Groundwater Monitoring Plan (Section 24.8);
- Heritage Management Plan (Section 24.9);
- Invasive Plant Management Plan (Section 24.10);
- Mine Waste, Tailings, and ML/ARD Management Plan (Section 24.11);
- Occupational Health and Safety Plan (Section 24.12);
- Soil Handling Management Plan (Section 24.13);
- Subsidence Effects and Terrain and Monitoring Plan (Section 24.14);
- Surface Erosion and Sediment Control Plan (Section 24.15);
- Surface Water Management Plan (Section 24.16);
- Waste Management Plan (Section 24.17);
- Water Treatment Plan (Section 24.18); and
- Wildlife Management and Monitoring Plan (Section 24.19).

25.5 FEDERAL SUMMARIES

25.5.1 Overview

Pursuant to the federal Minister of the Environment's Substitution Decision on April 8, 2014, the procedural aspects of the federal EA are being conducted by the BC EAO, but all federal requirements under Section 5 and 19 of the CEAA 2012 must be fulfilled by the assessment. Appendix 25-B provides the substitution summary table that summarizes information pertinent to CEAA 2012 Section 5 and 19 requirements.

This section summarizes the effects of changes to the environment as outlined in CEAA 2012 Sections 5(1)(a) and (b) and 5(2)(a) and (b). These include changes to the components of the environment within federal jurisdiction, changes to the environment that would occur on federal or transboundary lands, and changes to the environment that are directly linked or necessarily incidental to federal decisions and the effects of those changes on the human environment, as summarized in Table 25.6-1. Information requirements to address CEAA 2012 Section 5(1)(c) are addressed in Chapter 21 and summarized in Section 24.4.15 of this Application.

Table 25.6-1. Summary of Federal Areas of Interest under the *Canadian Environmental Assessment Act, 2012*

Federal Area of Interest	Changes to the Environment
Changes to Components of the Environment within Federal Jurisdiction	
Fish and Fish Habitat	Direct mortality; erosion and sedimentation; surface water quantity and quality; habitat loss
Aquatic Species at Risk	No aquatic species at risk, as defined under the *Species at Risk Act* (2002a) will be affected by the Project
Migratory Birds	Direct mortality; habitat loss and alteration; sensory disturbance; chemical hazards; attractants
Changes to the Environment that would occur on Federal or Transboundary Lands	
None	
Changes to the Environment that are Directly Linked or Necessarily Incidental to Federal Decisions	
Explosives Act (1985a)	Loss and degradation of ecosystems and soil; fugitive dust effects
Fisheries Act (1985b)	Direct mortality; habitat loss
Effects of Changes to the Environment that are Directly Linked or Necessarily Incidental to Federal Decisions	
None	

25.5.2 Changes to Components of the Environment within Federal Jurisdiction

Pursuant to CEAA 2012 Section 5(1)(a), the components of the environment under federal jurisdiction are fish and fish habitat, aquatic species at risk, and migratory birds.

25.5.2.1 Fish and Fish Habitat

The Project area encompasses several fish-bearing and non-fish-bearing streams, rivers, and lakes providing fish and aquatic habitat (periphyton, benthic invertebrates, and sediments) that could be

affected by Project activities. The *Fisheries Act* (1985b) protects fisheries (commercial, recreational, and Aboriginal) and fish species that support these fisheries. Nine fish species are found within the Project area and are identified in Table 25.6-2. No species listed under the *Species at Risk Act* (2002d) occur in the Project area, although bull trout is listed as Special Concern by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC).

Table 25.6-2. Summary of Fish Species Present in the Thutade Watershed and Upper Finlay River

		Conservation Status	
Common Name	Scientific Name	Provincial [1]	Federal
Bull trout	*Salvelinus confluentus*	Provincial blue	COSEWIC - Special Concern (2012)
Dolly Varden	*Salvelinus malma*	Provincial yellow	Not listed
Rainbow trout	*Oncorhynchus mykiss*	Provincial yellow	Not listed
Mountain whitefish	*Prosopium williamsoni*	Provincial yellow	Not listed
Slimy sculpin	*Cottus cognatus*	Provincial yellow	Not listed
Longnose sucker	*Catostomus catostomus*	Provincial yellow	Not listed
Kokanee	*Oncorhynchus nerka*	Provincial yellow	Not listed
Arctic Grayling	*Thymallus arcticus*	Provincial yellow	Not listed
Burbot	*Lota lota*	Provincial yellow	Not listed

[1]*Blue-listed are fish species of special concern because of characteristics that make them particularly sensitive to human activities or natural events. Yellow-listed fish species are not at risk in BC.*

Fish and aquatic habitat VCs included in the EA are outlined in Table 25.6-3.

Table 25.6-3. Fish and Aquatic Habitat Components Selected for Assessment

Subject Area	Valued Components	Indicator
Fish	Adfluvial bull trout Dolly Varden trout Rainbow trout	Changes in: • fish habitat (quality and availability); and • recruitment (as measured through changes in abundance and population structure).
Aquatic Habitat	Periphyton Benthic Invertebrates Sediment Quality	Changes in: • primary productivity, abundance and diversity; and • chemical concentrations (COPCs).

The assessment of effects to fish and aquatic habitat is presented in Chapter 14, and the effects were scoped using the following interaction pathways:

- direct mortality;
- erosion and sedimentation;
- changes in surface water quantity;
- changes in surface water quality; and
- habitat loss.

Table 25.6-4 provides a summary of the assessment for fish and aquatic habitat.

25.5.2.2 Aquatic Species at Risk

No aquatic species as defined in subsection 2(1) of the *Species at Risk Act* (2002d) occur in the Project area.

25.5.2.3 Migratory Birds

Under the *Migratory Birds Convention Act* (1994), individual birds, eggs and active nests are protected. Migratory birds were assessed by cohorts that share similar habitat requirements: migratory waterbirds and migratory landbirds.

Migratory Waterbirds

Migratory waterbirds include waterfowl and wading birds, such as ducks, geese, swans, loons, and grebes, as well as riverine birds such as American dippers (*Cinclus mexicanus*) and harlequin ducks (*Histrionicus histrionicus*). There were 44 waterbird species confirmed on waterbodies in the wildlife RSA during baseline studies with 37 of these occurring in the wildlife LSA, including ducks, geese, swans, loons, grebes, gulls, shorebirds, and riverine birds. All of the observed species would be considered migratory birds under Article I of the *Migratory Birds Convention Act* (1994). A species of waterbird of federal conservation concern occur in the Project area, the horned grebe (*Podiceps auritus*), listed as Special Concern by COSEWIC.

Waterbirds were assessed for potential Project related effects of habitat loss and alteration, sensory disturbance, direct mortality, and chemical hazards because those effects have the potential to create a residual effect on migratory waterbirds. The effects of disruption of movement, attractants, and indirect mortality were scoped out of this assessment because they were determined to have no interaction with waterbirds. The full assessment of potential effects on waterbirds is presented in Chapter 15; Table 25.6-5 provides a summary of the interaction pathways and mitigation measures for migratory birds. After the implementation of mitigation measures, no residual effects were assessed for migratory waterbirds.

Migratory Landbirds

Migratory landbirds include passerines, hummingbirds, swifts, and woodpeckers. There were 53 species of migratory landbirds confirmed in the wildlife RSA during baseline field studies, all of which occurred in the wildlife LSA. Two species of migratory landbirds of federal conservation were observed in the LSA: the olive-sided flycatcher (*Contopus cooperi*), listed under COSEWIC and Schedule 1 of the *Species at Risk Act* (SARA; 2002d) as Threatened, and the barn swallow (*Hirundo rustica*), listed as Threatened by COSEWIC. Breeding was confirmed within the LSA for the olive-sided flycatcher. Two species of federal conservation concern have been observed in the RSA in association with breeding bird atlas surveys: the rusty blackbird (*Euphagus carolinus*), which is listed by both COSEWIC and Schedule 1 of SARA as Special Concern and the common nighthawk, which is listed by both COSEWIC and Schedule 1 of SARA as Threatened.

Table 25.6-4. Summary of Interaction Pathways and Mitigation Measures for Fish and Aquatic Environment

Interaction Pathways	Key Potential Effect	Mitigation Measures	Residual Effect	Significance of Residual Effects	Cumulative Residual Effects
Changes in Surface Water Quantity	Change in flow and volume of water that can impact fish and aquatic habitat through change to channel morphology and stream flows resulting in alteration of aquatic habitat.	• Implement Surface Water Management Plan, Surface Erosion Prevention and Sediment Control Plan, Groundwater Monitoring Plan, and Fish and Aquatic Effects Monitoring Plan. • Discharge from KUG TSF will be staged to the existing hydrograph in Attichika Creek over a six-month period to limit proportional increases to baseline flow regime. Use of best management practices (BMPs) erosion and sediment control. • Limit surface disturbance to the extent possible. • Use of non-contact diversion ditches and sediment ponds.	Increases in Attichika Creek flow during the Project's Construction phase. Alterations to flow regime in Waste Rock Creek during the Project's Operations, Closure, and Post-Closure phases.	Not significant Not significant	None identified None identified
Changes in Water Quality	Change in surface water quality (including physical and chemical changes in water) can adversely affect fish and aquatic habitat receptors (periphyton, benthic invertebrates, planktonic communities) in varying degrees, the most severe being through direct lethal effects. Indirect effects can range from an individual to population level and can be presented through changes in health, productivity, biomass, and alterations to fish and aquatic community structures.	• Implement Mine Waste, Tailings and ML/ARD Management Plan, Surface Water Management Plan, Water Treatment Plan, and Fish and Aquatic Effects Monitoring Plan. • PAG material, including waste rock and tailings, will be managed by subaqueous deposition in the KUG TSF. • Staged discharge from KUG TSF during construction to match natural hydrograph of Attichika Creek • Treat discharge from the KUG TSF during operation and closure by means of selenium ion exchange (Se-IX) treatment and Metals Removal (MR) treatment. • Use of non-acid generating (NAG) material for construction for which runoff would not be directed to the KUG TSF.	Change in total Cd concentrations in Attichika Creek during the Project's Construction phase. Change in nitrate concentrations in Waste Rock Creek during the Project's Closure and Post-Closure phases. Change in total Al and Cu concentrations in Waste Rock Creek during the Project's Closure (Al only) and Post-Closure phases. Change in total Se concentrations in Waste Rock Creek during the Project's Closure and Post-Closure phases.	Not significant Not Significant Not Significant Not Significant	None identified None identified None identified None identified
Direct Mortality	Construction and upgrading access roads may improve access to fishing locations, which could lead to increased fishing pressure and mortality.	• Implement Access Management Plan. • Continue existing onsite "no fishing" policy from Kemess South. • Conduct instream works during appropriate fisheries work window with a qualified environmental professional (QEP) present to monitor instream works.	No residual effect	N/A	N/A
Erosion and Sedimentation	Land disturbance could increase surface erosion and runoff, leading to increases in TSS, turbidity, nutrients, and metals, and sedimentation in the receiving environment.	• Implement Surface Erosion Prevention and Sediment Control Plan, Fish and Aquatic Effects Monitoring Plan, and Surface Water Management Plan. • Use of sediment and erosion control BMPs. • Minimizing clearing and grubbing dimensions during construction activities.	No residual effect	N/A	N/A
Habitat Loss	Removal of vegetation within the terrestrial ecology LSA during Project construction has the potential to alter and/or result in the loss of riparian and instream fish and aquatic habitat. Loss of riparian habitat could result in subsequent alteration or loss of instream habitat features, including pools, aquatic vegetation, and substrates that could also affect availability of overwintering, spawning and rearing habitats for fish and aquatic colonization opportunities for primary and secondary producers.	• Implement Surface Erosion Prevention and Sediment Control Plan, and Fish and Aquatic Effects Monitoring Plan. • Identification and application of appropriate riparian zones as per the *Forest and Range Practices Act* (2002c). • Use of sediment and erosion control BMPs. • Falling of trees (if required) away from watercourses.	No residual effect	N/A	N/A

Table 25.6-5. Summary of Interaction Pathways and Mitigation Measures for Migratory Birds

Interaction Pathways	Key Potential Effect	Mitigation Measures	Residual Effect	Significance of Residual Effects	Cumulative Residual Effects
Migratory Waterbirds					
Direct Mortality	Migratory waterbird mortality due to nest removal during vegetation clearing	• Implement Wildlife Management and Monitoring Plan. • Timing of vegetation clearing outside of the breeding season of migratory birds (April 1-July 31). • Pre-clearing surveys if development activities take place during the breeding season (April 1-July 31).	No residual effect anticipated.	N/A*	N/A
Habitat Loss and Alteration	Direct removal or alteration of wildlife habitat may occur during the Construction phase of the Project due to vegetation clearing in the Project footprint area.	• Implement Wildlife Management and Monitoring Plan. • Minimize clearing during Construction. • Avoid active waterbird nests by conducting clearing outside the breeding period (April 1-July 31). • Pre-construction surveys for nests in suitable habitat when clearing occur during the breeding period. • If waterbird nests are found during the pre-construction surveys, an undisturbed buffer area will be established around nests. If it is necessary to work within the buffer during the breeding season, surveys will be conducted to ensure no nests will be impacted.	No residual effect anticipated.	N/A	N/A
Sensory Disturbance	Sensory disturbance could result from elevated continuous Project noise during Construction and Operation and from instantaneous noise sources such as vehicle traffic. Potential consequences of sensory disturbance include functional loss of habitat due to avoidance, increased energetic costs due to decreased foraging time and increased flying time, nest abandonment and increased predation rates, and reduced reproductive success.	• Implement Wildlife Management and Monitoring Plan. • Perform routine maintenance on vehicles and equipment. • Use noise dampening measures (e.g., mufflers) on machinery. • Vehicles to adhere to speed limits.	No residual effect anticipated.	N/A	N/A
Chemical Hazards	Two potential sources of exposure to COPC from Project-related activities were identified for waterbirds; uptake of COPC through direct ingestion of water from the KUG TSF during Operations and uptake of selenium from the water and aquatic food chain in Waste Rock Creek during Closure and Post-Closure. The potential consequence of this is reproductive impairment (decreased fertility, reduced egg hatchability, and increased incidence of deformity in embryos).	• Implement Wildlife Management and Monitoring Plan, Surface Water Management Plan, and Fish and Aquatic Effects Monitoring Plan. • Deter waterbirds from using the KUG TSF if water quality in the KUG TSF exceeds wildlife guidelines. • Monitor water quality in Waste Rock Creek as per the Fish and Aquatic Effects Monitoring Plan during Closure and initial Post-Closure to facilitate potential adaptive management and mitigation measures.	No residual effect anticipated.	N/A	N/A
Migratory Landbirds					
Direct Mortality	Potential sources of migratory landbird mortality are collisions with vehicles (traffic along access roads) as landbirds can be attracted to road salts, gravel, and sand; (Mineau and Brownlee 2005) and to nest removal during vegetation clearing.	• Implement Wildlife Management and Monitoring Plan. • Timing of vegetation clearing outside of the breeding season of migratory birds (April 1-July 31). • Pre-clearing surveys if development activities take place during the breeding season (April 1-July 31). • Speed restrictions will be imposed to reduce incidences of vehicle-wildlife collisions. The maximum speed limit on access roads will be 50 km/hour.	No residual effect anticipated.	N/A	N/A

(continued)

Table 25.6-5. Summary of Interaction Pathways and Mitigation Measures for Migratory Birds (completed)

Interaction Pathways	Key Potential Effect	Mitigation Measures	Residual Effect	Significance of Residual Effects	Cumulative Residual Effects
Migratory Birds (Landbirds) *(cont'd)*					
Habitat Loss and Alteration	Direct habitat loss and alteration (i.e., Project area) will occur wherever forest stands are cleared or snags and woody debris are removed from otherwise open areas. Some areas identified as high-quality habitat for the olive-sided flycatcher are predicted to be lost or altered in the wildlife LSA, including 132 ha or 7.6% of the LSA. Assuming a similar proportion of the habitat available in the wildlife RSA is suitable for olive-sided flycatcher this would represent a 0.087% loss of habitat in the RSA.	• Implement Wildlife Management and Monitoring Plan. • Pre-clearing surveys within seven days prior to vegetation clearing will be conducted if clearing is to take place during the breeding season (April 1 to July 31). • Buffer distances will be established and implemented around identified active nests during the breeding season until nestlings have fledged.	Direct habitat loss and alteration is not predicted to result in a residual effect on migratory landbirds, with the exception of the olive-sided flycatcher. Habitat loss and alteration of high-quality habitat for olive-sided flycatcher will be 7.6% of what is available within the wildlife LSA (0.087% of wildlife RSA habitat) and due to the species status as Threatened and observations of the species within the LSA this is considered a residual effect.	Not Significant	None anticipated
Sensory Disturbance	Sensory disturbance to landbirds was evaluated for the potential to occur due to continuous and instantaneous noise from Construction and Operation phases of the Project. Habitat areas have the potential to be functionally lost if elevated noise levels prevent effective auditory communication.	• Implement Wildlife Management and Monitoring Plan • Perform routine maintenance on vehicles and equipment • Use noise dampening measures (e.g., mufflers) on machinery • Vehicles to adhere to speed limits.	Sensory disturbance is not predicted to result in a residual effect on migratory landbirds. Taking a precautionary approach for olive-sided flycatcher, it is predicted to be a residual effect on this species because of its federal status as Threatened under Schedule 1 of *SARA* and observations within the wildlife LSA, up to 7.8% of high-quality olive-sided flycatcher habitat in the LSA may be disturbed due to noise.	Not Significant	None anticipated
Attractants	A small portion of the upland bird community may be attracted to the areas close to the Project infrastructure for establishment of breeding territories. It is possible that birds may use Project infrastructure as habitat (e.g., elevated sites for perching, singing, and nesting).	• Implement Wildlife Management and Monitoring Plan. • Limit access to infrastructure by birds. • Remove nesting material prior to egg-laying.	No residual effect anticipated.	N/A	N/A

** N/A: not applicable*

Landbirds were assessed for potential Project-related effects of habitat loss and alteration, sensory disturbance, direct mortality, and attractants. While this assessment includes all landbirds (e.g., both migratory landbirds and terrestrial gamebirds), the conclusions of the EA are consistent when only migratory landbirds are considered. The effects of disruption of movement, indirect mortality, and chemical hazards were scoped out of this assessment because they were determined to have no interaction with landbirds. The assessment of potential effects on landbirds is presented in Chapter 15. Table 25.6-5 provides a summary of the interaction pathways and mitigation measures for migratory birds.

25.5.3 Changes to the Environment that Would Occur on Federal or Transboundary Lands

The Project is located on provincial Crown land; the nearest federal land to the Project are Indian Reserves (IRs), including Sucker Lake No. 130 (78 km from the Project), Bear River 3 (88 km from the Project), and Fort Ware No. 80 (76 km from the Project). These IRs are located outside of the RSA for all VCs assessed in the Application (i.e., they are located outside of the area where measurable Project effects are expected to occur). Thus, no federal lands will be affected by the Project.

The Project is located it upper Finlay River watershed within the greater Peace River watershed. The Peace River flows east across northeastern BC, to Alberta to Lake Athabasca, and then north via the Slave River to Great Slave Lake in the Northwest Territories, finally emptying to the Arctic Ocean via the Mackenzie River. This downstream environment of the Project lies entirely within Canada. The RSAs for both surface hydrology and surface water quality do not extend beyond the Finlay River in north-central BC; thus, no transboundary lands will be affected by the Project.

25.5.4 Changes to The Environment that are Directly Linked or Necessarily Incidental to Federal Decisions

Section 5(2)(a) of CEAA 2012 requires the EA to evaluate changes to the environment that are directly linked or necessarily incidental to federal decisions as a result of the Project.

AuRico will require an approval under the *Explosives Act* to store and manufacture explosives. Pursuant to Section (7) of the *Explosives Act*, the Minister may issue (a) licences for factories and magazines; (b) permits for vehicles used for the transportation of explosives; and (c) certificates for carrying out, on an occasional and temporary basis, activities relating to the manufacture, testing or storage of explosives or the use of fireworks or the training of persons in the use of fireworks. The existing KS Mine site has explosives magazine licences to store both mining and avalanche explosives; however, a new license(s) may be required for Operations. As the environmental effects to this new license will be limited to small areas of ground disturbance, negligible environmental effects are expected.

There will be a total of four explosives magazines and four explosives accessories (i.e., cap) magazines underground: two on each of the extraction and undercut levels, located on the east and west rim tunnels. Explosives magazines will hold both packaged and bulk emulsion-based explosives required for both development and production activities. All magazines will be constructed in adherence with BC mining and construction regulations (BC MEMPR 2008). Detonators are stored separately from explosives supplies in magazines purpose-designed for each. The existing explosives facilities are

suitable for continued use for the Project. It is not anticipated that there will be any effects to the environment related to the manufacture, testing or storage of explosives.

In addition to new authorizations under the *Explosives Act*, AuRico holds existing authorizations under federal legislation for the KS Mine that have been in place since 1996 and remain in good standing (Table 25.6-6). These authorizations will be applicable to the KUG Project, though may require amendment or renewal before construction begins. Project activities related to the existing authorizations required under the *Explosives Act* (1985a), *Radiocommunication Ac*t (1985c), *Nuclear Safety and Control Act* (1997), and *Firearms Act (1998)* will not result in any effects to the environment.

Table 25.6-6. Existing Authorizations

Relevant Legislation	Authorization	Date	Relevant Project Component/Activity
Radiocommunication Act (1985c)	Radio License (1985c)	Re-issued February 2, 2015	Mine site communications
Nuclear Safety and Control Act	Nuclear Substances License – Fixed gauges (15710-1-17.0)	Re-issued November 10, 2015	Identification of site nuclear gauge sources and corresponding storage locations
Explosives Act (1985a)	Explosives Magazine License (BC-682)	Re-issued July 3, 2015	Storage of main magazine explosives and detonators including avalanche control explosives and detonators
Firearms Act (1998) Authorizations to Carry Restricted Firearms and Certain Handguns Regulations (SOR/98-207)	Corporate Firearm Licence (11750426.0010)	August 4, 2018	Site is used by wildlife, particularly bears, and occasionally are a safety risk for personnel

25.5.5 Effects of Changes to the Environment that are Directly Linked or Necessarily Incidental to Federal Decisions

Section 5(2)(b) of *CEAA* (2012) requires the EA to evaluate the effects of changes to the environment that are directly linked or necessarily incidental to federal decisions as a result of the Project that result in an effect to health or socio-economic conditions, physical and cultural heritage, or any site or thing that is of historical, archaeological, paleontological or architectural significance. As no changes to the environment that are directly linked or necessarily incidental to a federal decision are predicted for the Project, no effects of any changes are predicted.

25.6 CONCLUSION

The Project is a brownfield project and it will be developed using areas of existing disturbance and KS Mine infrastructure, which is now in care and maintenance. Northgate Minerals previously proposed to develop the KUG deposit as the Kemess North Project (KN). KN was to be an open pit mine that included use of Amazay Lake as a tailings and waste rock storage facility. It underwent a

federal and provincial environmental assessment by panel review in 2007. The panel recommended that KN not be approved as proposed and invited Northgate Minerals to submit an alternate project description for development of the KUG deposit. AuRico's proposed development of the KUG deposit by means of an underground mine with a limited area of new surface disturbance substantially addresses the concerns raised during the KN panel review. AuRico has used the EA outcomes from KN and the current EA specific to the KUG Project to identify design changes in response to environmental constraints present in the Project area, First Nations concerns, and potential environmental effects. Design changes are summarized as follows:

- developing the Project as an underground mine to:
  - minimize production of PAG waste rock;
  - substantially reduce the amount of new surface disturbance; and
  - manage safety issues in an area of high avalanche risk;
- eliminating the need to use Amazay Lake, which has high cultural and historical importance to TKN First Nations, by using the KS Mine open pit for subaqueous waste rock and tailings storage;
- selecting the 4.8 km access route from the KS Mine to the KUG deposit in consultation with First Nations groups, and avoiding high value forested areas;
- tunnelling through the ridgeline between the KS Mine site and the underground portal area rather than constructing a proposed road corridor along Upper El Condor Creek and Kemess Lake than to minimize landslide, avalanche and weather risks;
- removing proposed surface explosives magazines from the portal area due to potential landslide and avalanche risks and using existing explosives magazines near the KS Mine site; and
- selecting water management, treatment, discharge rates and location for discharge of water from the KUG TSF based on comprehensive engagement with the TKN First Nations as well as extensive water quality and water balance modelling, and receiving environment water quality and quantity considerations.

AuRico has a positive track record of conducting mine operations, reclamation and closure activities associated with the KS Mine. AuRico's reclamation program for the KS Mine has received several citations by the BC Technical and Research Committee on Reclamation for outstanding achievement in reclamation at a metal mine. AuRico is dedicated to continuing to conduct its business in a sustainable manner that achieves a balance between the environment, society, and the economy which is consistent with the intention of the BC EA process to promote sustainable development, while minimizing adverse environmental, economic, social, heritage, and health effects.

The Project will directly and indirectly create up to 23,545 person-years of employment in Canada and British Columbia during construction, operation, and closure, and will generate up $482.4 million in tax revenues for the governments of BC and Canada. In addition, the Project will contribute corporate tax revenue of $76.5 million (provincially), and $114.3 million (federally).

AuRico recognizes that the success of the Project is dependent on the establishment of positive and trusting relationships with Aboriginal groups, communities, stakeholders, government agencies, and the public. To this end, AuRico re-engaged with the TKN in 2010, prior to the Project formally entering the EA process in February 2014. An Interim Measures Agreement (IMA) signed by TKN and AuRico in June 2012 formally establishes the relationship between the parties, and has guided TKN involvement in the EA process. The IMA establishes two committees which have been instrumental to ensuring effective communications between TKN and AuRico. The Senior Implementation Committee and the Environmental Management Committee, comprised of TKN Chiefs, TKN technical representatives and AuRico's VP Development, Chief Operating Officer, Director Environment and Director Government Affairs and Community Relations, provides input on studies related to the Project's environmental assessment as well as identify new studies outside of the environmental assessment. Since May 2013, the Senior Implementation Committee has met 28 times, and the Environmental Management Committee has met 34 times. Negotiation of an Impact Benefits Agreement is currently underway with TKN.

As part of the development of the Application, TKN have contributed by participating in EA Working Group meetings, reviewed and commented on baseline study reports, the draft Valued Scoping Summary and various drafts of the Application Information Requirements (AIR), and hosted nine (three each) meetings in their communities. The TKN also contributed to AuRico's evaluation of proposed water discharge alternatives from the KUG Tailing Storage Facility (Appendix 4-D). The TKN also managed and provided oversight on the Traditional Land Use and Knowledge Study (Appendix 20-A) for the Project area, and information from this report has informed technical studies and has been incorporated throughout the Application. AuRico has provided the EA Application to TKN in advance of its submission to the BC EAO for screening against the AIR (2016) to provide TKN with additional review time.

This Application for an Environmental Assessment Certificate (EAC) (Application) represents the application made by AuRico Metals Inc. (AuRico) under the BC EAA and CEAA 2012. Subsequent to consideration of the content provided in the application, AuRico requests that the federal Minister of the Environment issue a decision statement under section 52 of CEAA 2012, and that the Province of BC issued an EA certificate for the Project to proceed. Successful completion of subsequent permitting processes is required prior to AuRico constructing, operating, and decommissioning the Project.

REFERENCES

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