

centerra **GOLD**



# Kemess Underground Mine 2020 Annual Report

Prepared for:

Impact Assessment Agency of Canada

Report Authored by:

Centerra Gold Inc.

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## EXECUTIVE SUMMARY

Aurico Metals Inc., a wholly own subsidiary of Centerra Gold Inc., obtained the Canadian Environmental Ministers Decision Statement on March 13, 2017 for the Kerness Underground Mine, an underground mine located in the mountains of north-central British Columbia (BC), 430 kilometres northwest of Prince George. Pre-construction activities commenced July 2018. The Implementation Schedule was provided to Aboriginal groups and the Canadian Environmental Assessment Agency (CEAA) in 2017. Pre-construction activities (road building, clearing) for the Kerness Underground Project Commenced July 16, 2018.

At the mine site, fish and fish habitat protection continues to be achieved through the implementation of erosion and sediment control (ESC) techniques as part of the KUG pre-construction activities in 2020. Very limited construction activities were located within the mine site water management area (MSWMA). Runoff water from the East Pit Quarry continued to flow into the Kerness Underground (KUG) tailings storage facility (TSF).

All water that reports to the MSWMA is either pumped to the KUG tailings storage facility (TSF) or flows to sediment settling features (i.e. settling ponds, check-dams) prior to release into the natural environment. Kerness implemented supplementary construction site water management and erosion control measures including the implementation of check dams, French drain features, placement of rip-rap, and hydroseeding efforts.

Monitoring of the Omineca Resource Access Road (ORAR) was completed to ensure adequate escape pathways were present to allow ungulates to exit the plowed roads during winter months when snowbanks were greater than 1 metre in height. A Hunting, Fishing and Gathering Policy was implemented in 2018 to prohibit fishing, hunting, and trapping within the Project area.

Minimal clearing occurred in 2020. A 0.863 ha parcel of land was cleared to facilitate the construction of the SCSP pond. Pre-clearing surveys were conducted on May 19<sup>th</sup> and 20<sup>th</sup>, 2020 by a Qualified Professional. No suitable habitat was identified for Western Toad (*Anaxyrus boreas*). No maternal roosts were discovered for little brown myotis (*Myotis lucifugus*) and Northern myotis (*Myotis septentrionalis*). No furbearer dens or migratory bird nests were found.

No heritage or archaeological sites were discovered during the 2020 construction activities or during archaeological monitoring.

No accidents or malfunctions occurred in 2020 that had the potential to cause adverse environmental effects or trigger the emergency response plan.

## Résumé

Aurico Metals Inc., une société filiale en propriété exclusive à Centerra Gold Inc., a obtenu une déclaration de décision émise par le Conseil canadien des ministères de l'environnement le 13 mars, 2017, par rapport à Kemess Underground Mine (KUG). Cette mine souterraine est située dans les montagnes nord-centrales de la Colombie-Britannique (C-B), à 430 kilomètres au nord-ouest de Prince George. L'horaire de mise en oeuvre fut fournie aux groupes autochtones et à l'Agence canadienne d'évaluation environnementale (ACEE) en 2017. Les activités de pré-construction (construction de routes, défrichage de clairières) ont été initiées le 16 juillet 2018.

La protection des poissons et d'habitats de poissons a continué à la mine en 2020 grâce a la réalisation de technologies destinées à la lutte contre l'érosion dans le cadre des activités de pré-construction. Très peu de construction fut localisée dans la zone d'exploitation minière concernant la gestion des eaux. Le ruissellement en provenance du East Pit Quarry a continué à s'écouler vers le dépôt de résidus miniers du KUG.

Toutes les eaux se rapportant à la zone d'exploitation minière concernant la gestion des eaux sont soit pompées vers le dépôt de résidus miniers ou re-dirigées aux bassins de décantation des sédiments avant d'être émises a l'environnement. Kemess a mis en oeuvre des mesures supplémentaires pour la gestion des eaux et la lutte contre l'érosion telles que l'établissement des barrages de correction, de drains à pierres sèches, de riprap et d'ensemencement hydraulique.

En hiver, quand les bancs de neige excédaient 1 mètre en hauteur, un programme de surveillance de la Omineca Resource Access Road (ORAR) fut complété afin d'assurer le passage aux ongulés. Une politique de chasse, pêche et ceuillete mise en place en 2018 interdit ces activités dans la zone du projet.

Seule une parcelle de 0.863 ha fut défrichée en 2020 afin de faciliter la construction du bassin SCSP. Un inventaire complété pré-construction le 19 et 20 mai 2020 par un professionnel qualifié, n'a pas révélé d'habitat de crapaud boréal (*Anaxyrus boreas*), de nichoir à petite chauve-souris brune (*Myotis lucifugus*) ou de vespertillon nordique (*Myotis septentrionalis*). Aucune tanière d'animal à fourrure ou nid d'oiseau migrateur n'a été identifié.

Aucun site patrimonial ou emplacement archéologique n'a été découvert durant les activités de construction ou les relevés archéologiques entrepris en 2020.

Aucun accident ou défaut de fonctionnement ayant le potentiel de créer des effets environnementaux nuisibles ou de déclencher le plan des mesures d'urgence ne s'est produit en 2020.

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## 1. Introduction

AuRico Metals Inc. (AuRico) is a wholly own subsidiary company of Centerra Gold Inc. and is developing the Kemess Underground (KUG) Project, an underground copper-gold mine at the site of the former Kemess South mine.

The Project consists of the economic extraction of copper and gold ore from the underground deposit using panel caving techniques and processing approximately 13.5 million tonnes per year (average 37,500 tonnes per day equivalent) with an average annual production rate estimated at 149,000 ounces of gold and 63 million pounds of copper with a mine life of approximately 11 years. The project is located at the former Kemess South mine, which operated as an open pit copper-gold mine until 2011 and will use existing infrastructure to the extent possible. Other than the existing Kemess South development, the Project is located in a relatively undeveloped area in north central BC with limited sources of anthropogenic air emissions. Mineral exploration and forestry activities are the primary industrial related activities in the region.

AuRico received both a BC provincial Environmental Assessment Certificate (#M17-01) and a Canadian Environmental Ministers Decision Statement in March of 2017. All the various provincial and federal permits required to construct the mine have been received. Surface pre-construction activities began at the Kemess Mine Site on July 6, 2018.

This report has been developed to meet Decision Statement Condition 2.9: *“the Proponent Shall, commencing in the reporting year during which the Proponent begins the implementation of the conditions set out in this Decision Statement, prepare an annual report”*. The report is laid out such that each heading addresses an annual reporting requirement defined within the subheadings of Condition 2.9.

## **2. Condition 2.9.3: Consideration for consultation**

*2.9.3 for conditions set out in this Decision Statement for which consultation is a requirement, how the Proponent considered any views and information that the Proponent received during or as a result of the consultation*

The following sections identify the Decision Statement conditions that required consultation and how the Proponent has considered the views and information received as per the requirements set out in Condition 2.2.

*2.2 The Proponent shall, where consultation is a requirement of a condition set out in this Decision Statement:*

*2.2.1 provide a written notice of the opportunity for the party or parties being consulted to present their views and information on the subject of the consultation;*

*2.2.2 provide sufficient information on the scope and the subject matter of the consultation and a reasonable period of time to permit the party or parties being consulted to prepare their views and information;*

*2.2.3 provide a full and impartial consideration of any views and information presented by the party or parties being consulted on the subject matter of the consultation; and*

*2.2.4 advise in a timely manner the party or parties being consulted on how their views and information have been considered by the Proponent.*

### **3. Condition 3: Fish and Fish Habitat**

#### **3.1. Condition 3.1**

*The Proponent shall implement erosion and sedimentation control measures within the Project are during all phases of the Designated Project to avoid the deposit of deleterious substances in water frequented by fish.*

As per the Erosion Prevention and Sediment Control Plan, erosion and sediment control (ESC) techniques were implemented as part of all the KUG activities in 2020. All water that reports to the mine site water management area (MSWMA) is either pumped to the KUG tailings storage facility (TSF) or flows to sediment settling features (i.e. settling ponds, check-dams) prior to release into the natural environment.

Settlement ponds were successful in reducing sediment transport within the MSWMA, verified by in-situ turbidity measurements at discharge points. Three exceptions were noticed on June 19<sup>th</sup> at monitoring stations WQ-25, WQ-03 and WQ-01 (readings >10 NTU). Investigation concluded that this increased turbidity was the result of a naturally occurring landslide along Mill Creek, upstream of the MSWMA, therefore not related to mine activity. Turbidity at these stations returned to normal levels (<10 NTU) on June 21<sup>st</sup>.

#### **3.2. Condition 3.2**

*The Proponent shall, taking into consideration Fisheries and Oceans Canada's Measures to Avoid Causing Harm to Fish and Fish Habitat Including Aquatic Species at Risk, implement mitigation measures when conducting Designated Project activities to avoid causing harm to fish and fish habitat, including timing work in or around water to respect the timing windows identified to protect fish.*

No in-stream works were conducted during the reporting period. To avoid and mitigate any potential for serious harm to fish, the following measures will be implemented:

- Works will be completed during the November- February low flow period;
- A qualified environmental professional will be present to monitor for the presence of fish in the immediate construction areas; and
- Riparian clearing will be kept to a minimum.

#### **3.3. Condition 3.3**

*The Proponent shall comply with the Metal Mining Effluent Regulations and subsection 36(3) of the Fisheries Act regarding the deposit of effluent from the Designated Project in water frequented by fish, taking into account the Canadian Council of Ministers of the Environment's Water Quality Guidelines for the Protection of Aquatic Life, from the start of construction to the end of decommissioning. In doing so, the Proponent shall:*

*3.3.1 place all acid-generating and potentially acid-generating material into the tailings storage facility and submerge all such materials placed in the tailings storage facility under a permanent water cover; and*

During construction activities at the Kemess mine site, all acid-generating and potential acid-generating material was deposited into the KUG tailings storage facility under a permanent water cover.

In 2019, it was identified that potential acid-generating rock was placed as a roadbed material along the South Portal Access Road. In 2020, Approximately 17880 tonnes of this roadbed material was removed and placed in the Tailings Storage Facility. The excavated rock was replaced with suitable non-acid generating material.

*3.3.2 collect and treat all waters affected by the Designated Project that do not meet the requirements of the Metal Mining Effluent Regulations and subsection 36(3) of the Fisheries Act, as applicable, prior to the affected waters being deposited in waters frequented by fish.*

Water quality sampling will take place as per the Metal and Diamond Mining Effluent Regulation (MDMER) and the *Fisheries Act*, when production triggers that requirement, and will be conducted in accordance with the Canadian Council of Ministers of the Environment's Water Quality Guidelines for the Protection of Aquatic Life.

Select seepage water from the NAG Waste Rock Dump, relatively high in selenium, was collected in the Selenium Collection Pond. This water was then pumped directly to the KUG tailing storage facility through a pump and pipeline system. The new Southern Collection System Pond (SCSP) was completed and commissioned in Sept 2020 allowing a greater quantity of seepage water from the NAG waste rock dump to be captured and diverted to the KUG TSF.

### **3.4. Condition 3.6**

*The Proponent shall divert all runoff from the East Pit quarry into the tailings storage facility during construction and operation.*

Runoff from the East Pit Quarry drainage reports directly into the tailings storage facility via existing drainage ditches. Most flow is captured by gravity, and the rest is collected in a ditch that reports to Dump Pond 1 which is then pumped to the KUG tailings storage facility. No additional measures or works were implemented in 2020. Monitoring of the drainage pattern from the East Pit Quarry will continue through the pre-construction and operations phases of the mine life in accordance with the Mine Site Water Management Plan. Photo documentation of the East Pit Quarry drainage area into the KUG tailings storage facility (plate 3.6-1) is present in Appendix B.

### **3.5. Condition 3.7**

*Discuss consultation activities relative to Condition 3.7: The Proponent shall develop, prior to construction and in consultation with Indigenous groups, Gitxsan Wilp Nii Kyap, and relevant authorities, and implement, from the start of construction to the end of decommissioning, a follow-up program to verify the accuracy of the environmental assessment as it pertains to fish and fish habitat and to determine the effectiveness of mitigation measures referred to in conditions 3.1 to 3.6. As part of the follow-up program, the Proponent shall:*

*3.7.1 monitor quality of water discharged in Attichika Creek during the dewatering of the Kemess South Pit and treat that water to meet the requirements of subsection 36(3) of the Fisheries Act;*

*3.7.2 monitor surface water quality in Amazay Lake and groundwater movement between the subsidence zone identified by the Proponent during the environmental assessment and Amazay Lake;*

*3.7.3 monitor changes in channel form and sediment load downstream of the discharge location in Attichika Creek;*

*3.7.4 monitor changes in water quality in Waste Rock Creek and the tailings storage facility, including changes in selenium concentrations;*

*3.7.5 monitor the presence and use of spawning habitat by bull trout (*Salvelinus confluentus*) and rainbow trout (*Oncorhynchus mykiss*) downstream of the discharge location in Attichika Creek prior to and after the installation of the discharge pipeline into Attichika Creek. The Proponent shall offset any loss of spawning habitat for bull trout (*Salvelinus confluentus*) and rainbow trout (*Oncorhynchus mykiss*) in Attichika Creek if monitoring results show that spawning habitat loss has occurred; and monitor contaminants, including mercury, in the tissue of fish species harvested by Indigenous groups in Thutade Lake, including bull trout (*Salvelinus confluentus*)*

AuRico Metals submitted its permit application to the Major Mines Permitting Office (MMPO) on August 31, 2017. Prior to the official permit application submission, AuRico Metals consulted with Tsay Keh Nay (TKN) on the development of Fish and Aquatic Effects Monitoring Plans (FAEMP), Wildlife Management and Monitoring Plan, and Mine Site Water Management Plan (MSWMP), circulating draft copies of these plans on June 30, 2017, 60 days in advance of official permit application submission. These plans were developed in consideration of Condition 3.7. AuRico and TKN continued to consult on management plans through the permitting process and through established collaboration and consultation methods espoused within the 2017 Impact Benefit Agreement. Permitting and permitting consultation activities with relevant authorities and TKN as part of the Mine Review Committee (MRC) for KUG is ongoing.

During the permitting process, TKN, via their consultants at Environment Dynamics Incorporated (EDI), provided feedback on Fish and Fish Habitat. TKN comments focused on the Selenium Management Plan which outlines a selenium monitoring plan as well as mitigation measures for capturing flows with elevated selenium and addressing potential flow reduction in Waste Rock Creek. TKN is concerned that reduced flows in Waste Rock Creek may result in the environmental flow needs for fish and fish habitat not being met in Waste Rock Creek. In response, AuRico installed an additional monitoring station (WQ-14ds) in 2018 to gather flow data to verify model flow predictions, data from which will be used to inform management decisions if the environmental flow needs in Waste Rock Creek are not being met.

The TKN and AuRico IBA provides for capacity funding to support Additional Environmental Studies initiated by TKN, proposals for which are put forward to AuRico by TKN. In 2016 the Additional Studies program researched bull trout migration behaviour, spawner residence time and critical habitats in Lower Attichika Creek. Year three of the three-year study was completed in the summer of 2019, continued into 2020 and is currently being evaluated for continuation into 2021. Results from the Attichika Creek Bull Trout Study are shared between TKN and AuRico.

During the 2020 season of May-October, the Attichika Creek diffuser program was put into operation. Daily monitoring of flows entering Attichika Creek through the diffuser were taken and volumes adjusted to meet the permit requirements. Both Water Quality sampling and Toxicity testing continued throughout the pumping

duration. No toxicity failures were noted and all information was relayed to the Environmental Monitoring Committee (EMC) on a monthly basis. The Attichika Diffuser is shown in photo plate 3.5.1.

## **4. Condition 4: Migratory Birds**

### **4.1. Condition 4.1**

*The Proponent shall carry out Designated Project activities in a manner that protects migratory birds and avoids harming, killing, or disturbing migratory birds or destroying, disturbing, or taking their nests or eggs. In this regard, the Proponent shall take into account Environment and Climate Change Canada's Avoidance Guidelines. The Proponent's actions in applying the Avoidance Guidelines shall be in compliance with the Migratory Birds Convention Act, 1994 and with the Species at Risk Act.*

The only construction activities in 2020 that resulted in any vegetation clearing was completion of the SCSP collection ditch.

No nesting birds, active nests, furbearer dens or bat roosts were observed within the clearing area during the pre-clearing survey, and permission to initiate clearing was given by the Qualified Professional (Appendix D).

### **Condition 4.2**

*The Proponent shall deter migratory birds from accessing the tailings storage facility and seepage ponds until water quality is not harmful to migratory birds.*

Use of the KUG tailing storage facility and seepage ponds by migratory birds was monitored throughout the 2020 reporting year as part of the on-site wildlife reporting. No instances of birds accessing or inhabiting the tailing storage facility or seepage ponds were reported in 2020. Monitoring for use by migratory birds will continue in 2021 and deterrent(s) will be implemented as necessary. Although the water quality of the KUG tailings storage facility does not meet guidelines for some parameters, it is not considered harmful to migratory birds.



## **5. Condition 5: Human Health**

### **5.1. Condition 5.1**

*The Proponent shall develop, prior to construction and in consultation with Indigenous groups and relevant authorities, a follow-up program to verify the accuracy of the environmental assessment as it pertains to adverse effects on the health of Indigenous Peoples caused by changes in concentrations of contaminants of potential concern identified during the environmental assessment in air, soil, water, and sediment. The Proponent shall implement the follow-up program during construction and operation. As part of the development of the follow-up program, the Proponent shall:*

*5.1.1 identify levels of environmental change relative to established baseline conditions for contaminants of potential concern that would require the Proponent to implement modified or additional mitigation measure(s) to mitigate increased risks to human health; and*

*5.1.2 if monitoring results demonstrate that concentration levels for contaminants of potential concern are greater than the identified levels of environmental change, update the human health risk assessment for the consumption of traditional foods exposed to these contaminants and communicate the results of the updated human health risk assessment to Indigenous groups.*

AuRico Metals circulated the proposed Human Health Follow-up Program to TKN via email on March 20, 2018. A reminder of requests for feedback was discussed at the April 20, 2018 EMC meeting. To date no comments have been received. The Human Health Follow-Up Program dated February 2018 is present in Appendix A. In addition, the Health Canada comments on the Human Health Follow up Program are also included in this report under Appendix A.

## **6. Condition 6: Current Use of Lands and Resources for Traditional Purposes**

### **6.1. Condition 6.1**

*The Proponent shall install and maintain, during construction and operation, ramps every 100 to 300 metres over the discharge line between the tailing storage facility and Attichika Creek to provide passage for moose (*Alces alces*), woodland caribou (*Rangifer tarandus caribou*), grizzly bear (*Ursus arctos*), and furbearers. The Proponent shall identify the locations of ramps in consultation with Indigenous groups and relevant authorities.*

The KUG discharge line between the tailing storage facility and Attichika Creek was installed in 2018. There are no other impediments relating to this condition. The entire discharge line was buried at the time of installation; therefore, wildlife access will not be impeded, and installation of ramps became unnecessary.

### **6.2. Condition 6.2**

*The Proponent shall create and maintain, during construction and operation, escape pathways along all access roads associated with the Designated Project, including the northern section of the Omineca Resource Access Road, to allow ungulates to exit the plowed roads. The Proponent shall identify the locations of escape pathways in consultation with Indigenous groups and relevant authorities.*

As per the Wildlife Management and Monitoring Plan, Kemess conducted a monitoring program of the Omineca Resource Access Road (ORAR) snowbanks during the winter months of 2020. Management of snowbanks on the ORAR included ensuring banks remained under one metre in height or that sufficient gaps were presents to provide escape pathways to allow ungulates to exit the plowed roads. Monthly monitoring events were carried out by Kemess Environmental staff augmented by the contracted snow removal company on a regular, sometimes daily basis. Any events of ORAR snowbank non-compliance were noted in 2020. Photo documentation of the ORAR snowbank survey (plate 6.2-1) is present in Appendix B. For the winter season of 2020-2021, the ORAR was not being kept open and maintained, therefore no monitoring was necessary in the latter half of 2020.

Kemess also completed snow track surveys to monitor the use of escape gaps and high-traffic crossing areas created in snowbanks along the ORAR. This data will be used to selectively install wildlife crossing signs along the ORAR in high-traffic areas in the future.

### **6.3. Condition 6.3**

*The Proponent shall, from the start of construction to the end of decommissioning, remove carrion within 24 hours of its discovery by the Proponent from all access roads associated with the Designated Project, including the northern section of the Omineca Resource Access Road.*

As per the Wildlife Management and Monitoring Plan, Kemess tracked incidental wildlife occurrences on-site and on the Omineca Resource Access Road (ORAR). All wildlife observations by Kemess staff and contractors were communicated to the Kemess environmental department via in-person communication, radio communication, or self-documentation. Employees are encouraged to submit photos along with the location, date and time of observation to help confirm the ID of the species and track movement. Supplementary data were collected from truck drivers coming to Kemess along the ORAR, as well as Avalanche Technicians who

frequented the ORAR. No instances of carrion were observed on the ORAR during the 2020 reporting year. Carrion monitoring and removal will continue through the life of mine to the end of decommissioning.

#### **6.4. Condition 6.4**

*The Proponent shall prohibit employees and contractors associated with the Designated Project from fishing, hunting, and trapping within the Project Area, unless an employee or a contractor is provided access by the Proponent for traditional purposes or for exercising Aboriginal rights, to the extent that such access is safe.*

As per condition 6.4, AuRico has created the No Fishing, Hunting and Gathering Policy on June 29, 2018 and is reviewed within the new worker orientation. The Kemess Mine Fishing and Hunting Policy (FaHP) is designed to ensure safety of Kemess Mine personnel, contractors and the general public in the Kemess Mine area as well as for the protection of fish, wildlife and plant resources at the mine site. The policy defines that hunting, fishing or trapping, mushroom, berry picking, or the gathering of plants is not permitted by mine personnel or contractors at the mine site at any time. The policy is communicated to all employees at the Kemess Mine site through the mandatory Mine Site Orientation. Supplementary signage is posted around site displaying the policy.

#### **6.5. Condition 6.5**

*The Proponent shall, prior to construction and in consultation with Indigenous groups and relevant authorities, conduct pre-clearing surveys to identify Western toad (*Anaxyrus boreas*) breeding habitat, and shall implement measures to mitigate the loss of Western toad (*Anaxyrus boreas*) breeding habitat caused by the Designated Project.*

Prior to the official permit application submission AuRico Metals consulted with Tsay Keh Nay (TKN) on the development of the Wildlife Management and Monitoring Plan. To date no comments on the Western Toad pre-clearing surveys have been received. AuRico and TKN continue to consult on management plans and follow up program development through established collaboration and consultation methods espoused within the 2017 Impact Benefit Agreement.

No amphibian surveys were conducted in 2020. Pre-clearing surveys of the vegetation clearing performed for completion of the SCSP pond identified the habitat was unsuitable word the Western Toad, therefore the survey was not required (Appendix D)

AuRico, through its joint Environmental Management Committee (EMC) with TKN, discusses plans for any pre-clearing surveys and the subsequent results with TKN.

#### **6.6. Condition 6.6 and 6.7**

*The Proponent shall conduct pre-clearing surveys to determine the distribution of little brown myotis (*Myotis lucifugus*) and Northern myotis (*Myotis septentrionalis*), and establish, in consultation with Indigenous groups and relevant authorities, buffer zones around active hibernacula and active roosts.*

During the permitting process, TKN, via their consultants at Environment Dynamics Incorporated (EDI),

provided feedback on the bat pre-clearing surveys, submitting seven questions. TKN comments focused on the methodology used to identify what species of bat were using roosting structures and identify which roosting structures or nursery bat boxes were actively used.

AuRico conducted initial bat habitat surveys in November of 2017 to inform the initial offsetting requirements for roosting structures. Pre-Clearing surveys were conducted prior to construction from April 17 to April 22, 2018 and thirty-five nursery bat boxes were installed before the start of construction. During 2020, surveys of the bat boxes showed only one instance of bat activity at these sites. Installed bat boxes will be subject to ongoing monitoring to determine usage and if active, will assist in identifying active hibernacula and active roosts and establishing buffer zones.

### **6.7. Condition 6.10**

*The Proponent shall develop, prior to construction and in consultation with Indigenous groups and relevant authorities, a follow-up program to verify the accuracy of the environmental assessment as it pertains to the presence of hoary marmot (*Marmota caligata*), white-tailed ptarmigan (*Lagopus leucura*), and short-eared owl (*Asio flammeus*) within the subsidence zone identified by the Proponent during the environmental assessment and within a buffer area of 250 metres along the limits of that subsidence zone. The Proponent shall implement the follow-up program during construction and operation.*

AuRico Metals submitted its permit application to the Major Mines Permitting Office (MMPO) on August 31, 2017. Prior to the official permit application submission AuRico Metals consulted with Tsay Keh Nay (TKN) on the development of the Wildlife Management and Monitoring Plan circulating a draft copy of the plan for comment and feedback on June 30, 2018, 60 days in advance of the official permit submission. Permitting and permitting consultation activities with relevant authorities and TKN as part of the Mine Review Committee (MRC) for KUG concluded in Q2 2018. To date no specific feedback has been received on the subsidence zone follow up program. AuRico and TKN continue to consult on management plans and follow up program development through the permitting process and through established collaboration and consultation methods espoused within the 2017 Impact Benefit Agreement.

### **6.8. Condition 6.11**

*The Proponent shall develop, prior to construction and in consultation with Indigenous groups and relevant authorities, a follow-up program to verify the accuracy of the environmental assessment as it pertains to the effects of changes caused by the Designated Project to the Chase herd of Southern mountain caribou (*Rangifer tarandus caribou*) and the Thudade herd of Northern mountain caribou (*Rangifer tarandus caribou*) on caribou hunting activities for traditional purposes and to determine the effectiveness of the mitigation measures. The Proponent shall implement the follow-up program from the start of construction to the end of decommissioning. As part of the follow-up program, the Proponent shall:*

*6.11.1 monitor, during construction and the first three years of operation, the use by moose (*Alces alces*),*

*woodland caribou (Rangifer tarandus caribou), grizzly bear (Ursus arctos), and furbearers of the ramps referred to in condition 6.1 and of the escape pathways referred to in condition 6.2; and 6.11.2 monitor mortality of wildlife on all access roads associated with the Designated Project, including the northern section of the Omineca Resource Access Road.*

Follow up programs for conditions 6.11.1 and 6.11.2 are outlined in previous sections 6.1 and 6.2, respectively. Photo documentation of the wildlife cameras set up for KUG (plate 6.8-1) is present in Appendix B.

## **7. Condition 7: Physical and Cultural Heritage and Structures, Sites, or Things of Historical, Paleontological, or architectural Significance**

### **7.1. Condition 7.1**

*The Proponent shall, for any previously unidentified archeological structures, sites, or things of historical, archaeological, paleontological, or architectural significance discovered by the Proponent or brought to the attention of the Proponent by an Indigenous group, Gitxsan Wilp Nii Kyap, or another party during any phase of the Designated Project: 7.1.1 immediately halt work at the location of the discovery; 7.1.2 have a qualified individual conduct an assessment at the location of the discovery; 7.1.3 inform, forthwith, in writing, Indigenous groups and Gitxsan Wilp Nii Kyap of the discovery, and allow for monitoring by Indigenous groups and Gitxsan Wilp Nii Kyap during archeological work; and 7.1.4 comply with all applicable legislative or legal requirements and associated regulations and protocols respecting the discovery, recording, transferring, and safekeeping of previously unidentified archeological structures, sites, or things of historical, archaeological, paleontological, or architectural significance.*

In early August 2017, an Archeological Impact Assessment (AIA) of five ancillary development areas to the proposed KUG was conducted to ensure compliance with the Heritage Consultation Act (HCA) prior to any ground altering activities. A total of 70 ha of area was surveyed, 295 tests were excavated, and 15 exposures were inspected. The field crew consisted of Millennia personnel and members of Tsay Keh Dene, Kwadacha, and Takla Lake First Nations.

In 2018 an Archaeological Chance Find Procedure was developed for the Project. It provides a standard operating procedure should heritage sites, not identified during baseline studies, be discovered during Construction or Operations. The Archaeological Chance Find Procedure includes the following steps if personnel suspect archaeological, traditional use, and paleontological materials or human remains are discovered:

- immediately contact the Environmental Superintendent or Construction Manager to implement a stop work order to reduce/minimize impacts to the site;
- leave the material in place and protect and/or mark the area around the site, and do not disturb or collect any archaeological, paleontological, heritage materials, or human remains; and
- report the discovery to their immediate Supervisor.

The General Manager and the Project Archaeologist will also be notified as outlined in the management plan. The Archaeology Branch and local Aboriginal groups/organizations will be advised of the discovery, if necessary. Final mitigation measures will be determined through consultation with the Archaeology Branch.

No new archaeological sites were identified in 2020 from chance encounters.

### **7.2. Condition 7.2**

*The Proponent shall not undertake any ground altering activities within 50 metres of the boundaries of archeological sites, unless authorized by relevant authorities.*

As per the Heritage Management Plan, all known archaeological sites within 150 m of the Project footprint have been clearly indicated on development maps in relation to the Project footprint components. If construction is occurring within 150 m of a protected heritage site, the site will be flagged or temporarily fenced to serve as a visible barrier. The Kemess Environment Monitor will monitor for archaeological site impacts or situations where construction activities occur less than 50 m from a site. Should impacts be anticipated or found to have occurred within 50 m of an archaeological site, the Project Archaeologist will be contacted to determine if additional mitigation measures are required. Environment Department staff members will be fully briefed on the HMP and resulting mitigation measures.

During construction activities, the preferred mitigation measure for archaeological sites is avoidance. No construction occurred within 150m of any identified site during the 2020 reporting season, therefore, construction monitoring was not required.

## **8. Condition 8: Independent Environmental Monitor**

### **8.1. Condition 8.1**

*Prior to the start of construction, the Proponent shall retain the service of an independent environmental monitor, who is a qualified individual as it pertains to environmental monitoring of mining projects in British Columbia, to observe, record, and report on the implementation of the mitigation measures set out in this Decision Statement.*

Environmental Dynamics Inc. (EDI) was retained in 2018 as the KUG Mine Site independent environmental monitor (IEM). A formal Terms of Engagement Document was submitted to AuRico by EDI in April 2018. EDI has been performing as an IEM throughout the 2020 reporting period.

### **8.2. Condition 8.2**

*The Proponent shall give the independent environmental monitor the authority to stop Designated Project activities that do not comply with the conditions set out in this Decision Statement.*

As per the 2018 IEM Terms of Engagement document, the IEM will have authority for stop work and will keep record of all stop work orders where works are resulting in, or are at imminent risk of, causing material environmental damage, in accordance with the EA Certificate and applicable legislation.

A Stop Work Order may be issued under two circumstances:

- In the event where an environmental incident, or where the completion of works at or in proximity to the location of the incident, has the potential to cause material unauthorized environmental impacts.
- In the event that a lack of compliance with the Certificate conditions, authorizations/permits and management plans has the potential to cause unauthorized adverse material environmental effects and previous communications with the responsible parties have not led reasonable corrective action.

Under both circumstances, the IEM will inform the responsible parties, EAO, CEAA and the Holder of the issue within 24 hours and provide rationale and high-level options/considerations for achieving compliance as soon as possible. A recommendation to lift the stop work order will occur when the IEM is satisfied that the appropriate steps have been taken to ensure compliance. To date no STOP WORK orders have been issued by the IEM.

### **8.3. Condition 8.3**

*The Proponent shall require the independent environmental monitor to prepare reports that include:*

- 8.3.1 a description, including through photo evidence, of the Designated Project activities that occurred and the mitigation measures that were applied during the period covered by the report; and*
- 8.3.2 if any, a description, including through photo evidence, of occurrences of non-compliance related*



*to the implementation of mitigation measures set out in this Decision Statement Page 12 of 14 observed during the period covered by the report, the date of the occurrence(s) of non-compliance, whether Designated Project activities were stopped as a result of non-compliance, how the occurrence(s) of non-compliance was or were corrected by the Proponent, the date that the corrective action(s) was or were completed by the Proponent, or, if any, the status of pending occurrence(s) non-compliance that have not been corrected yet, and a description of any adverse environmental effect(s) associated with the occurrence(s) of non-compliance.*

As per the 2018 IEM Terms of Engagement document, a monthly meeting is proposed to occur with the IEM, the Holder, EAO, CEAA, and other Regulators and Aboriginal Groups. This will be aligned with EMC meetings. The Holder will provide a summary of Project activities since the last meeting and forecasted construction activities. The IEM will provide an update on the following items.

- Review of previous environmental concerns and status; and
- Summary of new environmental non-compliances and incidences, all corrective actions undertaken and successes of those actions.

A summary of compliance will be provided in a monthly report. The IEM will document, through written and photo documentation, any relevant inspections and communications pertaining to any non-compliance within the IEM checklist and the issue tracking log. Non-compliances will be closed out pending corrective action and removed from the issue tracking log in the subsequent report following indication of closure. Corrective actions by the Holder will be documented in the monthly report along with the date of corrective actions, the status of pending occurrences that have not been corrected yet, and a description of any adverse environmental effects associated with the occurrences of non-compliance.

The first IEM inspection commenced July 11-12, 2018, and AuRico Metals has received monthly IEM compliance reports summarizing site visits that occurred in 2020. The site is currently on a care and maintenance status.

#### **8.4. Condition 8.4**

*The Proponent shall require the independent environmental monitor to retain the reports referred to in condition 8.3 until the end of decommissioning. The Proponent shall require the independent environmental monitor to provide the reports referred to in condition 8.3 to the Agency, Indigenous groups, and relevant federal authorities within 10 days of their production. If occurrence(s) of non-compliance are observed by the independent environmental monitor, the Proponent shall require the independent environmental monitor to report all occurrence(s) of non-compliance directly to the Agency, Indigenous groups, and relevant federal authorities immediately.*

AuRico has communicated the requirement for the IEM to retain compliance reports until the end of decommissioning. The IEM and IEM Support will be tasked with documenting compliance with the Certificate conditions and management plan commitments throughout all Project phases. The IEM will provide information to EAO, CEAA, Ministry Energy and Mines (MEM), Ministry of Environment (ENV), Forests, Lands, Natural Resources Operations & Rural Development (MFLNRORD) and to Aboriginal Groups as directed by EAO and set out in the Decision Statement. The IEM will not provide such information or reports to the Holder in

advance of providing such information or reports to the EAO and CEAA. The IEM will submit monthly (or following their site visit) a report to the Holder, the EAO, and CEAA simultaneously via email. Information or reports related to non-compliance will not be submitted to the Holder in advance of providing the information to the EAO and CEAA. To align with Condition No. 12 of the Certificate related to the Environmental Monitoring Committee (EMC), and item 8.4 of the Decision Statement to provide reports to Indigenous groups, the IEM will submit the monthly (subject to site visit) and end of phase reports to the EMC on behalf of the Holder.

## **9. Condition 9: Accidents and Malfunctions**

### **9.1. Conditions 9.1, 9.2, 9.3, 9.4**

*9.1 The Proponent shall take all reasonable measures to prevent accidents and malfunctions that may result in adverse environmental effects.*

*9.2 The Proponent shall, prior to construction, consult with Indigenous groups and relevant authorities on the measures to be implemented to prevent accidents and malfunctions.*

*9.3 The Proponent shall, prior to construction and in consultation with Indigenous groups and relevant authorities, develop an emergency response plan in relation to the Designated Project.*

*9.4 In the event of an accident or malfunction with the potential to cause adverse environmental effects, the Proponent shall implement the emergency response plan referred to in condition 9.3 and shall:*

*9.4.1 notify Indigenous groups, Gitxsan Wilp Nii Kyap, and relevant authorities of the accident or malfunction as soon as possible, and notify the Agency in writing;*

*9.4.2 implement immediate measures to mitigate any adverse environmental effects associated with the accident or malfunction;*

*9.4.3 submit a written report to the Agency no later than 30 days after the day on which the accident or malfunction took place. The written report shall include:*

*9.4.3.1 a description of the accident or malfunction and of its adverse environmental effects;*

*9.4.3.2 the measures that were taken by the Proponent to mitigate the adverse environmental effects of the accident or malfunction;*

*9.4.3.3 any views received from Indigenous groups, Gitxsan Wilp Nii Kyap, and relevant authorities with respect to the accident or malfunction, its adverse environmental effects, and measures taken by the Proponent to mitigate adverse environmental effects; Page 13 of 14*

*9.4.3.4 a description of any residual adverse environmental effects and any modified or additional measures required by the Proponent to mitigate residual adverse environmental effects;*

*9.4.3.5 details concerning the implementation of the emergency response plan referred to in condition 9.3; and*

*9.4.4 submit a written report to the Agency, no later than 90 days after the day on which the accident or malfunction took place, on the changes made to avoid a subsequent occurrence of the accident or malfunction, and on the implementation of any modified or additional measures to mitigate and monitor residual adverse environmental effects and to carry out any required progressive reclamation, taking into account the information in the written report submitted pursuant to condition 9.4.3.*

AuRico Metals submitted its permit application to the Major Mines Permitting Office (MMPO) on August 31, 2017. Prior to the official permit application submission AuRico Metals consulted with Tsay Keh Nay (TKN) on the development of the Emergency Response Plan, circulating a draft copy of the plan for comment and feedback on June 30, 2018, 60 days in advance of the official permit submission. The Mine Emergency Response Plan (MERP) is developed in consideration to conditions 9.3 and 9.5. To date no comments from TKN have been received on the draft Mine Emergency Response Plan or the draft Accidents and Malfunctions Communication Plan. AuRico and TKN continue to consult on management plans through the permitting process and through established collaboration and consultation methods espoused within the 2017 Impact Benefit Agreement. Permitting and permitting consultation activities with relevant authorities and TKN as part of the Mine Review Committee (MRC) for KUG is ongoing.

Regarding Condition 9.5, AuRico circulated the draft Accidents and Malfunctions Communication Plan to Gitxsan Wilp Nii Kyap on December 22, 2017.

During the 2020 reporting year, the ERP was not invoked as there were no events that had the potential to cause adverse environmental effects.

## **9.2. Condition 9.5**

*The Proponent shall develop and implement a communication plan in consultation with Indigenous groups and Gitxsan Wilp Nii Kyap. The Proponent shall develop the communication plan prior to construction and shall implement and maintain it up to date from the start of construction to the end of decommissioning. The plan shall include:*

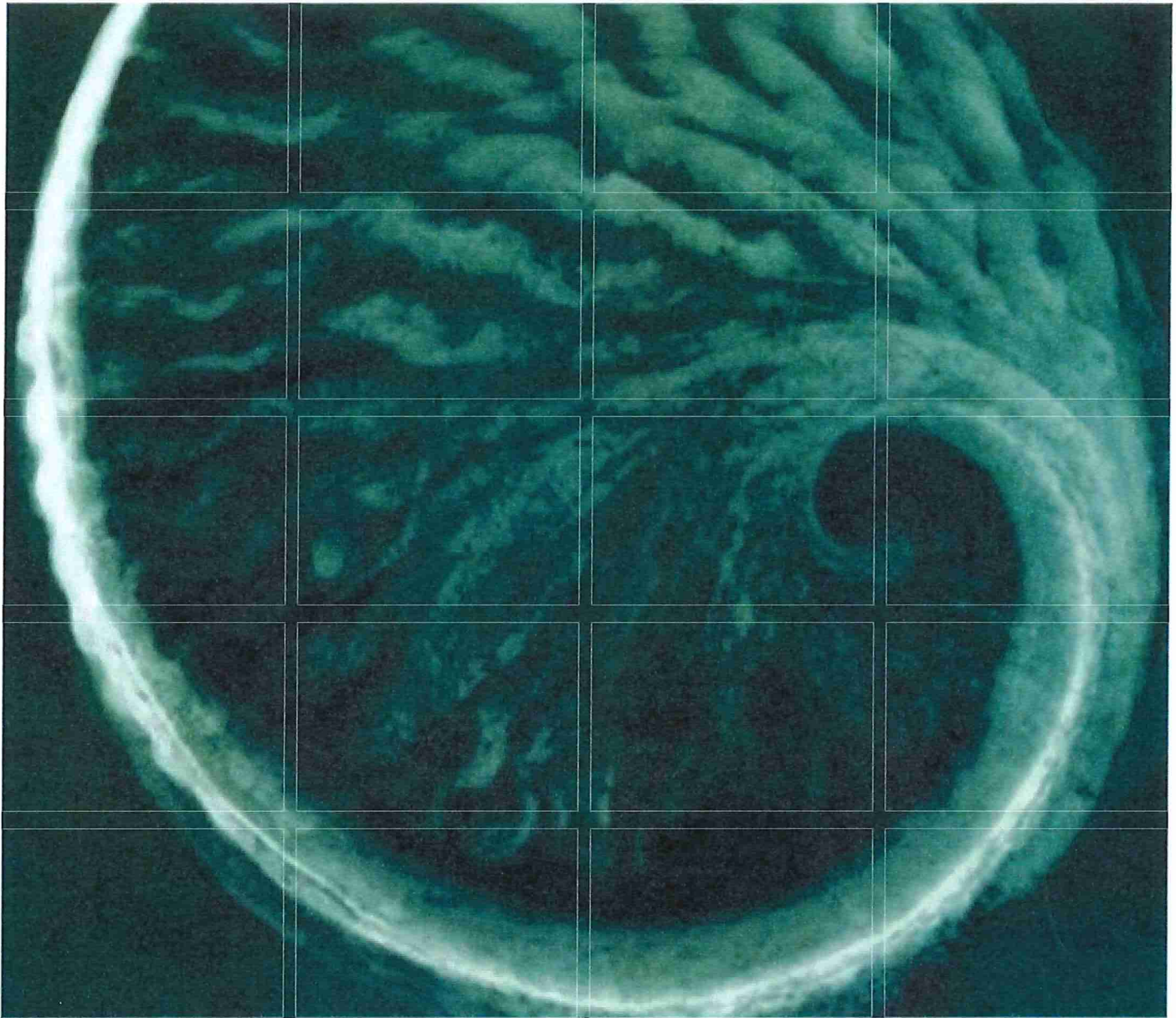
*9.5.1 the types of accidents and malfunctions requiring the Proponent to notify the respective Indigenous groups and Gitxsan Wilp Nii Kyap;*

*9.5.2 the manner by which Indigenous groups and Gitxsan Wilp Nii Kyap shall be notified by the Proponent of an accident or malfunction and of any opportunities for the Indigenous groups and Gitxsan Wilp Nii Kyap to assist in the response to the accident or malfunction; and*

*9.5.3 the contact information of the representatives of the Proponent that the Indigenous groups and Gitxsan Wilp Nii Kyap may contact and of the representatives of the respective Indigenous groups and Gitxsan Wilp Nii Kyap to which the Proponent provides notification.*

As per condition 9.5, the Accidents and Malfunctions Communication Plan was developed in 2018 to guide the co-ordination of communications between the organization and any applicable outside agencies (e.g. regulatory agencies, stakeholders, and the public) in the event of an accident and/or malfunction resulting from the KUG Project. This plan identifies the types of accidents and malfunctions requiring notification to external stakeholders and the timeframe of notification (including updates subsequent to the initial notification) to each Aboriginal Group community and other users of the area that could be affected by the accident and/or malfunction. The Accidents and Malfunctions Management Plan is present in Appendix C.

**Appendix A:**  
Human Health Follow Up Program and Comments



Prepared for:

centerragOLD



**KEMESS UNDERGROUND PROJECT  
Human Health Follow-up Program**

February 2018

**DRAFT**

**Centerra Gold Inc.**

# **KEMESS UNDERGROUND PROJECT Human Health Follow-up Program**

**February 2018**

Project #0371562

**DRAFT**

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**ERM**

ERM Building, 15th Floor  
1111 West Hastings Street  
Vancouver, BC  
Canada V6E 2J3  
T: (604) 689-9460  
F: (604) 687-4277

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# KEMESS UNDERGROUND PROJECT

## Human Health Follow-up Program

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## GLOSSARY AND ABBREVIATIONS

Terminology used in this document is defined where it is first used. The following list will assist readers who may choose to review only portions of the document.

<b>Agency, the</b>	The Canadian Environmental Assessment Agency
<b>BC</b>	British Columbia
<b>BC ENV</b>	British Columbia Ministry of Environment & Climate Change Strategy
<b>CCME</b>	Canadian Council of Ministers of the Environment
<b>COPC</b>	Contaminant of potential concern
<b>CSF</b>	Cancer slope factor
<b>EAC</b>	Environmental Assessment Certificate
<b>EDI</b>	Estimated daily intake
<b>EEM</b>	Environmental Effects Monitoring
<b>ELDE</b>	Estimated lifetime daily exposure
<b>EMP</b>	Ecosystem Management Plan
<b>FAEMP</b>	Fish and Aquatic Effects Monitoring Plan
<b>HHFP</b>	Human health follow-up program
<b>HHRA</b>	Human health risk assessment
<b>HQ</b>	Hazard quotient
<b>IBA</b>	Impact Benefits Agreement
<b>ILCR</b>	Incremental lifetime cancer risk
<b>km</b>	Kilometre
<b>KUG</b>	Kemess Underground Project
<b>MA/EMA</b>	<i>Mines Act/Environmental Management Act</i>
<b>ML/ARD</b>	Metal leaching/acid rock drainage
<b>MSWMP</b>	Mine Site Water Management Plan
<b>ORAR</b>	Omineca Resource Access Road

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## HUMAN HEALTH FOLLOW-UP PROGRAM

<b>Project, the</b>	The Kemess Underground Project
<b>RPD</b>	Relative percent difference
<b>SeMP</b>	Selenium Management Plan
<b>SOP</b>	Standard operating procedure
<b>TKN</b>	Tse Keh Nay
<b>TRV</b>	Toxicity reference value
<b>TSF</b>	Tailings Storage Facility
<b>ww</b>	Wet weight

## 1. INTRODUCTION

The Canadian Environmental Assessment Agency (the Agency) conducted an environmental assessment of the Kemess Underground Project (KUG; the Project) pursuant to the *Canadian Environmental Assessment Act, 2012* and the *Memorandum of Understanding between the Canadian Environmental Assessment Agency and the B.C. Environmental Assessment Office on the Substitution of Environmental Assessments* (2013). A positive Decision Statement was issued by the Agency on March 9, 2017, with conditions (CEAA 2017). Condition 5 relates to Human Health:

*5.1. The Proponent shall develop, prior to construction and in consultation with Indigenous groups and relevant authorities, a follow-up program to verify the accuracy of the environmental assessment as it pertains to adverse effects on the health of Indigenous Peoples caused by changes in concentrations of contaminants of potential concern identified during the environmental assessment in air, soil, water, and sediment. The Proponent shall implement the follow-up program during construction and operation. As part of the development of the follow-up program, the Proponent shall:*

*5.1.1. identify levels of environmental change relative to established baseline conditions for contaminants of potential concern that would require the Proponent to implement modified or additional mitigation measure(s) to mitigate increased risks to human health; and*

*5.1.2. if monitoring results demonstrate that concentration levels for contaminants of potential concern are greater than the identified levels of environmental change, update the human health risk assessment for the consumption of traditional foods exposed to these contaminants and communicate the results of the updated human health risk assessment to Indigenous groups.*

This document describes the Human Health Follow-up Program (HHFP) to address the above condition.

### 1.1 PURPOSE AND OBJECTIVES

The purpose of the HHFP is to mitigate potential adverse effects on the health of Indigenous Peoples as a result of the Project. Objectives of the HHFP are to:

1. Enable the Proponent to verify the accuracy of the environmental assessment as it pertains to adverse effects on the health of Indigenous Peoples caused by changes in concentrations of contaminants of potential concern (COPCs) identified during the environmental assessment.
2. Identify levels of environmental change relative to established baseline conditions for contaminants of potential concern that would require the Proponent to implement modified or additional mitigation measure(s) to mitigate increased risks to human health.

As per Condition 5.1.2, mitigation measures include an update to the human health risk assessment for the consumption of traditional foods exposed to contaminants exceeding identified levels of environmental change. Thus, a country foods risk assessment is one of the endpoints for the HHFP. Focusing a risk assessment to country foods is justified because food ingestion can be a significant pathway of exposure in humans to contaminants, contaminants can bioaccumulate in the food chain, and animal food (meat or fish) can migrate from high-exposure locations to traditional

hunting/fishing areas distant from Project sites, where exposure pathways to Project-related contaminants in air and water are much less significant.

The HHFP contains the following components:

- a review of the COPCs identified for baseline and Project phases;
- a summary or relevant monitoring commitments contained in other Project monitoring and management plans, specifically:
  - Mine Site Water Management Plan (MSWMP);
  - Fish and Aquatic Effects Monitoring Plan (FAEMP);
  - Selenium Management Plan (SeMP); and
  - Ecosystem Management Plan (EMP).
- a sampling plan for additional and future sampling of environmental media necessary for country foods monitoring that are not covered under other monitoring plans;
- identification of levels of environmental change relative to baseline conditions in media that would require the Proponent to implement modified or additional mitigation measure(s) to mitigate increased risks to human health;
- an outline of human health risk assessment (HHRA) steps;
- methodology for the derivation of hazard quotients (HQs) and incremental lifetime cancer risks (ILCRs); and
- a data management and reporting framework.

There is limited use of the KUG mine site area by Indigenous peoples and AuRico Metals Inc. (acquired by Centerra Gold Inc.) has agreed to an area of restricted access (“exclusion area”) around the mine site through their Impact Benefits Agreement (IBA). The IBA for the Project was established between AuRico Metals Inc. and the Tse Keh Nay (TKN) First Nations in May 2017. The TKN is an alliance of the Takla Lake First Nation, the Tsay Keh Dene Nation, and Kwadacha Nation. Thus the HHFP is another layer of measures to avoid impacting the health of Indigenous peoples.

## 1.2 GENERAL APPROACH

As indicated in Condition 5.1, the objective of the HHFP for the Project is to 1) verify the accuracy of the environmental assessment and to 2) identify levels of environmental change at which modified or additional mitigation measure(s), including an update of the country foods risk assessment, to mitigate increased risks to human health may be implemented. The country foods evaluated in the Project’s Application for an Environmental Assessment Certificate (EAC Application; AuRico 2016) were:

- berries: crowberry and soapberry (measured COPC tissue concentrations);
- freshwater fish: Bull Trout, Dolly Varden, Whitefish, and Rainbow Trout (measured COPC tissue concentrations);
- moose (COPC tissue concentrations calculated with a food chain model);

- snowshoe hare (COPC tissue concentrations calculated with a food chain model); and
- ruffed grouse (COPC tissue concentrations calculated with a food chain model).

The calculation of COPC tissue concentrations for moose, snowshoe hare, and ruffed grouse using a food chain model (Golder Associates Ltd. 2005) requires the input of measured COPC concentrations in surface water, soil, and diet items (i.e., vegetation). Thus, the environmental media data required for an updated HHRA for country foods includes: surface water, soil, fish tissue, and vegetation tissue (berries for human consumption and vegetation diet items for moose, hare, and grouse).

Monitoring of air quality (i.e., dustfall levels and metals in dustfall) is not required for the HHFP as potential COPCs from the Project through atmospheric deposition will be addressed with the monitoring of metal concentrations in soil and vegetation samples.

Monitoring of relevant environmental media (i.e., surface water, soil, fish tissue) is described in a series of other monitoring and management plans developed for the Project. It is assumed that if there is no change in these environmental media, the quality of country foods will not change and will not require an update to the risk assessment. Therefore, the HHFP relies on commitments and results from the other monitoring plans developed for the Project. The HHFP includes supplemental sampling specifically designed to meet the objectives of the HHFP and needs of a potential future update to the country foods risk assessment. The general structure of the HHFP is as follows:

1. Monitoring of surface water, sediment, soil, and fish tissues as per the MSWMP, FAEMP, SeMP, and EMP.
2. Should soil sampling within the Project footprint under the existing Ecosystem Management Plan indicate increasing COPC concentrations in soil (i.e., above soil metal concentrations predicted in the EAC Application), additional soil samples will be collected from outside of the Project footprint that are accessible to potential country foods consumers.
3. If trigger levels are exceeded in soil samples outside the Project footprint, sampling of vegetation (berries for human consumption and vegetation diet items for moose, hare, and grouse) will be initiated.
4. If levels of environmental change (defined in Section 5) are exceeded in environmental media, the combined environmental media sampling results will be used to update the HHRA for country foods and/or will trigger adaptive management actions described in other management plans, such as:
  - alteration of drainage pathways, re-evaluation of the water balance and water quality model, diversion of non-contact water, water treatment options, and re-evaluation of discharge limits (discussed in Sections 5 and 8 of the MSWMP; AuRico 2017d).
  - initiation of additional fish and aquatic habitat Adaptive Management Monitoring Programs and control charting using control datasets (discussed in Section 8.3.7 of the FAEMP; AuRico 2017b).
  - corrective actions to lower selenium concentrations in the environment (discussed in Section 8 of the SeMP; AuRico 2017e).

- corrective action or additional control measures to reduce negative effects to soils and vegetation (discussed in Section 6.3.2 of the EMP; AuRico 2017a).
- 5. The results and uncertainties of the updated HHRA for country foods will be compared to established baseline and predicted Project results to verify the accuracy of the environmental assessment as it pertains to adverse effects on the health of Indigenous Peoples and to indicate whether an increased risk to consumers of country foods exists due to Project activities.
- 6. Adaptive management/mitigation measures will be reviewed and additional measures will be considered if a significant increase in risk to consumers of country foods due to Project activities has been identified.

This phased approach intends to provide an integrated approach with other ongoing monitoring programs within the Project area, maintains monitoring techniques of historical data collection approaches to allow comparability with previous and ongoing sampling in the Project area, and follows the requirements of federal HHRA guidelines.

### **1.3 APPLICABLE GUIDANCE**

The HHRA methodology is based on Health Canada's guidelines for HHRA and environmental assessments (Health Canada 2010a, 2010e, 2010d). Health Canada (2007) also provides a management strategy to reduce the risk of unacceptable exposures to mercury from fish consumption, which is also considered.

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## 2. REVIEW OF CONTAMINANTS OF POTENTIAL CONCERN

The EAC Application (AuRico 2016) identified COPCs for human health under established baseline and predicted Project conditions (i.e., the Construction and Operations phases). Specific contaminants were selected as COPCs if they met at least one of the following five screening criteria:

1. The concentration of metals bound to PM<sub>10</sub> exceeded (or were predicted to exceed) the Texas Commission on Environmental Quality Effects Screening Levels (Texas CEQ 2014) and the Ontario Ministry of the Environment Ambient Air Quality Criteria (Ontario MOE 2012). However, this COPC screening only applies to the inhalation pathway, which is not considered in the HHFP, as it is of lesser significance than the country foods ingestion pathway.
2. The maximum metal concentrations in soil samples considered in the assessment exceeded (or were predicted to exceed) the Canadian Council of Ministers of the Environment (CCME) Soil Quality Guidelines for Agricultural Land Use (CCME 2013).
3. The maximum metal concentrations in surface water exceeded (or were predicted to exceed) the British Columbia Ministry of Environment (BC ENV) Water Quality Criteria for the drinking water supply or Health Canada guidelines for Canadian drinking water quality, whichever guideline was lower (BC MOE 2015; Health Canada 2015). However, this COPC screening only applies to the drinking water pathway, which is not considered in the HHFP, as it is of lesser significance than the country foods ingestion pathway.
4. Fish tissue metal concentrations considered in the assessment exceeded (or were predicted to exceed) the fish tissue residue guidelines for mercury and selenium:
  - a. The BC MOE (Beatty and Russo 2014) screening value of 1.83 mg selenium/kg wet weight (ww) for a high fish consumption rate of >220 g/day.
  - b. The Health Canada fish tissue consumption guideline of 0.5 mg mercury/kg ww (Health Canada 2013).
5. Metals that have a potential to bioaccumulate in organisms or biomagnify in food webs, such that there could be significant transfer of the metal from soil to plants and subsequently into higher trophic levels even at concentrations lower than guidelines. These metals include: arsenic, cadmium, lead, mercury, nickel, selenium, thallium, and zinc.

The Joint *Mines Act/Environmental Management Act* (MA/EMA) Permit Application (AuRico 2017c) also evaluated potential changes in COPCs for human health due to updates to air and water quality modelling associated with waste discharge authorizations for the Project. However, no new COPCs were identified during the Joint MA/EMA Permit Application process, thus it is not discussed further. The results of the COPC selection process for the EAC Application are summarized in Sections 2.1 to 2.3; however, the discussion is limited to the COPC screening applicable to country foods (e.g., does not discuss results of screening metals bound to PM<sub>10</sub>).



## **2.1 CONTAMINANTS OF POTENTIAL CONCERN IDENTIFIED FOR HUMAN HEALTH UNDER BASELINE CONDITIONS IN THE ENVIRONMENTAL ASSESSMENT**

The COPCs identified in the baseline soil quality screening (see Section 4.5 and Table 4.5-1 of Appendix 18 A of the EAC Application; AuRico 2016) were: arsenic, barium, boron, cadmium, chromium, copper, lead, molybdenum, nickel, selenium, vanadium, and zinc.

The COPCs identified in the baseline surface water quality screening (see Sections 4.6.1 and 4.6.2, Tables 4.6-1 and 4.6-2 of Appendix 18-A of the EAC Application using drinking water quality guidelines; AuRico 2016) were: dissolved and total aluminum, cadmium, iron, lead, manganese, nitrate, selenium, and sulphate. However, iron was not retained as a COPC as it is an essential element for humans and since environmental exposure to iron from food consumption (the largest source of exposure) is not likely lead to adverse health effects. Furthermore, iron is considered an innocuous substance by Health Canada (2010c).

The COPCs identified in the baseline fish tissue concentrations (see Section 4.7.1.2 and Appendix A of Appendix 18 A of the EAC Application; AuRico 2016) were mercury and selenium.

Thus, with the addition of bioaccumulative contaminants, the COPCs selected for the baseline HHRA included: aluminum, arsenic, barium, boron, cadmium, chromium, copper, lead, manganese, mercury, molybdenum, nickel, nitrate (water only), selenium, sulphate (water only), thallium, vanadium, and zinc.

## **2.2 CONTAMINANTS OF POTENTIAL CONCERN IDENTIFIED FOR HUMAN HEALTH UNDER PROJECT-RELATED CONDITIONS IN THE ENVIRONMENTAL ASSESSMENT**

The soil quality selection identified the following COPCs during the Construction and Operations phases (see Section 3.4 and Table 3.4-2 of Appendix 18-B of the EAC Application; AuRico 2016): arsenic, barium, boron, cadmium, chromium, copper, lead, molybdenum, nickel, selenium, vanadium, and zinc.

The following non-metal COPCs in surface water were screened in (against drinking water quality guidelines) during both the Construction and Operations phases (see Section 3.5.1 and Table 3.5-1 of Appendix 18-B of the EAC Application; AuRico 2016): nitrate and sulphate. The surface water quality COPC screening (against drinking water quality guidelines) identified the following metal COPCs during both the Construction and Operations phases (see Section 3.5.2 and Table 3.5-2 of Appendix 18-B of the EAC Application; AuRico 2016): total and dissolved aluminum, cadmium, iron, lead, manganese, and selenium. Consistent with the baseline HHRA (Section 4.8 of Appendix 18-A of the EAC Application; AuRico 2016), iron was not retained as a COPC.

Fish tissue selection identified selenium as a COPC during both the Construction and Operations phases (see Section 3.6.1 and Tables 3.6-1 and 3.6-2 of Appendix 18-B of the EAC Application; AuRico 2016).

Thus, with the addition of bioaccumulative contaminants, the COPCs selected for the Project-related HHRA include: aluminum, arsenic, barium, boron, cadmium, chromium, copper, lead, manganese, mercury, molybdenum, nickel, nitrate (water only), selenium, sulphate (water only), thallium, vanadium, and zinc. These COPCs are the same as those selected in the baseline HHRA (Appendix 18-A of the EAC Application; AuRico 2016).

There were no COPCs identified from road dust (Section 3.7 of Appendix 18-B of the EAC Application; AuRico 2016).

### **2.3 OVERALL LIST OF CONTAMINANTS OF POTENTIAL CONCERN IDENTIFIED FOR HUMAN HEALTH**

The overall list of COPCs identified for human health during the EAC Application (AuRico 2016) were: **aluminum, arsenic, barium, boron, cadmium, chromium, copper, lead, manganese, mercury, molybdenum, nickel, nitrate (water only), selenium, sulphate (water only), thallium, vanadium, and zinc.** This list of COPCs is proposed for monitoring in environmental media.

### 3. RELEVANT MONITORING AND MANAGEMENT PLANS

A series of management and monitoring plans have been developed for the Project. Many of these plans outline monitoring commitments relevant to the HHFP objectives. The HHFP relies on the monitoring and associated results from several of the plans as described below.

#### 3.1 MINE SITE WATER MANAGEMENT PLAN

Section 6.1.2 of the MSWMP (AuRico 2017d) describes the surface water monitoring in the receiving environment that will be conducted for the Project.

Surface water quality monitoring sites and monitoring frequency under the MSWMP (AuRico 2017d) build on monitoring sites identified in the FAEMP (AuRico 2017b) and have been designed to incorporate the monitoring required under existing permits. Further, the components of the monitoring program are intended to provide sufficient temporal coverage to collect representative data during the most ecologically relevant periods and, as applicable, sample and data collection for the separate components of the MSWMP and FAEMP will be coordinated to ensure data are contemporaneous, which reduces the potential for confounding factors in subsequent analyses.

Surface water quality locations monitored during Construction and Operations phases under the MSWMP include six of the 14 surface water quality model node locations (i.e., KN-11b, WQ-01, WQ-14F, WQ-17, WQ-18, and Thutade Lake) that were used in the HHRA presented in the EAC Application (see Section 4.6 of Appendix 18-A). Thus for the HHFP, water quality samples obtained from these six monitoring locations can be compared to the baseline and predicted Project water quality presented in the EAC Application and the Joint MA/EMA Permit Application.

Stream water quality samples will be collected monthly (12 times per year) during pre-Construction, Construction, and Operations, except for sampling at the far-field monitoring site (Thutade Lake), which will be sampled quarterly. The timing of quarterly sampling is designed to capture representative periods during winter low-flow conditions, freshet, summer low flow, and the increased stream flows in fall.

All of the COPCs listed in Section 2.4 are proposed for monitoring under the MSWMP (i.e., aluminum, arsenic, barium, boron, cadmium, chromium, copper, lead, manganese, mercury, molybdenum, nickel, nitrate, selenium, sulphate, thallium, vanadium, and zinc). Therefore, it is possible to do a direct comparison of water quality parameters monitored under the MWSMP to the baseline and predicted Project water quality presented in the EAC Application.

The water quality parameters, monitoring locations, and frequency of monitoring proposed in the MSWMP (AuRico 2017d) are considered to be sufficient to identify levels of environmental change (as described in Section 5.1) for water quality that could trigger an update to the HHRA under the HHFP.

### 3.2 FISH AND AQUATIC EFFECTS MONITORING PLAN

Monitoring of aquatic resources (i.e., fish, periphyton, and benthic invertebrate communities, and sediment quality) under the FAEMP (AuRico 2017b) will begin during the first year of Construction. There are three sampling locations for aquatic resources proposed under the FAEMP (shown in Figure 4-1): EEM-18 (equivalent to WQ-18), ATT-DIS, and EEM-13 (equivalent to WQ-13).

The monitoring program will occur every few years over a seven-year period, with infill years of slightly reduced monitoring requirements. Kemess South aquatic monitoring plans include: the Provincial Environmental Effects Monitoring (EEM) in Kemess Creek; Selenium reporting in Waste Rock Creek; Long-term fish monitoring in Attichika/Kemess creeks; and the Federal EEM in Kemess Creek. The KUG aquatic monitoring includes: Discharge monitoring and adaptive management in Attichika Creek/Waste Rock Creek and the Northern Project Area; and the Federal EEM in Attichika Creek.

As described in Section 8.3.7.2 of the FAEMP (AuRico 2017b), surface water quality in Amazay Lake (which is one of the 14 surface water quality model node locations used in the HHRA presented in the EAC Application) will be monitored during the early Construction phase under the standalone Amazay Lake Monitoring Plan (to be submitted to the BC Environmental Assessment Office prior to Construction). Thus, water quality samples obtained under the Amazay Lake Monitoring Plan can also be applied in the HHFP.

Fish monitoring studies are described in Section 8.3.5.7 of the FAEMP (AuRico 2017b). As part of the Adult Fish Monitoring Study, annual non-lethal fish tissue monitoring of adfluvial Bull Trout from Thutade Lake will be conducted. This study will monitor contaminants that can bioaccumulate within fish species, including mercury, and focus specifically on Bull Trout in Thutade Lake, given this population's importance as a food source for Indigenous groups in the area. Sampling will be conducted at three locations in Attichika Creek (Thutade Lake Bull Trout migrate up Attichika Creek to reach spawning habitats), similar to baseline studies presented in Hatfield and Bustard (2015). A target of eight fish will be captured by angling and non-lethal sampling using dermal tissue punches. Sampling will occur annually and be used to both monitor metal levels in fish tissue over time and assess safety of fish consumption. Monitoring will be conducted on an ecologically relevant timeline and will match previous baseline sampling and other ongoing monitoring activities to maximize comparability of data over time.

All of the COPCs listed in Section 2.4 (except for those that only apply to surface water) are proposed for monitoring under the FAEMP Adult Fish Monitoring Study (i.e., aluminum, arsenic, barium, boron, cadmium, chromium, copper, lead, manganese, mercury, molybdenum, nickel, selenium, thallium, vanadium, and zinc).

Biological monitoring in Amazay Lake will only be implemented when routine water quality monitoring from the Amazay Lake Monitoring Plan initiates a trigger response (outlined in Section 8.3.7.1 of the FAEMP). In addition, biological sampling is also proposed in Amazay Lake during the early Construction phase years (either fall 2018 or 2019) as an adaptive management approach and to update baseline information for this lake. Proposed sampling includes Rainbow Trout tissue metal analysis because they are the most abundant fish species in the Lake. Thus, if fish



tissue sampling is triggered or fish is collected as an adaptive management approach, samples will also be incorporated in the HHFP.

Monitoring of surface water quality, sediment quality, and fish tissue conducted under the FAEMP and other aquatic monitoring programs ongoing in the Kemess Area will be incorporated into the HHFP. The parameters, monitoring locations, and frequency of monitoring for surface water and sediments proposed in the FAEMP (AuRico 2017b) are considered to be sufficient to identify levels of environmental change (described in Section 5.1 and 5.2) for the HHFP. Should an update of the HHRA for country foods be required, fish tissue monitoring data will be incorporated into the risk assessment for consumers of fish.

### 3.3 SELENIUM MANAGEMENT PLAN

Section 6.1.2 of the SeMP (AuRico 2017e) describes the surface water and sediment monitoring in Waste Rock Creek that will be conducted for the Project. Monitoring will be conducted in accordance with permit PE15335, with sample sites and frequencies specified in the permit.

Section 6.5 of the SeMP (AuRico 2017e) describes the proposed fish tissue sampling. A very small population of adult fish is present in Waste Rock Creek, thus alternate locations such as the Attichika wetlands will be considered for an annual lethal fish survey. Methodology for fish tissue sampling is provided in the FAEMP (AuRico 2017b). Fish tissue will be analyzed for the full suite of metals, which includes the COPCs listed in Section 2.4.

Surface water quality data, sediment quality data, and fish tissue metal data obtained via monitoring under the SeMP will be incorporated in the HHFP. The parameters, monitoring locations, and frequency of monitoring for surface water and sediment proposed in the SeMP (AuRico 2017e) are considered to be sufficient to identify levels of environmental change (described in Sections 5.1 and 5.2) for the HHFP. Should an update of the HHRA for country foods be required, fish tissue monitoring data will be incorporated into the risk assessment for consumers of fish.

### 3.4 ECOSYSTEM MANAGEMENT PLAN

Sections 5.2.2 and 5.2.3 of the EMP (AuRico 2017a) describes the monitoring for trace metal uptake in soil and vegetation that will be conducted for the Project.

Trace metal concentrations in soil will be monitored in samples collected from areas disturbed by the Project (i.e., the Project footprint) during the life of mine. Soil samples will also be collected from a non-impact control site for comparison. Metal concentrations in soil will be compared to CCME (2017) Soil Quality Guidelines, the Soil Criteria for Toxicity to Soil Invertebrates and Plants listed in the Contaminated Sites Regulation (B.C. Reg. 375/96) included in the BC *Environmental Management Act* (2003), and to baseline concentrations presented in the Project's Terrain and Soils Baseline Report (Ardea Biological Consulting Ltd. 2015).

Soil samples will be analyzed for a comprehensive suite of total metals with detection limits applicable for Agricultural and/or Residential/Parkland use standards. All of the COPCs listed in Section 2.4 (except for those that only apply to surface water) are proposed for monitoring in the soil samples

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(i.e., aluminum, arsenic, barium, boron, cadmium, chromium, copper, lead, manganese, mercury, molybdenum, nickel, selenium, thallium, vanadium, and zinc). The frequency of soil sampling will be every three to five years to match the frequency of the Reclamation and Closure Plan review/update.

The parameters, monitoring locations, and frequency of monitoring for soil metals proposed in the EMP (AuRico 2017a) are considered to be sufficient to identify levels of environmental change (described in Section 5.4) for soil within the Project footprint.

There are no federal or provincial guidelines for metals in vegetation; therefore, vegetation sampling for metal analysis will only be conducted under the EMP if soil monitoring indicates increasing trends near or above soil quality guidelines. If vegetation sampling commences, the frequency of sampling would be the same as that of soil sampling - every three to five years to match the frequency of the Reclamation and Closure Management Plan review/update. Vegetation samples will be collected in the middle of July, close to the peak summer growth prior to seedset, and at the end of August when berries are ripe.

If triggered, trace metal concentrations in vegetation will be monitored in samples collected from areas disturbed by the Project (i.e., the Project footprint) during the life of mine. Vegetation samples will also be collected from a non-impact control site for comparison. Metal concentrations in vegetation samples will be compared to baseline concentrations presented in the EAC Application. All of the COPCs listed in Section 2.4 (except for those that only apply to surface water) are proposed for monitoring in the vegetation samples (i.e., aluminum, arsenic, barium, boron, cadmium, chromium, copper, lead, manganese, mercury, molybdenum, nickel, selenium, thallium, vanadium, and zinc).

Under the EMP (AuRico 2017a), vegetation sampling conducted during the life of mine will include species growing in areas found to have (i) elevated soil metals, (ii) species used for progressive reclamation if reclaimed area has potential for metal leaching/acid rock drainage (ML/ARD), and (iii) species used on stockpiles that will be used for reclamation purposes.

The parameters, monitoring locations, and frequency of monitoring for vegetation tissue metals proposed in the EMP (AuRico 2017a) are not considered to be sufficient for use in a HHRA for country foods if required as all vegetation sampling is proposed within the Project footprint. Therefore, supplemental vegetation sampling (if triggered) is proposed at locations outside of the Project footprint where baseline vegetation sampling for the EAC Application was conducted (see Section 4.5).

## 4. SAMPLING PLAN

The monitoring locations of environmental media required for the HHFP are shown in Figure 4-1.

### 4.1 WATER

The water quality parameters, monitoring locations, and frequency of monitoring described in the MSWMP (AuRico 2017d), FAEMP (AuRico 2017b), and SeMP (AuRico 2017e) are considered to be sufficient to identify levels of environmental change (described in Section 5.1) for the HHFP. Thus additional surface water quality monitoring is not proposed. Surface water quality monitoring locations for the HHFP (i.e., KN-11b, WQ-01, WQ-14F, WQ-17, WQ-18, Thutade Lake, and Amazay Lake) are shown on Figure 4-1.

### 4.2 SEDIMENT

The parameters, monitoring locations, and frequency of monitoring for sediment described in the FAEMP (AuRico 2017b) and SeMP (AuRico 2017e) are considered to be sufficient to identify levels of environmental change (described in Section 5.2) for the HHFP. Thus additional sediment quality monitoring is not proposed. Sediment quality sampling locations are shown on Figure 4-1.

### 4.3 FISH

The parameters, monitoring locations, and frequency of monitoring for fish tissue metals described in the FAEMP (AuRico 2017b) and SeMP (AuRico 2017e) are considered sufficient for fish metal characterization for a potential country foods risk assessment. A country foods risk assessment for fish will only be triggered by increases in COPC concentrations of substances in water and sediments above levels of environmental change set out in Sections 5.1 and 5.2 that are known to bioconcentrate or bioaccumulate in fish. Exact locations for fish tissue sampling under the SeMP are currently unknown (potential locations include the Attichika wetlands). Fish tissue sampling locations under the FAEMP are shown on Figure 4-1.

Fish tissue COPC concentrations are generally of higher variability than COPC concentrations in other environmental media due to various factors, including smaller sample size, matrix differences, fish age, developmental stage, life history, habitat, and condition factor. Therefore, fish tissue monitoring data obtained as part of the Adult Fish Monitoring Study of the FAEMP and SeMP will not be used to set trigger levels, but rather to update the country foods risk assessment, if required.

### 4.4 SOIL

The parameters, monitoring locations, and frequency of monitoring for soil metals described in the EMP (AuRico 2017a) are considered to be sufficient to identify levels of environmental change (described in Section 5.4) for soil within the Project footprint. If soil sampling under the EMP indicates levels are exceeded within the Project footprint, additional soil sampling will be conducted at locations

outside of the Project footprint where baseline soil sampling was conducted (shown in Figure 4.5-1 of Appendix 18-A of the EAC Application).

A subset (~10) of the 56 sites (within and outside of Project footprint; Figure 4-1) sampled during baseline soil quality monitoring programs would require follow-up sampling and will focus on sites located outside of the Project footprint downwind of the Project, where dustfall is predicted to be highest during the Construction and Operations phases (i.e., immediately south of the TSF and around the main mine site area). Only the top 0 to 20 cm of the soil horizon should be sampled for metal analysis consistent with the HHERA approach in the EAC Application. Otherwise, the same soil sampling methodology and laboratory analysis described in Section 5.2.2.2 of the EMP (AuRico 2017a) should be followed.

#### 4.5 VEGETATION

Vegetation monitoring from the EMP (AuRico 2017a) will be considered in the HHFP. If vegetation sampling is triggered under the EMP (and/or HHFP), supplemental vegetation sampling is proposed at locations outside of the Project footprint where baseline vegetation sampling for the EAC Application was conducted (shown in Figure 4-1) and co-located with soil sampling described in Section 4.4.

Preferably multiple vegetation species should be co-collected with each soil sample. Priority species for sampling include country foods (i.e., crowberry and soapberry) and diet species for moose, hare, and grouse assessed in the HHERA in the EAC Application to ensure data comparability with baseline studies. The vegetation diet items included: unidentified grass, unidentified willow, Barratt's willow, Barclay's willow, Drummond's willow, grey-leaved willow, tea-leaved willow, variable willow, large-leaved lupine, Arctic lupine, water sedge, fireweed, broad-leaved willowherb, crowberry, soapberry, unidentified lichen, cow parsnip, red clover, clover, common horsetail, meadow horsetail, and sagewort.

A minimum of three samples and ideally five vegetation samples per species will be collected; however, due to the large number of species sampled under baseline programs, not all baseline species need to be sampled.

Vegetation sampling methodology and laboratory analysis will be consistent with that described in Section 5.2.3 of the EMP (AuRico 2017a).





## 5. LEVELS OF ENVIRONMENTAL CHANGE

The BC MOE (2013) has defined no change in surface water quality as a difference of no greater than 20% since laboratory precision for measurement of low concentration metals in replicate samples is typically no better than 20% (quantified as the relative percent difference; RPD) and natural variability is often greater than 20%. The issues with laboratory precision and natural variability also apply to sampling other types of environmental media. Natural matrix variability/heterogeneity is generally higher in soils and sediments than in water and higher acceptable RPDs on the order of 30 to 40% are reasonable for these media (Austin 2015). Therefore, a magnitude of 30% change will be applied to sediment, soil, and dustfall monitoring for most COPCs, and a magnitude of 40% will be applied to high variability metal COPCs (i.e., aluminum, barium, lead, mercury, and molybdenum) as identified in Austin (2015).

### 5.1 WATER

If the results of surface water quality monitoring at the seven surface water quality model nodes (i.e., KN-11b, WQ-01, WQ-14F, WQ-17, WQ-18, Thutade Lake, and Amazay Lake) indicate that COPC concentrations exceed predicted Project concentrations during the Construction or Operations phases (as described in Appendix 11-D of the EAC Application and Appendix 5-G of the Joint MA/EMA Permit Application) plus 20% for at least three consecutive samples, a HHRA for country foods will be triggered.

### 5.2 SEDIMENT

If the results of sediment quality monitoring indicate that COPC concentrations in sediment exceed established baseline concentrations (as described in Section 14.4.3.3 of the EAC Application, since sediment quality is not expected to change from baseline conditions due to the Project) by 30% (40% for high variability metals) of at least three consecutive samples, a HHRA for country foods will be triggered.

### 5.3 SOIL

If the results of soil quality monitoring indicate that COPC concentrations in soil samples exceed predicted concentrations during the Construction or Operations phases (as shown in Table 3.4-2 of Appendix 18-B of the EAC Application) plus 30% (40% for high variability metals) of at least three consecutive samples, a HHRA for country foods will be triggered.

### 5.4 VEGETATION

Vegetation tissue metal monitoring will only be triggered if soil quality monitoring indicates concentrations are increasing beyond the defined level of environmental change (Section 5.3), which will also result in triggering an update of the HHRA for consumption of country foods. In this case, collected vegetation tissue metal data would be used as input for an updated HHRA.



## 6. COUNTRY FOODS RISK ASSESSMENT STEPS

Should monitoring results demonstrate that concentration levels for contaminants of potential concern are greater than the identified levels of environmental change (Section 5), the HHRA for the consumption of country foods exposed to these contaminants will be updated. As with the HHRAs conducted in the EAC Application (Appendices 18-A and 18-B), the HHRA for country foods will be divided into the following six steps based on guidance from Health Canada (2007, 2010a, 2010e, 2010d), and considering any updates to guidance as issued from time to time:

1. **Problem Formulation:** the conceptual model developed for Project conditions for the EAC Application for conducting the HHRA will be updated in the problem formulation stage. The problem formulation will revisit human receptors and human receptor characteristics, identify the COPCs and media that have triggered the HHRA, and describe food chain and exposure routes considered in the assessment (country foods ingestion only).
2. **Exposure Assessment:** exposure equations, COPC-specific characteristics, receptor assumptions, and the measured (water, soil, sediment, vegetation) or calculated (country food species) COPC concentrations are presented in this section. An estimated daily intake (EDI) is calculated to estimate the exposure level for human receptors. For country foods where tissue concentrations are not measured during monitoring studies (i.e., moose, snowshoe hare, and ruffed grouse), food chain modelling will be conducted to estimate tissue concentrations. Food chain modelling of COPC uptake into wildlife tissue is generally highly conservative relative to direct measurement and has the potential to overestimate COPC tissue concentrations by orders of magnitude (Health Canada 2010d). This maintains the conservative nature of the HHRA and ensures with a high degree of certainty that risks will not be under-estimated or overlooked (Health Canada 2010d).
3. **Toxicity Assessment:** the toxicity reference values for the COPCs (TRVs; levels of daily exposure that can be taken into the body without appreciable health risk) are identified.
4. **Risk Characterization:** HQs are calculated for threshold chemicals (i.e., non-carcinogens) and ILCRs for non-threshold chemicals (i.e., carcinogens). The exposure and effects assessments are integrated by comparing the EDIs with TRVs to produce quantitative risk estimates (HQs or ILCRs). Exposure via the country foods pathway is compared to a single TRV for each COPC.
5. **Uncertainty Analysis and Data Gaps:** the assumptions made throughout the HHRA and their effects on the confidence in the conclusions are evaluated.
6. **Conclusions:** the potential for risk to human health from country foods consumption is described based on the results of the risk characterization, with qualitative consideration of uncertainties and data gaps that might influence the quantitative assessment.

If additional risk assessment guidance from Health Canada becomes available, it will also be considered for use in the HHRA.

## 7. METHODOLOGY FOR HAZARD QUOTIENTS AND INCREMENTAL LIFETIME CANCER RISKS

Using the results of the exposure assessment and TRV assessment (described in Section 6 above), human health risks are quantified using HQs for non-carcinogens and ILCRs for carcinogens. The HQ is the ratio between the EDI and the TRV and provides a measure of exposure to a COPC via the country foods exposure pathway. The ILCR is calculated for COPC(s) that may be associated with carcinogenic potential through ingestion (i.e., arsenic).

### 7.1 HAZARD QUOTIENTS

The following equation (Health Canada 2010a) is used to estimate the EDI of COPCs from the consumption of country foods:

$$EDI = \frac{C_{food} \times IR \times RAF \times ET}{BW} \quad \text{[Equation 1]}$$

where:

<i>EDI</i>	= estimated daily intake of COPC from country food (mg COPC/kg BW/day)
<i>IR</i>	= ingestion rate (kg/day)
<i>C<sub>food</sub></i>	= concentration of COPC in food (mg/kg)
<i>RAF</i>	= relative absorption factor from the gastrointestinal tract for the contaminant (unitless)
<i>ET</i>	= days per 365 days during which consumption of food will occur (days/365 days)
<i>BW</i>	= body weight (kg BW)

The EDI of COPCs from country foods ingestion is divided by the TRV (in mg/kg BW/day) to obtain the HQ (unitless), as follows (Health Canada 2010a):

$$HQ = EDI/TRV \quad \text{[Equation 2]}$$

where:

<i>HQ</i>	= hazard quotient for the COPC from country foods ingestion (unitless)
<i>EDI</i>	= estimated daily intake of COPC from country food (mg COPC/kg BW/day)
<i>TRV</i>	= toxicity reference value for the COPC (mg COPC/kg BW/day)

For non-carcinogenic COPCs, Health Canada (2010a) suggests that an HQ of less than 0.2 indicates that the exposure does not pose a significant health risk to human receptors. An HQ of 0.2 is used as the benchmark (instead of 1.0) because the assessment does not consider intake of contaminants from all potential exposure routes (e.g., from drinking water ingestion, air inhalation, dermal contact, incidental soil ingestion).

An HQ value greater than 0.2 does not necessarily indicate that adverse health effects will occur since the TRVs are conservative (i.e., protect human health by including additional uncertainty factors) and

the assumptions made in the assessment are conservative (e.g., 100% of exposure to country foods comes from within the Human Health LSA).

The results for HQ values and uncertainties for country foods consumption during the assessed monitoring period (i.e., Construction, Operations) will be compared qualitatively to established baseline and predicted Project HQ values.

## 7.2 INCREMENTAL LIFETIME CANCER RISKS

Arsenic is the only potential Project-related COPC that is considered carcinogenic through the ingestion pathway. The following equation is used to calculate the ELDE from ingestion of arsenic (Health Canada 2010a):

$$ELDE = \frac{C_{food} \times IR \times RAF \times DE \times YE}{BW \times DE \times LE} \quad \text{[Equation 3]}$$

where:

<i>ELDE</i>	= estimated lifetime daily exposure (mg/kg BW/day)
<i>C<sub>food</sub></i>	= concentration of arsenic in food (mg/kg)
<i>IR</i>	= ingestion rate (kg/day)
<i>RAF</i>	= relative absorption factor (unitless)
<i>DE</i>	= days exposed per 365 days consuming food from the area (days/365 days)
<i>YE</i>	= years exposed to site (years)
<i>BW</i>	= body weight (kg)
<i>LE</i>	= life expectancy (years)

Carcinogenic risks are calculated as ILCR estimates according to the following formula (Health Canada 2010a):

$$ILCR = ELDE \times \text{Oral CSF} \quad \text{[Equation 4]}$$

where:

<i>ILCR</i>	= incremental lifetime cancer risk (unitless)
<i>ELDE</i>	= estimated lifetime daily exposure (mg/kg BW/day)
<i>Oral CSF</i>	= oral cancer slope factor (mg/kg BW/day) <sup>-1</sup>

The oral cancer slope factor (CSF) for arsenic is 1.80 (mg/kg BW/day)<sup>-1</sup> (Health Canada 2010b). If the calculated ILCR for arsenic ingestion is less than 1 × 10<sup>-5</sup>, it is considered to be of negligible risk (Health Canada 2010a).

The results of the ILCR assessment and uncertainties for country foods consumption during the assessed monitoring period (i.e., Construction, Operation) will be compared qualitatively to established baseline and predicted Project ILCR values.

## 8. DATA MANAGEMENT AND REPORTING FRAMEWORK

Standard operating procedures (SOPs) will be used for environmental data collection, as referenced in the MSWMP, FAEMP, SeMP, and EMP. SOPs will cover all aspects of data collection, data processing, data quality assurance and control (QA/QC), and data management. SOPs will include duplicate sampling, relevant blanks, chain-of-custody procedures, and recordkeeping. The SOPs will be reassessed and updated when necessary, as part of the iterative QA/QC process conducted under the MSWMP (AuRico 2017d), the FAEMP (AuRico 2017b), the SeMP (AuRico 2017e), and the EMP (AuRico 2017a).

Centerra Gold Inc. will assume the responsibility of data management and record-keeping of monitoring results. Data are entered into suitable electronic databases, checked for QA/QC purposes, and stored. Data are entered in a format and program that allow for comparison over time and storage in a single file format for each type of survey or monitoring activity. Monitoring data will be stored for the life of the mine and be made available for review upon request. Designated personnel will coordinate preparation, review, and distribution of the data and reports required for regulatory purposes.

The environmental media data, including COPC concentrations, gathered during monitoring will be presented annually in monitoring reports for surface water, sediments, fish, and soil under the MSWMP (described in Section 7.1 of the MSWMP; AuRico 2017d), FAEMP (described in Section 8.3.6 of the FAEMP; AuRico 2017b), SeMP (described in Section 7.1.1 of the SeMP; AuRico 2017e), and EMP (described in Section 6.2 of the EMP; AuRico 2017a). Annual HHFP reports will provide a summary of relevant environmental monitoring data results for other Project monitoring reports and any additional monitoring data as described in Section 4, as well as the following:

- summary of environmental media COPC monitoring results for surface water, sediments, fish tissues, and soils;
- comparison of monitoring results to established baseline and predicted COPC concentration data reported in the EAC Application;
- calculated levels of environmental change in environmental media (Section 5) and interpretation;
- identification of any emerging negative environmental trends likely attributable to the Project identified by monitoring and if additional monitoring (i.e., of additional soils outside of the Project footprint, or vegetation) has been triggered; and
- description of proposed revisions to the management plans to address emerging negative trends, or to update the HHRA for country foods, if required.

If the levels of environmental change exceed the levels described in Section 5, then a HHRA for country foods will be triggered following the steps and methodology described in Sections 6 and 7. The results of the updated HHRA for country foods will be communicated to Indigenous groups.



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## REFERENCES

Definitions of the acronyms and abbreviations used in this reference list can be found in the Glossary and Abbreviations section.

2003. *Environmental Management Act*, SBC. C. c. 53.

Contaminated Sites Regulation, B.C. Reg. 375/96.

Ardea Biological Consulting Ltd. 2015. *Kemess Underground Project: Terrain and Soils Baseline Report*. Prepared for AuRico Metals Inc. by Ardea Biological Consulting Ltd.: Smithers, BC.

AuRico. 2016. *Kemess Underground Project: Application for an Environmental Assessment Certificate*. Assembled for AuRico Metals Inc. by ERM Consultants Canada Ltd.: Vancouver, BC.

AuRico. 2017a. *Kemess Underground Project: Ecosystem Management Plan, Version 1.0*. AuRico Metals Inc.: Toronto, ON.

AuRico. 2017b. *Kemess Underground Project: Fish and Aquatic Effects Monitoring Plan*. AuRico Metals Inc.: Toronto, ON.

AuRico. 2017c. *Kemess Underground Project: Joint Mines Act/Environmental Management Act Permits Application*. Assembled for AuRico Metals Inc. by ERM Consultants Canada Ltd.: Vancouver, BC.

AuRico. 2017d. *Kemess Underground Project: Mine Site Water Management Plan, Version 1.0*. AuRico Metals Inc.: Toronto, ON.

AuRico. 2017e. *Kemess Underground Project: Selenium Management Plan, Version 1.0*. AuRico Metals Inc.: Toronto, ON.

Austin, J. 2015. *British Columbia Environmental Laboratory Manual*. Section A: Laboratory Quality Assurance / Quality Control. Environmental Monitoring, Reporting & Economics Section, Knowledge Management Branch, British Columbia Ministry of Environment with the assistance of the British Columbia Environmental Laboratory Technical Advisory Committee: Victoria, BC.

BC MOE. 2013. *Guidance for the Derivation and Application of Water Quality Objectives in British Columbia*. Water Protection and Sustainability Branch, Environmental Sustainability and Strategic Policy Division, Ministry of Environment: Victoria, BC.

BC MOE. 2015. *Working Water Quality Guidelines for British Columbia*. BC Ministry of Environment. [http://www2.gov.bc.ca/assets/gov/environment/air-land-water/water/waterquality/waterqualityguidesobjsfinal\\_2015\\_wwqgs\\_26\\_nov\\_2015.pdf](http://www2.gov.bc.ca/assets/gov/environment/air-land-water/water/waterquality/waterqualityguidesobjsfinal_2015_wwqgs_26_nov_2015.pdf) (accessed January 2017).

Beatty, J. M. and G. A. Russo. 2014. *Ambient water quality guidelines for selenium technical report update*. British Columbia Ministry of Environment, Water Protection and Sustainability Branch, Environmental Sustainability and Strategic Policy Division: Victoria, BC.

# DRAFT

## HUMAN HEALTH FOLLOW-UP PROGRAM

- CCME. 2013. Canadian Soil Quality Guidelines for the Protection of Environmental and Human Health (Agricultural): Summary Table. Environment Canada. Canadian Council of Ministers of the Environment. <http://st-ts.ccme.ca/> (accessed May 27, 2013).
- CCME. 2017. Canadian environmental quality guidelines - summary table. Canadian Council of Ministers of the Environment. <http://st-ts.ccme.ca/en/index.html> (accessed August 2017).
- CEAA. 2017. Decision Statement Issued under Section 54 of the Canadian Environmental Assessment Act, 2012 for the Kemess Underground Project. Assembled for AuRico Metals Inc. by the Canadian Environmental Assessment Agency: Victoria, BC.
- Golder Associates Ltd. 2005. *Guidance for Including Country Foods in Human Health Risk Assessments for Federal Contaminated Sites*. 04-1412-041. Prepared for Health Canada: Burnaby, BC.
- Hatfield and Bustard. 2015. *Kemess Underground Project Fish and Aquatics Baseline Report*. Prepared for AuRico Gold Inc. by Hatfield Consultants and David Bustard and Associates Ltd.: Vancouver, BC.
- Health Canada. 2007. Human Health Risk Assessment of Mercury in Fish and Health Benefits of Fish Consumption. Bureau of Chemical Safety, Food Directorate, Health Products and Food Branch: Ottawa, ON.
- Health Canada. 2010a. Federal Contaminated Site Risk Assessment in Canada, Part I: Guidance on Human Health Preliminary Quantitative Risk Assessment (PQRA). Version 2.0. Revised 2012. Contaminated Sites Division, Safe Environments Directorate: Ottawa, ON.
- Health Canada. 2010b. Federal Contaminated Site Risk Assessment in Canada, Part II: Health Canada Toxicological Reference Values (TRVs) and Chemical-Specific Factors. Version 2.0. Contaminated Sites Division, Safe Environments Directorate: Ottawa, ON.
- Health Canada. 2010c. Federal Contaminated Site Risk Assessment in Canada, Part V: Guidance on Human Health Detailed Quantitative Risk Assessment for Chemicals (DQRACHEM). Contaminated Sites Division, Safe Environments Directorate: Ottawa, ON.
- Health Canada. 2010d. Federal Contaminated Site Risk Assessment in Canada, Supplemental Guidance on Human Health Risk Assessment for Country Foods (HHRAFoods). Contaminated Sites Division, Safe Environments Directorate: Ottawa, ON.
- Health Canada. 2010e. Useful Information for Environmental Assessments. 978-1-001-15153-3. Health Canada, Environmental Assessment Division: Ottawa, ON.
- Health Canada. 2013. Mercury in Fish - Questions and Answers. Health Canada. [http://www.hc-sc.gc.ca/fn-an/securit/chem-chim/envIRON/mercur/merc\\_fish\\_qa-poisson\\_qr-eng.php](http://www.hc-sc.gc.ca/fn-an/securit/chem-chim/envIRON/mercur/merc_fish_qa-poisson_qr-eng.php) (accessed August 22, 2013).
- Health Canada. 2015. Guidelines for Canadian Drinking Water Quality - Summary Table. Federal-Provincial-Territorial Committee on Drinking Water of the Federal-Provincial-Territorial Committee on Health and the Environment. [http://www.hc-sc.gc.ca/ewh-semt/pubs/water-eau/sum\\_guide-res\\_recom/index-eng.php](http://www.hc-sc.gc.ca/ewh-semt/pubs/water-eau/sum_guide-res_recom/index-eng.php) (accessed January 2017).
- Ontario MOE. 2012. *Ontario's Ambient Air Quality Criteria*. Standards Development Branch, Ontario Ministry of Environment.



<http://www.airqualityontario.com/downloads/AmbientAirQualityCriteria.pdf> (accessed February 2015).

Texas CEQ. 2014. *Effects Screening Levels (ESL) Lists Used in the Review of Air Permitting Data*.  
*Toxicology Division for Air Permitting, Texas Commission on Environmental Quality*.

[http://www.tceq.texas.gov/toxicology/esl/list\\_main.html#esl\\_1](http://www.tceq.texas.gov/toxicology/esl/list_main.html#esl_1) (accessed February 2015).

KEMES UNDERGROUND PROJECT  
Health Canada comments on the Human Health Follow-up Program

#	Document	Section, Page	Context and Rationale for the Request	Suggested Information Request	Response
			<i>Provide applicable background information.</i>	<i>Ask a specific question, or describe the specific request for additional information.</i>	
1	Human Health Follow-up Plan (HHFP)	1.2 General Approach, pp 1-3	The proponent states that "monitoring air is not required for the HHFP"; however, KUG Condition 5 (Human Health) states that "the proponent shall develop...a follow-up program to verify the accuracy of...adverse environmental effects on the health of Indigenous Peoples caused by changes in concentrations of contaminants of potential concern identified during the environmental assessment in air, soil, water and sediment." Health Canada suggests that non-threshold, non-carcinogenic compounds such as NO2 and PM should be evaluated during all phases of the project, since any increase in these compounds may result in a potential risk to human health.	Health Canada suggests implementing continuous air quality monitoring, at locations relevant to human receptors, to verify project predictions and to allow for future adaptive management should there be any unanticipated exceedances of CAC.	<i>The Air Quality Management Plan and Fugitive Dust Management Plan outline site-specific air quality monitoring, consisting of dustfall monitoring of total metals proportions in dustfall and passive air sampling system (PASS) for NO2 and SO2. A Partisal™ 2025i Sequential Air Sampler (www.thermofisher.com) is currently being sourced for implementation at the KUG Project, which will capture PM2.5 and PM10 particulate matter concentrations. The Partisal will be located where human activity is representative of the mine site.</i>
2	Human Health Follow-up Plan	1.2 General Approach, pp 1-3 4.4 Soil, pp 4-2	The proponent states that the HHFP relies on input from other monitoring and management plans, and assumes that if there is no change in environmental media according to these other plans, the quality of country foods will not change. These other monitoring plans do not describe how they will feed into the HHFP. For example, the MSWMP appears to be geared towards satisfying permitting requirements with minimal mention of human health.  The HHFP states that "only the top 0 to 20 cm of the soil horizon should be sampled for metal analysis consistent with the HHERA approach in the EAC Application." However, the Ecosystem Management Plan which outlines the soil sampling states that "soil samples will be collected from within the top 30 cm of the soil pits" (pp. 21).	To address inconsistencies between the HHFP and other monitoring programs, ensure the monitoring programs that feed into the HHFP acknowledge they are being used for the HHFP and update any protocols in these plans that do not sufficiently address the needs of the HHFP. Provide information in the HHFP on how the triggers for the other monitoring programs are appropriate for human health. Explain who will be looking at the data from a human health perspective, and with what frequency.	<i>The following plans will be updated to acknowledge that data collected through the plans will be used for the HHFP: Mine Site Water Management Plan, Selenium Management Plan, Fish and Aquatic Effects Monitoring Plan, and Ecosystem Management Plan.</i>  <i>The sampling protocol for vegetation tissue metals in the Ecosystem Management Plan will be updated to require sampling concurrent with soil sampling every 3 to 5 years, rather than only when soil exceedances are detected. This revised monitoring approach recognizes that vegetation tissue metals concentrations can be affected by both uptake from soils and by aerial deposition of dust, and is more protective of human health than the current approach. This revision to the Ecosystem Management Plan will be incorporated into the description of vegetation monitoring in the HHFP.</i>  <i>The trigger for an updated HHRA for country foods based on vegetation monitoring will be updated to be consistent with other HHFP triggers: if the results of vegetation monitoring indicate that COPC concentrations in vegetation samples exceed predicted concentrations during the Construction or Operations phases (as shown in Tables 4.6.1 and 4.6.2 of Appendix 18-B of the EAC Application) plus 30% (40% for high variability metals) for at least three consecutive samples (i.e., for at least nine to 15 years), a HHRA for country foods will be triggered.</i>  <i>For the other environmental media (soils, water, sediment), triggers for an updated HHRA are based on laboratory precision and anticipated natural variability (BC/MCE 2015, Section 4; Laboratory Quality Assurance Quality Control, in BC Environmental Laboratory Manual, Ed.) and are considered appropriate for the protection of human health.</i>  <i>All soils sampling completed for the HHERA in the EAC application was completed within the top 30 cm of the soil horizon. The HHFP text will be corrected accordingly.</i>  <i>The monitoring data collected from other monitoring programs will be reviewed annually from a human health perspective and reported on in annual HHFP reports.</i>
3	Mine Site Water Management Plan	4.3.4 Potable Water Supply Wells	The report notes that there are 3 existing potable water supply wells that continue to be operated.	With regards to the potable wells, please describe the proposed monitoring program (including the parameters and frequency of monitoring) that will be implemented to ensure the protection of human health.	<i>Samples are taken on a monthly basis for total coliforms and E. Coli. On a quarterly basis samples are analyzed for total metals, dissolved metals, anions, nutrients and general parameters.</i>
4	Mine Site Water Management Plan (MSWMP)	9.0 Plan Revision	The plan is a "living document".	HC suggests the proponent commit to, at minimum, an annual or semi-annual review of standards and objectives, update to the most conservative values and note any potential risks to human health.  For example, the Canadian Council of Ministers of the Environment have recently released Canadian Ambient Air Quality Standards for NO2. These are lower than the previous standards and are applicable as of 2020 which will be during the life of the project. <a href="https://www.ccmec.ca/en/current_priorities/air/caaq.html">https://www.ccmec.ca/en/current_priorities/air/caaq.html</a>	<i>Annual review of all standards and objectives will be completed for the Mine Site Water Management Plan. Any potential risks to human health will be identified in the annual report from the Human Health Follow Up Program.</i>
5	Fish and Aquatic Effects Monitoring Plan (FAEMP)	8.3.5.7 Fish Monitoring Studies (Sentinel Species Studies)	The report states that "ten fish of similar age and length from each of the three locations (for a total of 30 fish) will be retained for analysis of metals and moisture content in body tissue."	Health Canada suggests these data be used to help verify project predictions for concentrations of metals in fish tissues.	<i>Agreed. The tissue metal data from the sentinel species monitoring will be available for a future review of project predictions.</i>
6	Fish and Aquatic Effects Monitoring Plan	8.3.5.7 Fish Monitoring Studies (Adult Fish Monitoring Studies)	The report states that "adult fish monitoring studies will include...non-lethal fish tissue monitoring of adfluvial bull trout from Thutade Lake..."	Health Canada suggests these data are used to help verify project predictions for concentrations of contaminants in fish tissues.	<i>Agreed. The tissue metal data from the bull trout monitoring will be available for a future review of project predictions.</i>
7	Fish and Aquatic Effects Monitoring Plan	Appendix G (Fish Monitoring Studies)	The FAEMP states that total metal concentrations in dermal punch samples will be compared against applicable provincial and federal fish tissue guidelines, and site-specific toxicity thresholds for selenium in tissue.	Please specify what guidelines will be used and why they are appropriate for the protection of human health. In addition, it is suggested that MEHg be included in any fish monitoring program as it is more toxic than total mercury.	<i>In addition to the BC selenium guideline for the protection of aquatic life, fish tissue selenium concentrations will be compared to the BC selenium human consumption screening values, which are derived from Health Canada's recommended calculation of ingestion and tolerable upper intake.</i>  <i>Fish tissue total mercury concentrations will be compared to the BC total mercury aquatic life guidelines when human diet is based primarily on fish. The addition of methyl mercury analysis will be considered, but sample volume is limited in dermal punch samples.</i>
8	Human Health Follow-up Plan	3.4 Ecosystem Management Plan, pp 3-3	The report states that "soil samples will also be collected from a non-impact control site for comparison".	Please provide information on the location of the non-impact control site.	<i>The non-impact control site will be selected at the time of sampling, based on accessibility and air quality modeling. Based on PM2.5, the preferred location of the non-impact control site is southwest of the mine site and south of the ORAR, at least 1 km away from the ORAR.</i>
9	Human Health Follow-up Plan	3.4 Ecosystem Management Plan, pp 3-4	"frequency of sampling will be every 3 to five years to match the frequency of the Reclamation and Closure Plan review/update."	Provide rationale as how this frequency of sampling will be protective of human health.	<i>The predicted effects on soil metals concentrations during Construction and Operations were very small (Table 3.4-2 of Appendix 18-B of the EAC Application) and changes to soil metals are expected to occur over a long time horizon (e.g., several decades). Therefore, sampling every 3 to 5 years is considered sufficient for the protection of human health.</i> <i>As described in the response to #2, above, the Ecosystem Management Plan will be revised to require vegetation tissue sampling concurrent and co-located with soil sampling every 3 to 5 years, rather than only if exceedances are detected for soils. This approach is more protective of human health because it recognizes that vegetation tissue metals concentrations are affected through two pathways: uptake from soil and aerial deposition.</i>
10	Human Health Follow-up Plan	3.4 Ecosystem Management Plan, pp 3-4	The report states that "if vegetation sampling commences, the frequency of sampling would be the same as that of soil sampling - every three to five years... or every three years at a minimum should COPC concentrations in soil exceed CME Soil Quality Guidelines for the Protection of Environmental and Human Health - Agricultural, as well as baseline concentrations plus 30% (40% for high variability metals)."	Please provide rationale as to how the proposed vegetation sampling strategy is protective of human health.	<i>The predicted effects on vegetation tissue metals concentrations during Construction and Operations were very small (Tables 4.6.1 and 4.6.2 of Appendix 18-B of the EAC Application). Therefore, sampling every 3 to 5 years is considered sufficient for the protection of human health.</i>
11	Human Health Follow-up Plan	4.2 Sediment, pp 4-1	Sediment should be included in the HHFP as it can be an exposure route for fish and aquatic plants. Sediment is not included in the list of media provided on page 1-3 and has not been discussed in the report up until this point, but does appear as a trigger for fish metal characterization for potential country foods risk assessment in Section 4.3 Fish.	It is unclear why sediment is highlighted in section 4.2 but mentioned earlier in the report. Please update the HHFP with a discussion of sediment. Include a discussion of how triggers for sediment monitoring are suitable for assessment of HH.	<i>Sediments form part of the exposure pathway related to fish tissues for human health. Triggers for sediment are utilized in the HHFP as metals concentrations in sediment are less variable than those in fish tissues. Sediment sampling is completed as part of the Fish and Aquatic Effects Monitoring Plan and the Selenium Management Plan, as described in Sections 3.2 and 3.3 of the HHFP. Sediment will be added to the list of media discussed on page 1-3 of the HHFP.</i>
12	Human Health Follow-up Plan	4.5 Vegetation, pp 4-2	"Vegetation sampling will then be conducted every three years, co-located and during the same season as soil sampling."  Health Canada notes that collection of samples (from plants consumed by people, such as medicinal plants and berries is included in the monitoring plan for the project. In order to understand the potential intake of contaminants by consumers of local vegetation, it is essential that representative species and specific portions of those species (e.g. bark for tea, berries, etc.) are analyzed separately (i.e. do not composite leaves with berries from the same plant in one sample). Sufficient numbers and volumes of samples should be collected at individual locations. Ideally one sample volume collected from each plant rather than compositing samples from the same species located in a similar area (i.e. collecting berries from one plant as a sample, not collecting berries from multiple plants in an area and compositing those into one sample). Vegetation samples collected should be co-located with soil samples from the root zone to evaluate the difference between soil contaminant concentrations and concentrations in the plants themselves. This sampling will also identify variations between plants and between specific portions of plants (if more than one portion of the plant is consumed, e.g. leaves and bark).	Health Canada suggests that plant and soil sampling should occur at a time when plants are normally harvested in order to best reflect the COPCs present in the traditional foods and associated soil.  Health Canada suggests that proponent communicate with Indigenous groups to ensure they have an accurate list of traditional plants, what parts are collected, how they are collected and in what season they are collected.	<i>The vegetation sampling plan in the EMP will be updated as described in the response to #2 above. In addition, the vegetation sampling plan in the EMP and associated references in the HHFP will be revised to clarify the following:</i>  <i>1. Vegetation sampling will be completed during the peak of the growing season, or when berries are ripe (if berries are the target).</i> <i>2. Representative species and portions of those species (e.g., berries) will be collected and analyzed separately.</i> <i>3. Composite vegetation samples will be collected from at least 5 individuals at a sampling location. Collection methods will be consistent with the methods used during baseline data collection for vegetation tissue metals. Although composite samples have lower variability than those collected from single plants, they are more representative of what would be collected and consumed by humans or browsing wildlife. Consistency with the sampling approach taken during baseline data collection is required to evaluate levels of environmental change.</i> <i>4. Vegetation samples will be co-located with soil samples from the rooting zone (top 30 cm).</i> <i>5. Species selected for sampling will include country foods (i.e., crowberry and soapberry) and diet species for moose, hare and grouse assessed in the HHERA in the EAC Application to ensure comparability with baseline studies.</i> <i>6. Multiple species will be co-collected with each soil sample where possible.</i>

13	Human Health Follow-up Plan	7.1 Hazard Quotients, pp 7-1	It is noted that the Equation 1 in Section 7.1 is a dose or exposure estimate for the ingestion of traditional foods not an estimated daily intake. An EDI by definition is an estimate of exposure from all known or suspected sources via a multimedia exposure, whereas this equation only looks at one exposure pathway. Canadian Council of Ministers for the Environment (CCME). 2006. A Protocol for the Derivation of Environmental and Human Health Soil Quality Guidelines.	Please clarify in text.	Text will be updated to replace EDI with Estimated Exposure, consistent with Health Canada 2010a and CCME 2006 Health Canada. 2010a. Federal Contaminated Site Risk Assessment in Canada, Part I. Guidance on Human Health Preliminary Quantitative Risk Assessment (PQRA). Version 2.0. Revised 2012. Contaminated Sites Division, Safe Environments Directorate. Ottawa, ON.
14	Human Health Follow-up Plan	7.1 Hazard Quotients, pp 7-1	It is noted that Equation 1 is used to estimate the dose of COPCs from a single traditional food (e.g., blueberries). These doses would then be summed to get the total traditional foods dose, and the total traditional foods does would be used in the calculation of the HQ.	Please clarify in text.	Additional text will be added after Equation 1 to clarify that estimated exposures per country food will be summed within COPCs to a total estimated exposure prior to use in Equation 2
15	Human Health Follow-up Plan	7.2 Incremental Lifetime Cancer Risks, pp 7-2	It is noted that for Equation 3 in Section 7.2 the estimated lifetime daily exposure (ELDE) is more commonly referred to as the dose.	Please clarify in text.	Text will be updated to replace ELDE with Lifetime Average Daily Dose, consistent with Health Canada 2010a
16	Human Health Follow-up Plan	7.2 Incremental Lifetime Cancer Risks, pp 7-2	It is noted that Equation 3 is used to estimate the dose of COPCs from a single traditional food (e.g., blueberries). These doses would then be summed to get the total traditional foods dose, and the total traditional foods does would be used in the calculation of the ILCR.	Please clarify in text.	Additional text will be added after Equation 3 to clarify that estimated exposures per country food will be summed within COPCs to a total estimated exposure prior to use in Equation 4

# **Appendix B:**

## Photo Plates





**Plate 3.6-1 East Pit Quarry Drainage area into the KUG tailings storage facility**

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**Plate 3.5-1: Attichika Creek Diffuser in operation.**

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**Plate 6.2.1 ORAR snowbank survey**

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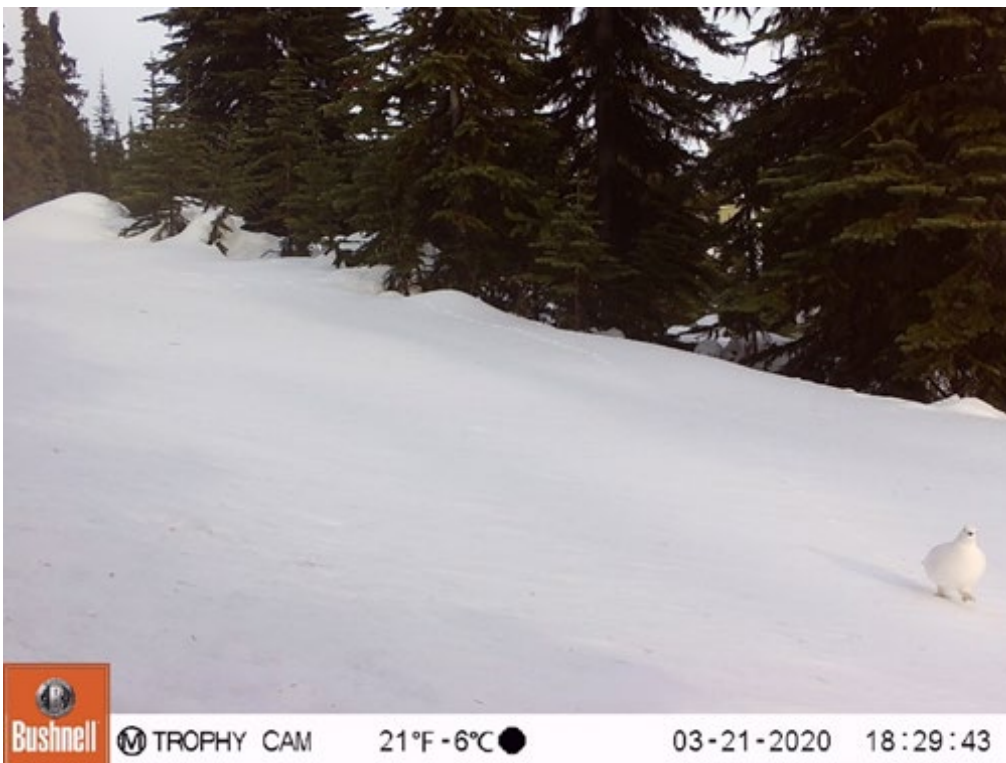
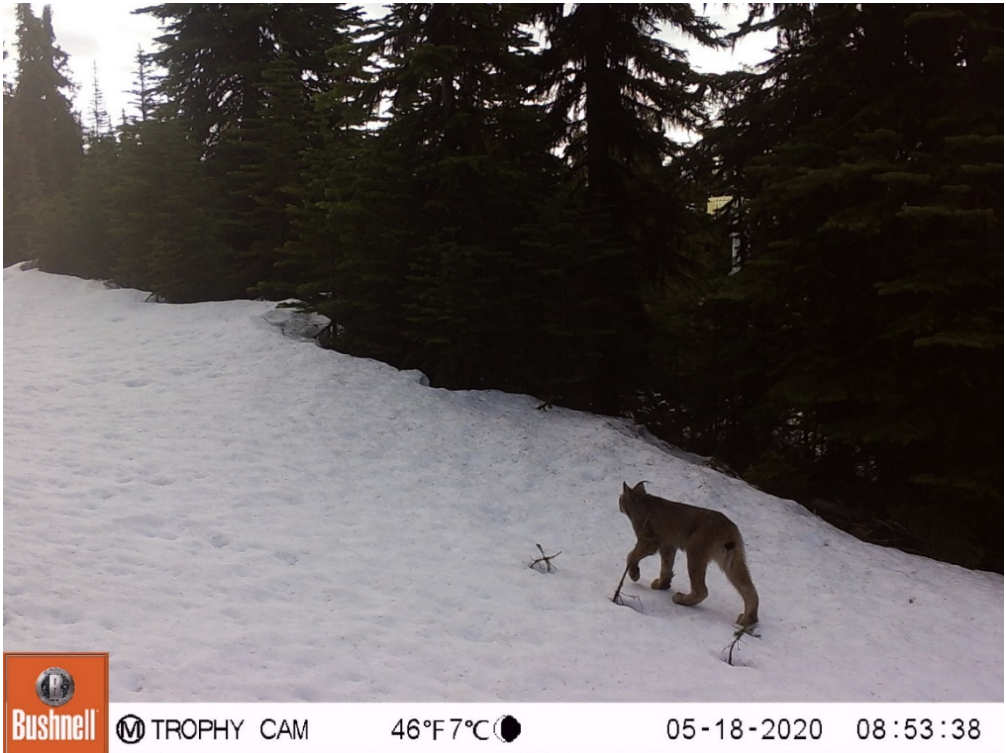


Plate 6.11-1 Wildlife Camera Setup



**Appendix C:**  
Accidents and Malfunctions Communications Plan





## KEMESS UNDERGROUND PROJECT

*AuRico Metals Inc., a subsidiary of Centerra Gold Inc.*



# Accidents and Malfunctions Communications Plan

Version: 2.0

Date: July 2018

AuRico Metals Inc.  
1 University Ave Suite 1500  
Toronto, ON  
Canada M5J 2P1  
T: (416) 204-1953  
F: (416) 204-1954

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# Accidents and Malfunctions Communications Plan

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## ACRONYMS, ABBREVIATIONS AND DEFINITIONS

Terminology used in this document is defined where it is first used. The following list will assist readers who may choose to review only portions of the document.

<b>Aboriginal Groups</b>	As defined in the BC EAO M-1701 the term used to describe Takla Lake First Nation, Tsay Keh Dene Nation and Kwadacha Nation.
<b>AuRico</b>	AuRico Metals Inc.
<b>BC</b>	British Columbia
<b>CEAA</b>	Canadian Environmental Assessment Agency
<b>CEAA 2012</b>	<i>Canadian Environmental Assessment Act, 2012</i>
<b>CEPA 1999</b>	<i>Canadian Environmental Protection Act, 1999</i>
<b>Code (the)</b>	Health, Safety and Reclamation Code for Mines in British Columbia
<b>EA</b>	Environmental Assessment
<b>EAO</b>	Environmental Assessment Office
<b>EMC</b>	Environmental Management Committee
<b>FLNRO</b>	Ministry of Forests, Lands and Natural Resource Operations (British Columbia)
<b>FMEA</b>	Failure Modes and Effects Analysis
<b>IBA</b>	Impact Benefit Agreement
<b>Indigenous Groups</b>	As defined by CEAA to mean Takla Lake First Nation, Tsay Keh Dene First Nation, and Kwadacha First Nation.
<b>KUG</b>	Kemess Underground
<b>MEM</b>	Ministry of Energy and Mines (British Columbia)
<b>MoE</b>	Ministry of Environment (British Columbia)
<b>Project</b>	KUG Project
<b>TKN</b>	Tse Keh Nay
<b>TSF</b>	Tailings Storage Facility

## 1. PURPOSE AND OBJECTIVES

The Accidents and Malfunctions Communications Plan is developed as an outcome of the Environmental Assessment process and the condition (#17) that is included with the Environmental Assessment (EA) Certificate M17-01 issued on March 15, 2017 under the British Columbia (BC) *Environmental Assessment Act* (2002) and *Canadian Environmental Assessment Act, 2012* (CEAA; 2012) Decision Statement condition 9.5 also issued on March 15, 2017.

## 2. PLANNING

### 2.1 ROLES AND RESPONSIBILITIES

AuRico Metals will be responsible for implementing this plan and initiating the communication of Accidents and Malfunctions, if any occur, in accordance with timelines that are mandated by the relevant legislation and conditions of the relevant permit. Where an Accident or Malfunction is of a minor nature and there is no reporting requirement, AuRico will report the event or events on a quarterly basis or in the case of Tsay Keh Nay at the next Environmental Management Committee (EMC) meeting. Additionally, AuRico has a responsibility to keep the BC Environmental Assessment Office (EAO), Canadian Environmental Assessment Agency (CEAA), Takla Lake, Kwadacha, Tsay Keh Dene, Gitksan Wilp Nii Kyap First Nations, Ministry of Forests, Lands and Natural Resource Operations (FLNRO), Ministry of Energy and Mines (MEM), Ministry of Environment (MoE), and Northern Health Authority informed of changes in contact information.

The First Nations, FLNRO, MEM, MoE, and Northern Health Authority likewise have a responsibility to maintain their contact information up to date, and to respond in a timely manner with follow up questions, comments, observations, and offers of assistance.

Indigenous Groups have a responsibility to maintain an up to date register of Aboriginal Businesses that identifies to AuRico where they may have the capacity and resources to assist in the event of accidents and malfunctions for which AuRico has inadequate physical resources to deal with the event in question.

If there is a major accident or malfunction that has the potential to affect people who are on the land in the area of Kemess, Indigenous Groups will have the responsibility of notifying AuRico as to where these people are and how AuRico may communicate with them. Alternately members who are on the land may choose to notify Kemess Security of their whereabouts when they arrive in the area.



## 2.2 COMPLIANCE OBLIGATIONS

### 2.2.1 Legislation and Regulations

Some of the Accidents and Malfunctions that were evaluated in the Failure Modes and Effects Analysis as part of the Environmental Assessment process, and as part of normal best management practice, are covered by Legislation and Regulation. Specifically, many of these potential Accidents and Malfunctions are regulated under the following:

- *Health, Safety and Reclamation Code for Mines in British Columbia* (Code; BC MEM 2017);
- *BC Mines Act* (1996a);
- *Occupational Health and Safety Regulation* (BC Reg. 296/97);
- *Workers Compensation Act* (1996b);
- *BC Environmental Management Act* (2003);
- *Spill Reporting Regulation* (BC Reg. 263/90);
- *Fisheries Act* (1985a);
- *Transportation of Dangerous Goods Act* (1992);
- *Transportation of Dangerous Goods Regulations* (SOR/2001-286);
- *Canadian Environmental Protection Act, 1999* (CEPA; 1999) and *Environmental Emergency Regulations* (SOR/2003-307);
- *Hazardous Products Act* (1985c);
- *Hazardous Materials Information Review Act* (1985b);
- *Controlled Products Regulations* (SOR/88-66); and
- *Workplace Hazardous Materials Information System Regulation (Mines)* (BC Reg. 257/88).

A number of Kemess Underground (KUG) Project permit applications also require the creation of Management Plans, which cover the responses to specific material accidents and malfunctions that were evaluated as part of Failure Modes and Effects Analysis (FMEA)

These Management Plans have been created as part of the KUG Project permitting process and as part of the Environmental Management System.

### 2.2.2 Provincial EA Certificate

Condition #17 of the Provincial EA Certificate issued on March 15, 2017 under the *BC Environmental Assessment Act* (2002) specifically states:

*The Holder must develop a communication plan for accidents and malfunctions. The plan must be developed in consultation with FLNRO, MEM, MoE and Aboriginal Groups.*

*The plan must include at least the following:*

- a) *The types of accidents and malfunctions requiring notification by the Holder and the timeframe of notification (including updates subsequent to the initial notification) to each Aboriginal Group community and other users of the area that could be affected;*
- b) *Information to be included in the notifications required by bullet a), and subsequent notifications, include but are not limited to:*
  - i) *Health advisories;*
  - ii) *Remedial action being taken by the Holder; and*
  - iii) *Details of subsequent monitoring.*
- c) *The manner by which Aboriginal Groups, communities or other users of the area must be notified by the Holder of an accident or malfunction, and of any opportunities for the Aboriginal Groups, communities and other users of the area to assist in response to the accident or malfunction; and*
- d) *The contact information of the representatives of the Holder and the Aboriginal Groups, communities and other users of the area to which the Holder must provide notification and a plan to regularly update this information.*

*The Holder must provide this draft plan to FLNRO, MEM, MoE, Aboriginal Groups and EAO for review a minimum of 45 days prior to the planned commencement of Construction.*

*The plan and any amendments thereto, must be developed and implemented throughout Construction, Operations, Closure and Post Closure to the satisfaction of EAO.*

### **2.2.3 Federal EA Decision Statement**

Condition 2.11 of the Federal Decision Statement issued on March 15, 2017 under CEEA 2012 specifically states:

*The Proponent shall publish on the Internet, or any medium which is widely publicly available [...] the reports related to accidents and malfunctions referred to in conditions 9.4.3 and 9.4.4, the communication plan referred to in condition 9.5.*

#### **Condition 9.4**

*9.4 In the event of an accident or malfunction with the potential to cause adverse environmental effects, the Proponent shall implement the emergency response plan referred to in condition 9.3 and shall:*

- *9.4.1 notify Indigenous groups, Gitksan Wilp Nii Kyap, and relevant authorities of the accident or malfunction as soon as possible, and notify the Agency in writing;*
- *9.4.2 implement immediate measures to mitigate any adverse environmental effects associated with the accident or malfunction;*
- *9.4.3 submit a written report to the Agency no later than 30 days after the day on which the accident or malfunction took place. The written report shall include:*
  - *9.4.3.1 a description of the accident or malfunction and of its adverse environmental effects;*

- 9.4.3.2 the measures that were taken by the Proponent to mitigate the adverse environmental effects of the accident or malfunction;
- 9.4.3.3 any views received from Indigenous groups, Gitxsan Wilp Nii Kyap, and relevant authorities with respect to the accident or malfunction, its adverse environmental effects, and measures taken by the Proponent to mitigate adverse environmental effects;
- 9.4.3.4 a description of any residual adverse environmental effects and any modified or additional measures required by the Proponent to mitigate residual adverse environmental effects;
- 9.4.3.5 details concerning the implementation of the emergency response plan referred to in condition 9.3; and
- 9.4.4 submit a written report to the Agency, no later than 90 days after the day on which the accident or malfunction took place, on the changes made to avoid a subsequent occurrence of the accident or malfunction, and on the implementation of any modified or additional measures to mitigate and monitor residual adverse environmental effects and to carry out any required progressive reclamation, taking into account the information in the written report submitted pursuant to condition 9.4.3.

Condition #9.5 of the Federal Decision Statement specifically states:

*The Proponent shall develop and implement a communication plan in consultation with Indigenous groups (a defined term meaning Takla Lake, Tsay Keh Dene, and Kwadacha First Nations) and Gitxsan Wilp Nii Kyap. The Proponent shall develop the communication plan prior to construction and shall implement and maintain it up to date from the start of construction to the end of decommissioning. The plan shall include:*

- 9.5.1 *the type of incidents and malfunctions requiring the Proponent to notify the respective Indigenous groups and Gitxsan Wilp Nii Kyap;*
- 9.5.2 *the manner by which Indigenous groups and Gitxsan Wilp Nii Kyap shall be notified by the Proponent of an accident or malfunction and of any opportunities for the Indigenous groups and Gitxsan Wilp Nii Kyap to assist in the response to the accident or malfunction; and*
- 9.5.3 *the contact information of the representatives of the Proponent that the Indigenous groups and Gitxsan Wilp Nii Kyap may contact and of the representatives of the respective Indigenous groups and Gitxsan Wilp Nii Kyap to which the Proponent provides notification.*

### **3. IMPLEMENTATION**

#### **3.1 TYPE OF ACCIDENTS AND MALFUNCTIONS REQUIRING NOTIFICATION AND TIMELINE OF NOTIFICATION**

High Environmental Risk accidents and malfunctions – of which two were identified in the FMEA process: 1) KUG Tailings Storage Facility (TSF) East Dam failure and 2) KUG TSF East Dam or pit wall overtopping – will require notification on a timeline as per the Mine Emergency Response Plan and the Code (BC MEM 2017). AuRico will conduct a post remediation Human Health Risk Assessment for High Environmental Risks accidents and malfunctions.

Four Moderate Environmental Risks were identified in the FMEA process. These events are as follows:

1. Leak/spill of hazardous substances stored on-site;
2. Leak/spill during road, air or water transport;
3. Fires or explosions; and
4. Discharge water quality exceedance to the receiving waterbody, Attichika Creek, during construction and operations.

Low Risk Failure Modes include a broad spectrum of leaks, releases of contaminants or sediments, industrial accidents, equipment malfunctions, and geotechnical hazards. Depending of the nature of the event, these will be reported to MEM and/or MoE as per requirements of various permits such as in Incident Reports or Annual Compliance Reports. In all cases, these events will be reported internally in accordance with internal reporting procedures and reporting to Tse Keh Nay via the EMC (i.e., the TKN-AuRico committee and not the EMC of Condition #12 of the BC EA Certificate). The frequency of EMC meetings is on an as-needed basis but no less than quarterly. Gitxsan Wilp Nii Kyap will receive quarterly reports.

Updates subsequent to the initial notification to each Aboriginal Group's, Gitxsan Wilp Nii Kyap, community and other users of the area that could be affected will be on a case by case basis as determined by either the EMC or the First Nations Chief of the potentially affected community in consultation with AuRico. Updates will use best practices and include communication process to clearly and carefully relay information to mitigate and minimize mental health impacts of an environmental accident or malfunction. A variety of communication tools and methods will be used to reach the target audience, get information to the audience when they need it, for as long as they need it and can be accessed within resource limitations.

### **3.2 INFORMATION TO BE INCLUDED IN THE NOTIFICATION OF THE ACCIDENT AND MALFUNCTION**

Information to be provided for High to Moderate environmental risk accidents and malfunctions will, as a minimum, be determined by legislation/permit conditions and/or relevant Management Plans such as, but not limited to, the Mine Emergency Response Plan and the Code (BC MEM 2017). The information will include remedial actions that have been taken and those planned actions to be undertaken, a schedule indicating the timing and nature of the actions taken, resources available and additional resources required. Health advisories will be included, as deemed necessary, in consultation with key agencies such as Northern Health and First Nations that are potentially affected. The necessity of subsequent monitoring will be determined in consultation with the AuRico-TKN EMC and the EMC (EAO condition #12); and will also be in accordance with AuRico's commitment to a strategy of Adaptive Environmental Management, an Ecosystem-based Approach, the Precautionary Principle and Sustainable Development, as defined in the Impact Benefit Agreement (IBA) with TKN.

Information on Low environmental risk accidents and malfunctions will be reported in accordance with internal procedures. For Tsay Keh Nay, reporting of low risk events will be via the EMC (i.e., the TKN-AuRico committee and not the EMC of Condition #12 of the BC EA Certificate). Gitxsan Wilp Nii Kyap will receive quarterly reports on low environmental risks accident and malfunctions. Subsequent monitoring will be in accordance with the terms of the relevant management plan unless the indigenous determines that adjustments are needed.

### 3.3 MANNER OF NOTIFICATION AND OPPORTUNITIES TO ASSIST

Aboriginal Group communities will initially be notified by AuRico of an accident or malfunction by telephone to the Band office in the event of a high or moderate risk event, as defined in Table 3.3-1, followed by an e-mail or fax with confirmation of receipt requested. In the event of low risk events, these will be communicated to the EMC by e-mail and information about these events will be located in a repository of information that AuRico has committed to establishing with the EMC.

**Table 3.3-1. Types of Accident or Malfunction and Corresponding Timeline of Notification**

Type of Accident or Malfunction	Timeline of Notification
KUG TSF East Dam Failure	Within 24 hours
KUG TSF East Dam or pit wall overtopping	Within 24 hours
Leak/spill of hazardous substances stored on site	Within 24 hours
Leak/spill during road, air or water transport	Within 24 hours
Fires or explosions	Within 24 hours
Discharge water quality exceedance to receiving waterbody	Within 24 hours

Signs posted on the Omineca Resource Access Road will encourage other users of the area to report their presence, approximate location and method of communication to Kemess security personnel so that AuRico can attempt to contact them in the event of an emergency at site.

Any opportunities for the Indigenous groups to assist in response to the accident or malfunction will be communicated to the the Tse Keh Nay designated Business Opportunities Committee members who have committed to maintaining a TKN Business Registry and to the Gitxsan Wilp Nii Kyap.

Communities and other users of the area will have the opportunity to assist in the response to the accident or malfunction if they have provided information about their potential services and their contact details to AuRico.

Per condition 2.11 of the CEAA Decision Statement, the reports related to accidents and malfunctions and this Communications Plan will be published on the Company's website, <https://www.centerragold.com/operations/kemess>, in the section related to the KUG Project.

### 3.4 CONTACT INFORMATION

#### First Nations

First Nation and Local Stakeholders	Contact Information
Kwadacha First Nation	250-471-2302
Prince George Office	250-563-4161
Tsay Keh Dene	250-993-2100
Prince George Office	250-562-8882
Takla Lake First Nation	250-564-9321
Prince George Office	250-996-7877
Gitxsan Wilp Nii Kyap	250-216-5268
Ron Steffey – Moose Valley Guide Outfitters	604-484-8278
Jean Tom, lead spokesperson, Trapline 0739T006	250-596-4649

#### AuRico Metals and Kemess Mine Site

Prince George Office		Toronto Office		
AuRico Metals Inc 299 Victoria St., Suite 200 Prince George, BC V2L 5B8		AuRico Metals Inc. 1 University Ave Suite 1500 Toronto, ON Canada M5J 2P1 T: (416) 204-1953 F: (416) 204-1954		
Name	Title	Ext.	Direct	Mobile
Ron Hampton	Project Manager			250-614-4851
Bruce Grau	Site Superintendent	13825	604-359-4383	NA
Gord Shepherd	Site Superintendent	13825	604-359-4383	NA
Chris Hiemstra	Environmental Coordinator	13833	604-424-9741	778-259-0167
Security Gatehouse		3802	604-227-1673	NA

### 3.5 REPORTING AND RECORDKEEPING

CEAA shall be notified of the accident or malfunction, as soon as possible, in writing. Within 30 days of the accident or malfunction a written report will be submitted to the Agency which includes:

- a description of the accident or malfunction and of its adverse environmental effects;
- the measures that were taken by the Proponent to mitigate the adverse environmental effects of the accident or malfunction;

- any views received from Indigenous groups, Gitxsan Wilp Nii Kyap, and relevant authorities with respect to the accident or malfunction, its adverse environmental effects, and measures taken by the Proponent to mitigate adverse environmental effects;
- a description of any residual adverse environmental effects and any modified or additional measures required by the Proponent to mitigate residual adverse environmental effects;
- details concerning the implementation of the emergency response plan referred to in condition 9.3; and

Furthermore, a written report will be submitted to the Agency, no later than 90 days after the day on which the accident or malfunction took place, on the changes made to avoid a subsequent occurrence of the accident or malfunction, and on the implementation of any modified or additional measures to mitigate and monitor residual adverse environmental effects and to carry out any required progressive reclamation, taking into account the information in the written report submitted within 30 days of the accident or malfunction.

These reports will be published on the Company's website, <https://www.centerragold.com/operations/kemess>.

### **3.6 COMMUNICATION PLAN REVISIONS**

TKN and Gitxsan Wilp Nii Kyap will be notified and consulted about revisions to the Accidents and Malfunctions Communications Plan. This Plan, and any amendments thereto, will be developed and implemented throughout Construction, Operations, Closure and Post Closure to the satisfaction of EAO.

In addition to the reciprocal obligation to notify parties of changes to contact information, AuRico and the TKN through the IBA have committed to an annual review of Management Plans and that commitment applies to this Plan.



## REFERENCES

Definitions of the acronyms and abbreviations used in this reference list can be found in the Glossary and Abbreviations section.

1985a. *Fisheries Act*, RS. C. F-14. s. 1.

1985b. *Hazardous Materials Information Review Act*, RSC. C. 24 (3rd Supp.), Part III. s. 9.

1985c. *Hazardous Products Act*, RSC. C. H-3.

1992. *Transportation of Dangerous Goods Act*, SC. C. 34.

1996a. *Mines Act*, RSBC. C. 293.

1996b. *Workers Compensation Act*, RSBC. C. 492.

1999. *Canadian Environmental Protection Act, 1999*, SC. C. 33.

2002. *Environmental Assessment Act*, RSBC. C. 43.

2003. *Environmental Management Act*, SBC. C. 53.

2012. *Canadian Environmental Assessment Act, 2012*, SC. C. 19. s. 52.

Workplace Hazardous Materials Information System Regulation (Mines), BC Reg. 257/88.

Spill Reporting Regulation, BC Reg. 263/90.

Occupational Health and Safety Regulation, BC Reg. 296/97.

Controlled Products Regulations SOR/88-66.

Transportation of Dangerous Goods Regulations, SOR/2001-286.

Environmental Emergency Regulations, SOR/2003-307.



# **Appendix D:**

## Pre-clearing Survey

**Memo**

<b>To</b>	Chris Werbicki - AuRico Metals Inc.
<b>From</b>	ERM Consultants Canada
<b>Date</b>	01 June 2020
<b>Reference</b>	0371562-0303
<b>Subject</b>	Kemess Underground Project – Wildlife Pre-clearing Survey Report

**1. INTRODUCTION**

This memo presents the results of pre-clearing surveys completed in 2020 at the Kemess Underground Project (The Project), which is being developed by AuRico Metals Inc. (AuRico), a wholly owned subsidiary of Centerra Gold Inc. (Centerra). Vegetation clearing in 2020 was scheduled to begin in late May within one Project area for the SCSP Collection Ditch (Figure 1-1 in Appendix A). According to the Provincial Environmental Assessment Certificate condition #25, federal Decision Statement conditions # 4.1, 4.3, 6.5, 6.6, and 6.7, and the Projects Wildlife Management and Monitoring Plan (WMMP Sections 4.2.3.2 and 7.1.2, Table 4.2-1; AuRico 2017a) and Ecosystems Management Plan (Section 4.3.2.3 and Table 5.1-1; AuRico 2017b), pre-clearing surveys are required in areas where vegetation will be cleared during wildlife sensitive periods for:

1. Active furbearer dens (when clearing occurs February to September).
2. Raptor nests (when clearing occurs in forested areas from March to August, and for short-eared owl February 28 to September 15).
3. Migratory bird nests (when clearing occurs April 15 to August 15).
4. Active maternal bat roosts (when clearing occurs May 15 to September 30).
5. Western toad breeding habitat (when clearing occurs May to August).

**1.1 Survey Objectives**

The objective of the 2020 fieldwork was to:

- Complete pre-clearing surveys for bird nests, maternal bat roosts, and furbearer dens no more than seven days prior to tree-felling activities along the proposed SCSP Collection Ditch.

Surveys for Western toad breeding habitat were not included in the survey objectives because of the lack of suitable wetland habitat in the area to be cleared.

## 2. METHODS

### 2.1 Migratory Birds

Environment and Climate Change Canada (ECCC) guidance informed the methodology of migratory bird pre-clearing surveys (Environment and Climate Change Canada 2017). Following ECCC guidance, non-invasive point count surveys were completed within seven days of tree-felling activities to determine the likelihood of birds nesting in the survey area (area to be cleared).

Point counts were completed over a period of 5 minutes with a 100 m survey radius, and were spaced no more than 200m apart within the survey area such that the point count survey areas did not overlap. Point count surveys were completed from official sunrise up to 4 hours (h) afterwards, following the methodology outlined in the BC Resource Information Standard Committee (RISC) inventory standards for forest and grassland birds (RIC 1999). All birds seen and heard during the point surveys were recorded, regardless of whether they occurred within the 100 m survey radius or beyond. Birds detected beyond 100 m, as well as those detected flying over the survey site, were considered incidental observations as they could not be determined to be using habitat within the focal 100 m survey radius. The behaviour of all birds were recorded during surveys. Surveyors paid attention for potential indications of breeding, including singing birds, territorial drumming in woodpeckers, observations of paired birds (e.g., two birds in close association or a male and female in sexually dimorphic species seen together), territorial aggression/displays between males, and observations of birds excavating nest cavities, carrying nesting material, or carrying food items for young. Other indication of breeding would include observations of physical nest sites other than cavities (e.g., cup nests) or adults feeding young.

Point count surveys were supplemented by walking transects through the survey area after completion of the morning point count surveys. During these walking surveys, surveyors returned to areas where birds had been detected during point count surveys to identify any potential indications of breeding behaviour not seen during earlier surveys. In addition, potential breeding habitats of resident and migratory birds, such as cavities in trees, were examined for breeding activity.

### 2.2 Furbearers

Furbearer pre-clearing surveys took the form of walking transects through the survey area. Like pre-clearing surveys for migratory birds, walking transects were completed within seven days of tree-felling activities to determine the likelihood of active furbearer dens being located in the area. During walking transects, any furbearer activity was noted, including tracks, scat, and evidence of use of subnivian access points and tree cavities for denning. Presence and habitat use by any potential prey species for furbearers, such as red squirrel and snowshoe hare, were also noted to determine the overall suitability of the areas for furbearer denning.

### 2.3 Bats

Bat pre-clearing surveys included a maternal roost tree assessment completed in the survey area. Walking transects were completed to assess the potential for ground level roost trees (Collins 2016). The objective was to identify older (structural stage 6 or 7) trees that could be used for day or maternal roosting. These roosts include large diameter stems with thick bark that has openings and cavities to maintain suitable environmental conditions (e.g., warm, and dry) while protecting bats



from predators (sufficiently high up the trunk, good access, and restricted openings; Nagorsen and Brigham 1993, Kalcounis, and Hecker 1995; Holroyd and Craig 2016).

Trees and snags with roosting potential were noted within the survey area. Key parameters collected for potential suitable trees were tree species, height of tree, diameter at breast height (dbh), tree decay class (Table 2.3-1), and any cavities or features (e.g., loose bark) that could support roosting, as well as the height and orientation of these features.

**Table 2.3-1: Tree Decay Class**

Decay Class	Description	
1	Live and Healthy	No decay. Tree has valuable habitat characteristics such as large, clustered or gnarled branches, or horizontal, thickly moss-covered branches.
2	Live and Unhealthy	Internal decay or growth deformities (including insect damage, broken tops); dying tree. Some use by the strongest primary cavity excavators (e.g., woodpeckers) but generally few excavated cavities.
3	Dead	Needles or twigs may be present; roots sound. Increased by primary cavity excavators (woodpeckers) and secondary cavity users (e.g., furbearers). Potential for use by bats.
4	Dead	No needles/twigs; 50% of branches lost; loose bark; top usually broken; roots stable. Roosting and nesting habitat for primary cavity excavators, use by secondary cavity users. Increased potential to be used by bats for roosting.
5	Dead	Most branches/bark absent; some internal decay; roots of larger trees stable. Increased used by weaker primary cavity excavators (chickadees and nuthatches), good habitat for secondary cavity users and bats.
6	Dead	Tree approx. 2/3 original height. No branches or bark; sapwood/ heartwood sloughing from upper bole; decay more advanced; lateral roots of larger trees softening; smaller ones unstable. Habitat for variety of primary cavity excavators and secondary cavity users, good habitat for bats.
7	Dead	Tree approx. 1/2 original height. Extensive internal decay; outer shell may be hard; lateral roots completely decomposed; hollow or nearly hollow shells. Use by wildlife mainly for feeding or as habitat for small mammals and salamanders, limited use by weaker cavity excavators, such as chickadees. Decreasing value as bat habitat with decreasing size.
8	Dead and Fallen	Tree approx. 1/3 original height. Extensive internal decay; outer shell may be hard; lateral roots completely decomposed; hollow or nearly hollow shells. Similar habitat values as decay class 7. Decreasing value as bat habitat with decreasing size.
9	Dead and Fallen	Downed trees or stumps. Value as feeding habitat for wildlife, security habitat for smaller mammals.

Note:

Adapted from Figure 8. British Columbia's wildlife tree classification system in BC MOF (2002).

In conjunction with the roost tree survey, two Wildlife Acoustics Song Meter SM3 bioacoustics recorders were placed at potential bat foraging locations within the survey area. These recorders, henceforth referred to as audio recording units (ARUs), were intended to identify presence and species of bats active in the Project area.

In the event that a suitable roosting tree was found, night emergence surveys were conducted from 30 minutes before sunset to one hour after sunset or until the roost tree was no longer visible. Potential cavities on the tree were watched for emergence of bats to determine if bats were present in the tree.

### **3. RESULTS AND DISCUSSION**

#### **3.1 Migratory Birds**

##### **3.1.1 Summary**

Pre-clearing surveys for migratory birds were completed between May 19<sup>th</sup> and May 21<sup>st</sup> by ERM personnel in the SCSP Collection Ditch Area (Figure 3.1-1 in Appendix A). Point count surveys were completed for two days at two locations. Walking transects were completed after point count surveys on both days to determine the likelihood of birds nesting (Figure 3.1-1 in Appendix A). A total of 8.1 h of survey time was spent walking through the Project area (which included time spent travelling in between point count locations during surveys, as observers were always recording bird behaviour while in the field).

Surveyors encountered early spring conditions at site during the survey period. Deep snow remained in shady and north facing aspects, and most plants were not yet leafing out. Temperatures hovered just above zero most days during the survey trip, with one night of heavy rainfall on May 20<sup>th</sup> that continued into the next morning. Considering these environmental conditions, it was determined that likelihood of encountering nests of migratory birds was low. Although some migratory birds were observed in the survey period, nesting behaviours were not observed. Breeding activity for resident birds was also not observed in the survey area. Further details on survey detections are provided below.

Overall, the results of pre-clearing surveys suggested that there was a low likelihood of bird species nesting in the proposed clearing area and permission to clear was given to tree-felling crews for a window of seven days after pre-clearing surveys were completed (May 20<sup>th</sup>), as per the WMMP.

##### **3.1.2 Survey and Incidental Detections**

Within or near the survey area, eleven bird species were recorded using habitat during pre-clearing surveys completed by ERM. Species detections included birds recorded either during point count surveys or during walking transects (Table 3.1-1). Of the eleven species recorded, nine are considered to be migratory birds that are only present in the Project area during specific times of the year (e.g., during migration or during the breeding season). In the case of the nine migratory species recorded, all are expected to breed locally in the Project area. The remaining two species are considered resident birds, i.e., birds that are present in the Project area year-round. All but one of the species observed are afforded protection under the *Migratory Bird Convention Act* (MBCA; 1994); gray jays (*Perisoreus canadensis*) are not protected under the MBCA (1994).

**Table 3.1-1: Bird Species Observed, May 19 and 20, 2020**

Species Group	Species	Scientific Name	Resident or Migratory Bird	Bird Listed under MBCA <sup>1</sup>	Species Detections	
					Pre-clearing Surveys	Incidental Observation
Songbirds	American robin	<i>Turdus migratorius</i>	Migratory, Local Breeder	X	X	X <sup>2,3</sup>
	Barn Swallow	<i>Hirundo rustica</i>	Migratory, Local Breeder	X		X <sup>3</sup>
	Boreal chickadee	<i>Poecile hudsonicus</i>	Resident	X	X	X <sup>2</sup>
	Cliff Swallow	<i>Petrochelidon pyrrhonota</i>	Migratory, Potential Local Breeder	X		X <sup>3</sup>
	Common Raven	<i>Corvus corax</i>	Resident			X <sup>2</sup>
	Dark-eyed Junco	<i>Junco hyemalis</i>	Migratory, Potential Local Breeder	X	X	
	Golden-crowned Sparrow	<i>Zonotrichia atricapilla</i>	Migratory, Local Breeder	X		X <sup>3</sup>
	Gray jay	<i>Perisoreus canadensis</i>	Resident		X	
	Lincoln's sparrow	<i>Melospiza lincolni</i>	Migratory, Local Breeder	X	X	
	Orange-crowned warbler	<i>Leiothlypis celata</i>	Migratory, Local Breeder	X	X	
	Ruby-crowned kinglet	<i>Regulus calendula</i>	Migratory, Local Breeder	X	X	
	Say's Phoebe	<i>Sayornis saya</i>	Migratory, Potential Local Breeder	X		X <sup>3</sup>
	Tree Swallow	<i>Tachycineta bicolor</i>	Migratory, Local Breeder	X		X <sup>3</sup>
	Varied Thrush	<i>Ixoreus naevius</i>	Migratory, Local Breeder	X	X	X <sup>2,3</sup>
	Violet-green Swallow	<i>Tachycineta thalassina</i>	Migratory, Local Breeder			X <sup>3</sup>
	White-crowned Sparrow	<i>Zonotrichia leucophrys</i>	Migratory, Local Breeder	X	X	X <sup>2</sup>
Wilson's Warbler	<i>Cardellina pusilla</i>	Migratory, Local Breeder	X	X	X <sup>2</sup>	
Yellow-rumped Warbler	<i>Setophaga coronata</i>	Migratory, Local Breeder	X	X	X <sup>2,3</sup>	



Species Group	Species	Scientific Name	Resident or Migratory Bird	Bird Listed under MBCA <sup>1</sup>	Species Detections	
					Pre-clearing Surveys	Incidental Observation
Waterfowl	Barrow's Goldeneye	<i>Bucephala islandica</i>	Migratory, Local Breeder			X <sup>2</sup>
	Canada Goose	<i>Branta canadensis</i>	Migratory, Local Breeder	X		X <sup>2,3</sup>
	Green-winged Teal	<i>Anas crecca</i>	Migratory, Local Breeder	X		X <sup>3</sup>
	Mallard	<i>Anas platyrhynchos</i>	Migratory, Local Breeder	X		X <sup>2,3</sup>
Loons	Common Loon	<i>Gavia immer</i>	Migratory, Local Breeder			X <sup>2</sup>

## Notes:

<sup>1</sup> MBCA = Migratory Bird Convention Act.

<sup>2</sup> Species incidentally observed during the survey trip (e.g., during travel to survey site or flying overhead during surveys).

<sup>3</sup> Species incidentally observed in Project area outside of survey area and time.

Territorial singing behaviours were observed from some migrant species during surveys completed by ERM, but additional behaviours indicative of breeding (i.e. nest building, carrying food, etc.) were not observed from those individuals. Bird locations were mapped during both point count surveys and walking transects, and individuals detected during point counts were often not re-sighted in the same location during walking transects across two different days. Males or mated pairs are expected to remain in the same general location if a breeding territory has been established. Furthermore, detections of birds were predominately detections of birds calling or visual observations. Song was detected within the survey area on three occasions; by ruby-crowned kinglet (*Regulus calendula*), Wilson's warbler (*Cardellina pusilla*), and Lincoln's sparrow (*Melospiza lincolnii*). For many songbird species, including ruby-crowned kinglet, song can be an indication of territory establishment (Swanson, Ingold, and Wallace 2020). A ruby-crowned kinglet was observed singing on perches in a circuit adjacent to the survey area on both days and briefly singing within the survey area, but only one individual was ever observed or heard. Wilson's warblers are known to sing less frequently once they start nesting (Ammon and Gilbert 2020). Male Lincoln's sparrows are known to sing throughout the breeding season (Ammon 2020), but the two individuals singing were observed for one hour and were only seen foraging in a shrub-dominant area adjacent to the survey area. Considering these observations and the environmental conditions, it seems unlikely that these species had initiated nest site selection and nest building at the time of the survey.

It was noted that the survey area consisted of largely poor quality nesting habitat for songbirds; predominantly young, sparsely placed lodgepole pine trees (*Pinus contorta*) with little to no understory vegetation (Photos 3.1-1 and 3.1-2 in Appendix B). Most of the songbird activity noted during pre-clearing surveys was in a densely shrubby area around a drainage ditch, of which the majority was more than 30 meters from the proposed tree-clearing area. Where the shrub-dominated area was closer than 30 meters to the clearing area, the area was carefully surveyed. No breeding behaviours were observed in this area.

In addition, suitable cavities for resident cavity-nesting species were observed in only one tree by ERM during surveys in the survey area, although no bird activity was noted in or around the tree (Photos 3.1-3a and 3.1-3b in Appendix B). Cavities were checked by approaching the tree and lightly tapping on the outside to elicit a response; no bird activity was noted at any of the cavities seen. Overall, these survey results suggest that the breeding season for resident bird species, including cavity-nesting residents, had not substantially commenced. Breeding activity for species that are known to breed outside of the typical breeding season from April 15 to August 15, including gray jay, red crossbill (*Loxia curvirostra*), and white-winged crossbill (*Loxia leucoptera*) (Environment and Climate Change Canada 2016), was also not observed during the surveys.

Incidental bird observations were recorded; these include species seen incidentally during point count surveys (beyond 100 m or flyovers), during travel to the survey area, or species seen or heard around existing Project infrastructure. Overall, a total of 23 bird species were recorded (which includes the 11 species recorded during pre-clearing surveys), and 21 of these 23 species are protected under the MBCA (1994). Few of the 23 species recorded are considered to be resident birds present year round in the Project area (3 species), while the remaining species are those that migrate to breeding areas from separate wintering grounds (21 species; Table 3.1-1).

Across all species detected, all are anticipated to breed locally (Table 3.1-1). Of note, several of the migrant bird species recorded, particularly songbird species, are considered to be early migrants. For example, Say's phoebe (*Sayornis saya*) are likely breed to the north of the Project in the Yukon, and dark-eyed junco (*Junco hyemalis*) are higher elevation breeders that would not commence breeding at elevation until snow melt had substantially started. These observations, coupled with environmental conditions encountered during the survey, suggested that there was a low likelihood that any migratory birds could have initiated breeding attempts at the time of the pre-clearing surveys.

### 3.2 Furbearers

Pre-clearing surveys for furbearers were completed May 19<sup>th</sup> and 20<sup>th</sup> by ERM personnel. A total of 8.1 hours of survey time was used to complete walking transects in the survey area. To evaluate the potential for furbearer denning, surveyors targeted mature stands of large trees with a more closed canopy, with snags and coarse woody debris. The forest along the survey area contained very few larger trees and was quite open with little coarse woody debris or snags (Photos 3.1-1 and 3.1-2 in Appendix B). While there was evidence of suitable prey in this area (i.e., squirrels), furbearer tracks were not observed (e.g., fisher (*Pekania pennanti*), marten (*Martes americana*), lynx (*Lynx canadensis*), wolf (*Canis lupus*)). Three potential old den sites were found beneath boulders that may have been suitable for a smaller mammal such as a marten (Figure 3.2-1 in Appendix A; Photos 3.2-1, 3.2-2, and 3.2-3 in Appendix B). However, the vegetation in and around the den had grown in and there was no evidence (e.g. scat, tracks, fur) that the den had been in use in the past year. Overall, the majority of the survey area consisted of pre-existing disturbance and was comprised of younger aged stands less suitable for denning. There was no evidence of any active furbearer denning activity and the approval to clear this area was provided.



### 3.3 Bats

Pre-clearing surveys for maternal bat roost trees were completed on May 19<sup>th</sup> and May 20<sup>th</sup> by ERM personnel in the proposed SCSP Collection Ditch tree-clearing area (survey area). Pre-clearing surveys included auditory surveys with ARUs, transect surveys to search for potential roost sites, and an emergence survey. Temperatures encountered during the evenings surveys were between 0°C and 5°C. Wildlife Acoustics ARUs were deployed on May 18<sup>th</sup> within the survey area at potentially suitable bat foraging habitat (i.e. clearings adjacent to snags or large trees; Figure 3.3-1). One ARU recorded for two nights and the other recorded for three nights. The ARU that recorded for three nights was moved closer to a snag with cavities after one night of recording. ARUs were programmed to begin recording at sunset and stop at sunrise, for approximately 7.5 hours each night. Bats were detected at all three ARU locations. Three species were detected: little brown myotis (*Myotis lucifugus*), northern myotis (*Myotis septentrionalis*), and long-legged myotis (*Myotis volans*). Of these, little brown myotis and northern myotis are listed as Endangered on Schedule 1 of the *Species at Risk Act* (Environment Canada 2015), and maternal roosts cannot be cleared as per the WMMP.

Walking transects assessed the survey area for snags with potential to support bat day roosting or maternal roosts. A total of 8.1 hours of survey time was used to complete walking transects in the survey area. The vast majority of trees on site were healthy or not advanced enough in decay to be excavated by primary cavity users such as woodpeckers, and had small diameters (<45 cm dbh). These tree characteristics have low potential to support bat colonies or day roosting habitat and were not searched in depth for bat activity. However, there was one notable snag in the survey area that was examined for bat activity and assessed for its suitability as maternal roost habitat (Figure 3.3-1 in Appendix A; Photos 3.1-3a and 3.1-3b in Appendix B). The tree was decay class 5 (Table 2.2-1), approximately 60 cm dbh, and had three excavated holes; one was approximately 3 m up and south facing, and two were approximately 10 m up and north facing. This tree had no evidence of recent use by bats, but had high potential as a summer roost, as it was mostly hollow and had a cavity on a warm, south facing aspect.

In order to verify that the identified snag was not being used for roosting by bats, ERM conducted an emergence survey on May 20<sup>th</sup>. The survey began approximately 30 minutes before sunset to one hour after sunset, when it was no longer possible to see the tree. During this survey no bats were seen entering or leaving the cavities in the tree, and it was determined that the tree was not in use as a bat roost. No other trees were identified in the survey area with a similar level of decay, excavated holes, or bark characteristics (loose/flaking) that had potential for use for roosting. Overall, while bats were detected foraging in the survey area, there was no evidence of active roosting habitat and approval to clear the area was provided.

## 4. SUMMARY

- Pre-clearing surveys:
  - Pre-clearing surveys for migratory birds conducted by ERM from May 19<sup>th</sup> – 20<sup>th</sup> indicated that the likelihood of encountering nests of birds was very low due to early spring conditions, lack of suitable nesting habitat, and absence of breeding behaviour observed during surveys.

- Pre-clearing surveys for furbearers conducted by ERM from May 19<sup>th</sup> – 20<sup>th</sup> indicated very little evidence of furbearer activity and no active dens were detected.
- Pre-clearing surveys for bats conducted by ERM from May 18<sup>th</sup> – 20<sup>th</sup> indicated that the survey area provided foraging habitat for bats but no active roosts were detected, likely due to the lack of suitable roosting habitat.
- Pre-clearing surveys for western toads were not conducted due to a lack of wetlands in or near the tree-clearing area.
- The approval to clear the survey area, along the proposed SCSP Collection Ditch, was given after bird, furbearer, and bat surveys were completed.

## 5. QUALIFIED PROFESSIONALS

The following individuals are the qualified professionals who undertook the field surveys and contributed to writing this memo.

<Original signed by>

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Tracey Zacharias, B.Sc., R.P.Bio.  
Principal Consultant/Wildlife Biologist

<Original signed by>

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Nina Morrell, M.Sc.  
Consultant/Wildlife Biologist

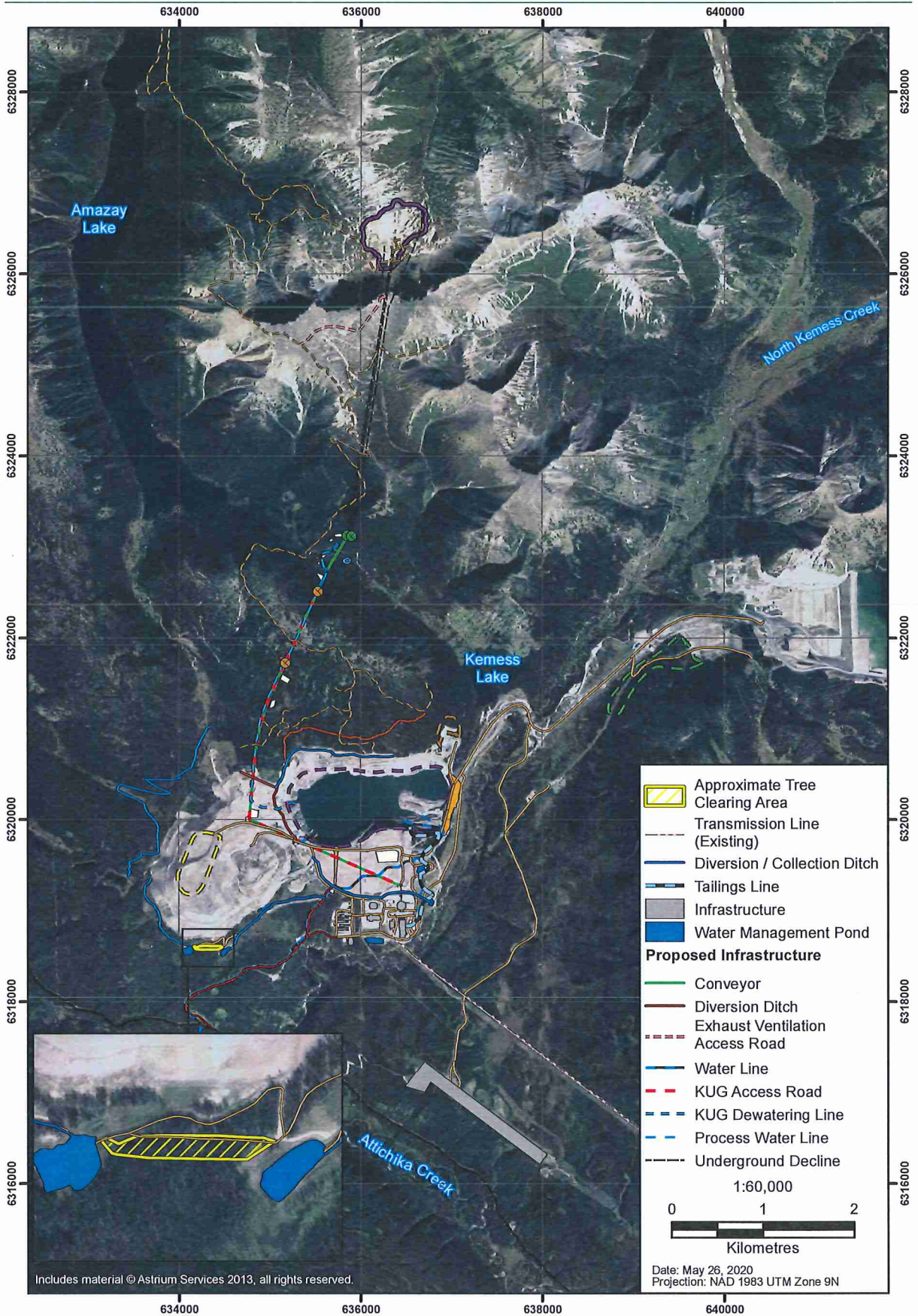
## 6. REFERENCES

1994. *Migratory Birds Convention Act* (MCBA), SC. C. 22.
- Ammon, E. M. (2020). Lincoln's Sparrow (*Melospiza lincolnii*), version 1.0. In *Birds of the World* (A. F. Poole and F. B. Gill, Editors). Cornell Lab of Ornithology, Ithaca, NY, USA. <https://doi.org/10.2173/bow.linspa.01>
- Ammon, E. M. and W. M. Gilbert (2020). Wilson's Warbler (*Cardellina pusilla*), version 1.0. In *Birds of the World* (P. G. Rodewald, Editor). Cornell Lab of Ornithology, Ithaca, NY, USA. <https://doi.org/10.2173/bow.wlswar.01>
- AuRico. 2017a. *Kemess Underground Project: Wildlife Management and Monitoring Plan. July 2018*. Document Prepared by AuRico Metals Inc. Vancouver, BC.
- AuRico. 2017b. *Kemess Underground Project: Ecosystems Management Plan*. Document Prepared by AuRico Metals Inc. Vancouver, BC.
- BC MOF. 2002. *Stand Level Biodiversity: Web-based Training Course. Module 3. Part B — Wildlife trees*. <https://www.for.gov.bc.ca/hfp/training/00001/module03/figure08.htm> (Accessed September 2018).
- Collins, J. (ed.). 2016. *Bat Surveys for Professional Ecologists: Good Practice Guidelines (3<sup>rd</sup> ed.)*. London: The Bat Conservation Trust.
- Environment Canada. 2015. *Recovery Strategy for Little Brown Myotis (Myotis lucifugus), Northern Myotis (Myotis septentrionalis), and Tri-colored Bat (Perimyotis subflavus) in Canada [Proposed]*. Species at Risk Act Recovery Strategy Series. Environment Canada, Ottawa. ix + 110 pp.
- Environment and Climate Change Canada. 2016. *General Nesting Periods of Migratory Birds in Canada*. <http://www.ec.gc.ca/paom-itmb/default.asp?lang=En&n=4F39A78F-1>. Accessed 2018.
- Environment and Climate Change Canada. 2017. *Migratory birds: technical information on risk factors*. <https://www.canada.ca/en/environment-climate-change/services/avoiding-harm-migratory-birds/technical-information-risk-factors.html>. (accessed September 2018)
- Holroyd, S. L. and V. J. Craig. 2016. *Best Management Practices Guidelines for Bats in British Columbia - Chapter 1: introduction to Bats of British Columbia*. BC Ministry of Environment: Victoria, BC.
- Kalcounis, M. C. and K. R. Hecker. 1995. Intraspecific Variation in Roost-site Selection by Little Brown Bats (*Myotis lucifugus*). In *Bats and forests symposium: October 19-21, 1995 Victoria, British Columbia, Canada*. Eds. R. M. R. Barclay and R. M. Brigham. 81-88. Victoria, BC: Ministry of Forests Research Program.
- Nagorsen, D.W. and R.M. Brigham. 1993. *The Bats of British Columbia. Royal British Columbia Museum Handbook. Volume 1: The Mammals of British Columbia*. UBC Press: Vancouver, BC.

- RIC. 1999. *Inventory Methods for Forest and Grassland Birds. Standards for Components of British Columbia's Biodiversity No. 15. Version 2.0.* Prepared by Ministry of Environment, Lands, and Parks Resources Inventory Branch for the Terrestrial Ecosystems Task Force Resource Inventory Committee.
- Swanson, D. L., J. L. Ingold, and G. E. Wallace. 2020. Ruby-crowned Kinglet (*Regulus calendula*), version 1.0. In *Birds of the World* (A. F. Poole, Editor). Cornell Lab of Ornithology, Ithaca, NY, USA. <https://doi.org/10.2173/bow.ruckin.01>

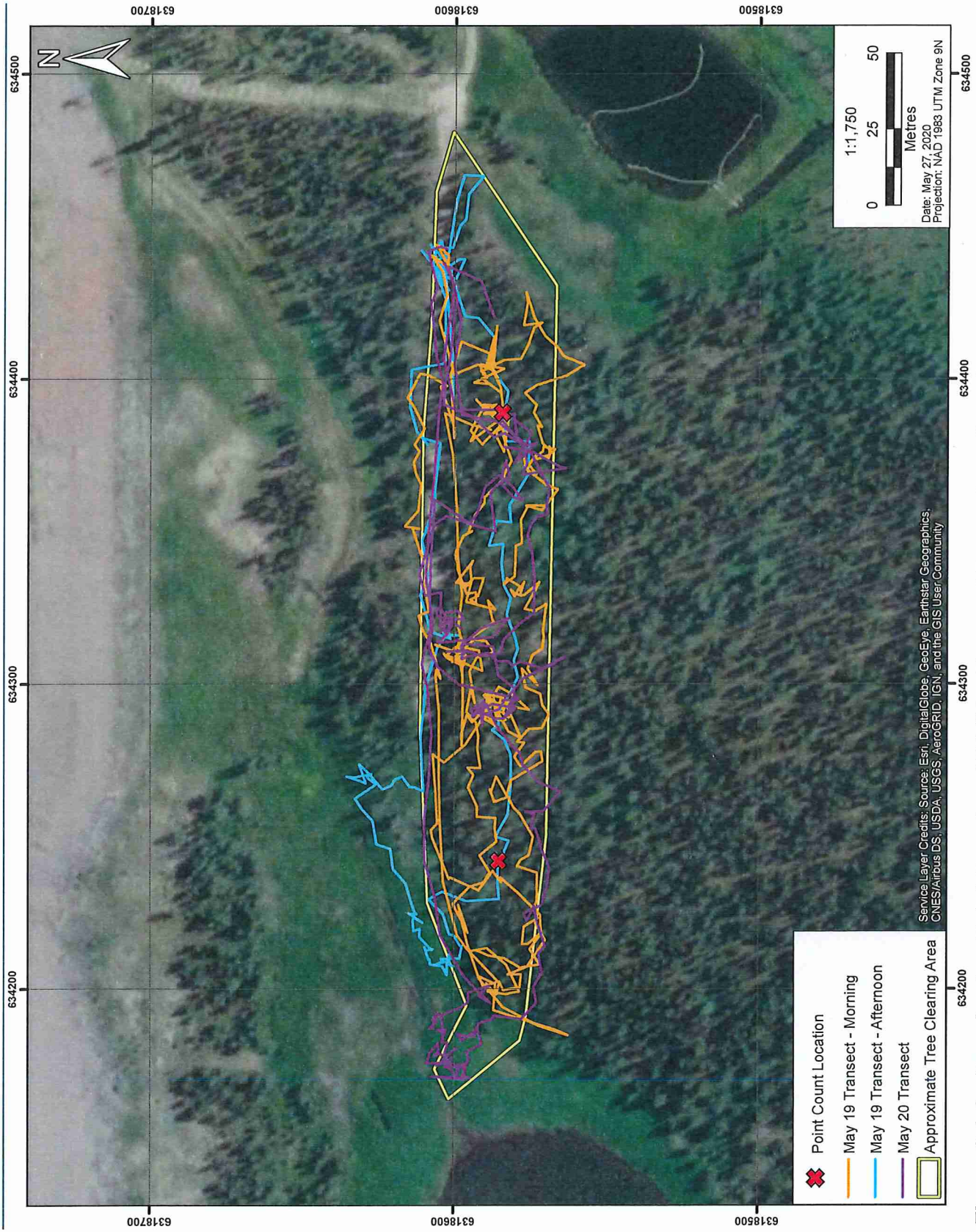
**APPENDIX A      FIGURES**





**Figure 1-1: Kemess Underground Project Layout and Focal Area for 2020 Surveys**





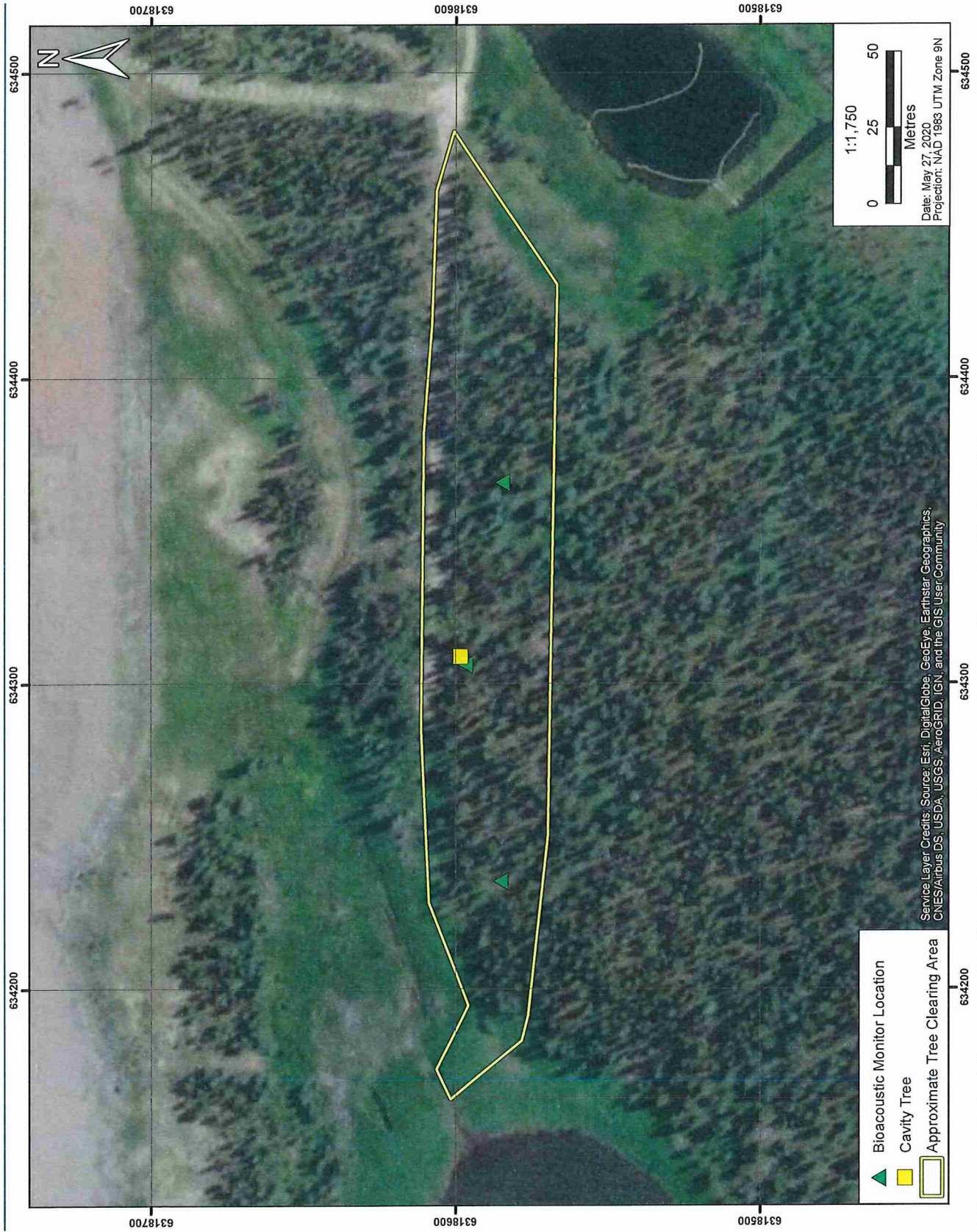
**Figure 3.1-1: Pre-clearing Point Count and Walking Transect Survey Locations for Migratory Birds and Furbearers in the SCSP Collection Ditch Area**





**Figure 3.2-1: Locations of Inactive Dens for Furbears in the SCSP Collection Ditch Area**





**Figure 3.3-1: Bioacoustic Monitor Locations for Assessing Bat Habitat Use**

**APPENDIX B      PHOTOS**





**Photo 3.1-1: Example of early spring conditions and typical forest cover encountered during pre-clearing surveys in the SCSP Collection Ditch area, May 19<sup>th</sup>, 2020.**



**Photo 3.1-2: Example of early spring conditions and typical forest cover encountered during pre-clearing surveys in the SCSP Collection Ditch area, May 19<sup>th</sup>, 2020.**



**Photo 3.1-3a: View of south side of snag with inactive cavities recorded next to road in the SCSP Collection Ditch area. Suitable for woodpeckers, chickadees and nuthatches, and bats. No birds seen or heard near cavity during check, no bats seen leaving cavities during night survey.**



**Photo 3.1-3b: View of north side of snag with inactive cavities recorded next to road in the SCSP Collection Ditch area. Suitable for woodpeckers, chickadees and nuthatches, and bats. No birds seen or heard near cavity during check, no bats seen leaving cavities during night survey.**





**Photo 3.2-1: Inactive small mammal den encountered during pre-clearing surveys the SCSP Collection Ditch area, May 19<sup>th</sup>, 2020.**



**Photo 3.2-2: Inactive small mammal den encountered during pre-clearing surveys the SCSP Collection Ditch area, May 19<sup>th</sup>, 2020.**





**Photo 3.2-3: Inactive small mammal den encountered during pre-clearing surveys the SCSP Collection Ditch area, May 19<sup>th</sup>, 2020.**

