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FINAL

ENVIRONMENTAL IMPACT ASSESSMENT ADDENDUM

High Arctic Weather Station Project Improvements for: Construction of New Road, Construction of Water Crossing over Black Top Creek, and Development of New Quarry Site

March 2018

Environmental Impact Assessment: Addendum

High Arctic Weather Station Project Improvements for:

Construction of New Road, Construction of Water Crossing over Black Top Creek, and Development of New Quarry Site

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EXECUTIVE SUMMARY

In 2015, Arcadis Canada Inc. (Arcadis) was retained by Public Works and Government Services Canada (PWSGC) now Public Services and Procurement Canada (PSPC), on behalf of Environment Canada (EC) now Environment and Climate Change Canada (ECCC), to prepare a due diligence Environmental Impact Assessment (EIA) for four (4) proposed Improvement Projects at the Eureka High Arctic Weather Station (HAWS) in Eureka, Nunavut (NU). The final report pertaining to the 2015 EIA encompassed four Improvement Projects at the Eureka HAWS, namely:

- Eureka Runway Recap
- Construction of New Multipurpose Building
- Reservoir Upgrades
- Sewage and Wastewater System Upgrades

The original EIA for the 2015 study encompassing the above four Improvement Projects was submitted and approved under the Nunavut Impact Review Board (NIRB) 150922-12XN020 in September of 2015. Due to logistical constraints, some of the proposed work at the HAWS has yet to occur. To date, the multi-purpose building has been constructed and completed in September 2017. However, construction of the remainder of these projects has yet to take place. Additionally, the scope of work has been revised. This addendum report is for the purposes of revising the existing 2016 Arcadis EIA report to include three (3) additional proposed project components at the Eureka HAWS and airstrip, as components of the Eureka Runway Recap Improvement Project. Upon completion of the EIA, a project proposal will be submitted under the Nunavut Planning Commission (NPC). This current addendum does not repeat general information that is already contained in the previous EIA, but instead focuses on aspects that are more specific to the three new project components.

Three specific project components have been identified for the revised scope of work at the HAWS runway, which are the subject of this EIA addendum report, namely:

- Development of New Quarry Site
- Construction of New Access Road
- Construction of Water Crossing over Black Top Creek

The project components will generally include the following activities:

- extraction and crushing of aggregate (creation of new quarry);
- earthworks (excavating, grading);
- material handling (loading and dumping);

- vehicle travel; and
- refuelling of vehicles.

The Eureka HAWS Improvement Projects are not subject to the Canadian Environmental Assessment Act (2012) (*CEAA*); however, ECCC identified the need to conduct an EIA as due diligence in order to identify and mitigate potential environmental impacts on the site and surrounding environment associated with Improvement Project activities. The proposed Eureka HAWS Improvement Projects are planned to meet existing regulatory conditions and anticipated capacity demands over the next 30 years.

The EIA addendum considers key environmental components including:

- Atmospheric – air quality and noise
- Geological – hydrology, and soil quality
- Aquatic – including sediments
- Terrestrial – vegetation communities and species; rare and sensitive species
- Physical and cultural resources (archaeology and natural heritage)
- Socio-economic and human environment

The evaluation is focused on the construction and operations activities of the additional scope and project components of the Eureka Runway Recap Improvement Project. All of the construction activities are of limited scope and duration and will cause temporary effects, with no residual effects and therefore no cumulative effects. Operations effects will be similar to current operations at the main HAWS site in Eureka, as they do not greatly deviate from the site activities and daily operations which are currently ongoing (including site maintenance and facility use). Apart from the decommissioning of a temporary tent camp associated with the development of the new quarry site, the Improvement Projects are considered permanent, and therefore the effects of decommissioning do not require assessment.

As an active and operating site, the HAWS has to be compliant with a number of Federal and Territorial regulations. Adherence to regulations including conditions annexed to and forming part of Land Use Permit N2017N0017 (INAC, 2017) and the Fisheries and Oceans Canada (DFO) *measures to avoid causing harm to fish and fish habitat including aquatic species at risk* (DFO, 2018), implementation of existing mitigation obligations, in addition to those proposed within this addendum, will ensure that all of the Improvement Projects and associated activities do not cause significant adverse effects on the environment.

1 INTRODUCTION

In 2015, Arcadis Canada Inc. (Arcadis) was retained by Public Works and Government Services Canada (PWSGC) now Public Services and Procurement Canada (PSPC), on behalf of Environment Canada (EC) now Environment and Climate Change Canada (ECCC), to prepare a due diligence Environmental Impact Assessment (EIA) for four proposed Improvement Projects at the Eureka High Arctic Weather Station (HAWS) in Eureka, Nunavut (NU). The final report pertaining to the 2015 EIA was dated January 25, 2016; and it encompassed the Environmental Impact Assessment (EIA) of four (4) Improvement Projects at the Eureka HAWS, namely:

- Project 1 – Eureka Runway Recap
- Project 2 – Construction of New Multi-Purpose Building
- Project 3 – Reservoir Upgrades
- Project 4 – Sewer and Wastewater System Upgrades

The original EIA for the 2015 study encompassing the above four Improvement Projects was submitted and approved under the Nunavut Impact Review Board (NIRB) 150922-12XN020 in September of 2015. Due to logistical constraints, some of the proposed work at the HAWS has yet to occur. To date, the multi-purpose building has been constructed and completed in September 2017. However, construction of the remainder of these projects has yet to take place. Additionally, the scope of work has been revised. This addendum report is for the purposes of revising the existing EIA to include three (3) additional proposed project components at the Eureka HAWS and airstrip, as part of the Eureka Runway Recap Improvement Project. Upon completion of the EIA, a project proposal will be submitted under the Nunavut Planning Commission (NPC).

1.1 Project Background and Rationale

The Project site is located on land owned by ECCC (land reserve #1021) and the Meteorological Service of Canada (MSC) and has been operating since 1947. Regular improvements and upgrades have been made to the buildings and infrastructure since that time as required and in response to changing needs, and ECCC is currently undertaking several Improvement Projects at the HAWS and nearby Eureka runway. Three (3) specific project components have been identified for the revised scope of work at the HAWS, in relation to the Eureka Runway Recap Improvement Project, which are the subject of this EIA addendum report, namely:

- Development of New Quarry Site
- Construction of New Access Road
- Construction of Water Crossing over Black Top Creek

The Eureka HAWS Improvement Projects are not subject to the Canadian Environmental Assessment Act (2012) (*CEAA*); however, ECCC identified the need to conduct an EIA as due diligence in order to identify and mitigate potential environmental impacts on the site and surrounding environment associated with Improvement Project activities. The proposed Eureka HAWS Improvement Projects are planned to meet existing regulatory conditions and anticipated capacity demands over the next 30 years.

1.2 Location and Study Areas

The Eureka HAWS is located on the north side of Slidre Fjord, at the northwestern tip of Fosheim Peninsula, Ellesmere Island, Nunavut (Refer to Figure 1.1 of the EIA Report (Arcadis, 2016), referred to throughout this report as the 2016 Arcadis EIA).

The weather station is a very remote site. In 2009, the total area of the occupied site, including the runway to the accommodations building, was approximately 2.23 ha. The runway (airstrip) is located approximately 1.5 km northeast of the main site. The main portion of the site occupies an area immediately east of Station Creek. Buildings and infrastructure at the site include: operations/residence complex, garages, powerhouse, warehouses, electrical building, carpentry shop, transient quarters, miscellaneous small buildings, sealift landing area, active landfill; closed landfills; contaminated soil treatment facilities; roads; water reservoir; sewage lagoon; tank farm, and fuel pipeline (PSPC, 2018).

The Eureka HAWS is not only an operational weather monitoring facility; but is also a hub of activity for the Department of National Defence (DND), the Polar Continental Shelf Project (PCSP), and the Polar Environment Atmospheric Research Lab (PEARL), to name a few. The Canadian Network for the Detection of Atmospheric Change (CANDAC) runs the PEARL as well as the Surface and Atmospheric Flux, Irradiance and Radiation Extension (SAFIRE) and Zero Altitude PEARL Auxiliary Laboratory (OPAL) sites at Eureka (PSPC, 2018).

Operation of the station has resulted in several petroleum hydrocarbon spills, production of landfills on the site, ash from incineration, demolition of a number of buildings, storage and processing of fuel barrels, and production of ‘dead’ vehicles and sewage. Petroleum hydrocarbon spills at the former fuel storage area have occurred resulting in an estimated 21,000 m^3 of contaminated soil. Consequently, some of the Eureka HAWS Improvement Projects may involve reclamation, remediation or management of these areas (PSPC, 2018).

With respect to construction timelines, the HAWS is located in an extreme climate with long, very cold winters and short, cool summers. The field season for the completion of construction activities is, understandably, extremely short. It consists of (at most) July, August and the beginning of September. Outside these months, the ground is frozen, or spring freshet will prevent proper construction activities.

1.3 Legal Framework and Regulatory Requirements

The legal framework and regulatory requirements are outlined in Section 1.3 of the 2016 Arcadis EIA. These apply to the three new project components and are not repeated here.

2 PROJECT DESCRIPTION

There are three (3) new project components associated with the Eureka Runway Recap Improvement Project that are proposed to occur at the HAWS within the upcoming years, which are the subject of this addendum. These are identified and described in Section 2.1 below, based on information provided by PSPC.

2.1 Description of Proposed Additional Components of Runway Recap Improvement Project

2.1.1 Development of New Quarry Site at West Remus Creek

As part of the proposed Improvement Projects, particularly those at the Eureka Runway, borrow material is required. Although there is an existing borrow source at Black Top Creek, this borrow location is not large enough to supply sufficient material for the proposed improvements. Subsequent to additional sampling and testing at this location it was determined that Black Top Creek was not a viable source of granular material for the project. A new gravel source has been identified near the mouth of West Remus Creek, approximately 15 km east of Eureka; activities planned at this site will include extraction at the new gravel source and use of a road/trail to the site (Figures 2.1, 2.2, and 2.3).

The creation of the borrow pits at the new quarry site is for the purposes of aggregate extraction. Aggregate from the quarry site will be used in the HAWS aircraft runway expansion/maintenance project. A temporary camp will be set up at the quarry site. As the camp and quarry site are on the East side of Black Top Creek, construction of a water crossing will also be required (see Section 2.1.3).

The construction contractor will be charged with relocating the existing crusher at the Black Top Creek quarry site to West Remus Creek to commence mining and crushing the appropriate sizes and quantities to be used to construct the 9 km access road extending from West Remus Creek to the Eureka Runway. An All Terrain Vehicle (ATV) trail at this location will be constructed into a permanent road capable of mining truck and light vehicle traffic, using crushed aggregate of different sizes extracted from the new quarry site. It is currently proposed that approximately 250,000 m^3 of finished aggregate will be extracted from the new quarry site to complete the HAWS Improvement Projects.

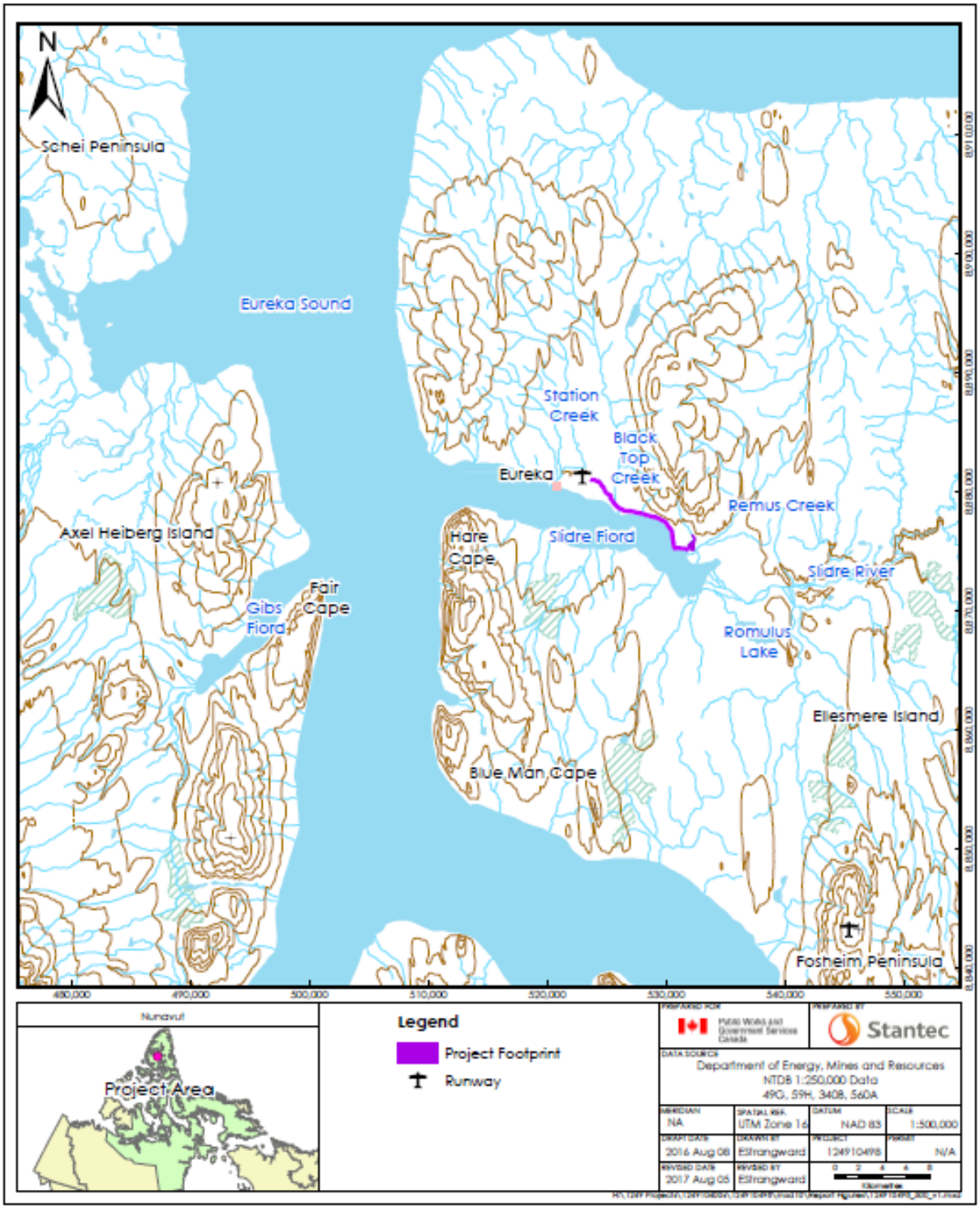
A temporary 24-person tent camp will be established at the new quarry site, which will be used to house a total of 50 contract workers at the site for the duration of project works at this location. At the same location, approximately 150 fuel totes (5000 L) will be stored by the construction contractor which will be used for the construction of the new access road (see Section 2.1.2). Quarters for the contractor at the Eureka runway site will be used to host workers during the runway reconstruction work (until 2020). This is a hard-sided camp, and there are no plans to relocate this camp elsewhere,

until demobilization upon completion of the runway reconstruction project (Nuna East, 2018; PSPC, 2018).

2.1.1.1 Estimated Work Duration

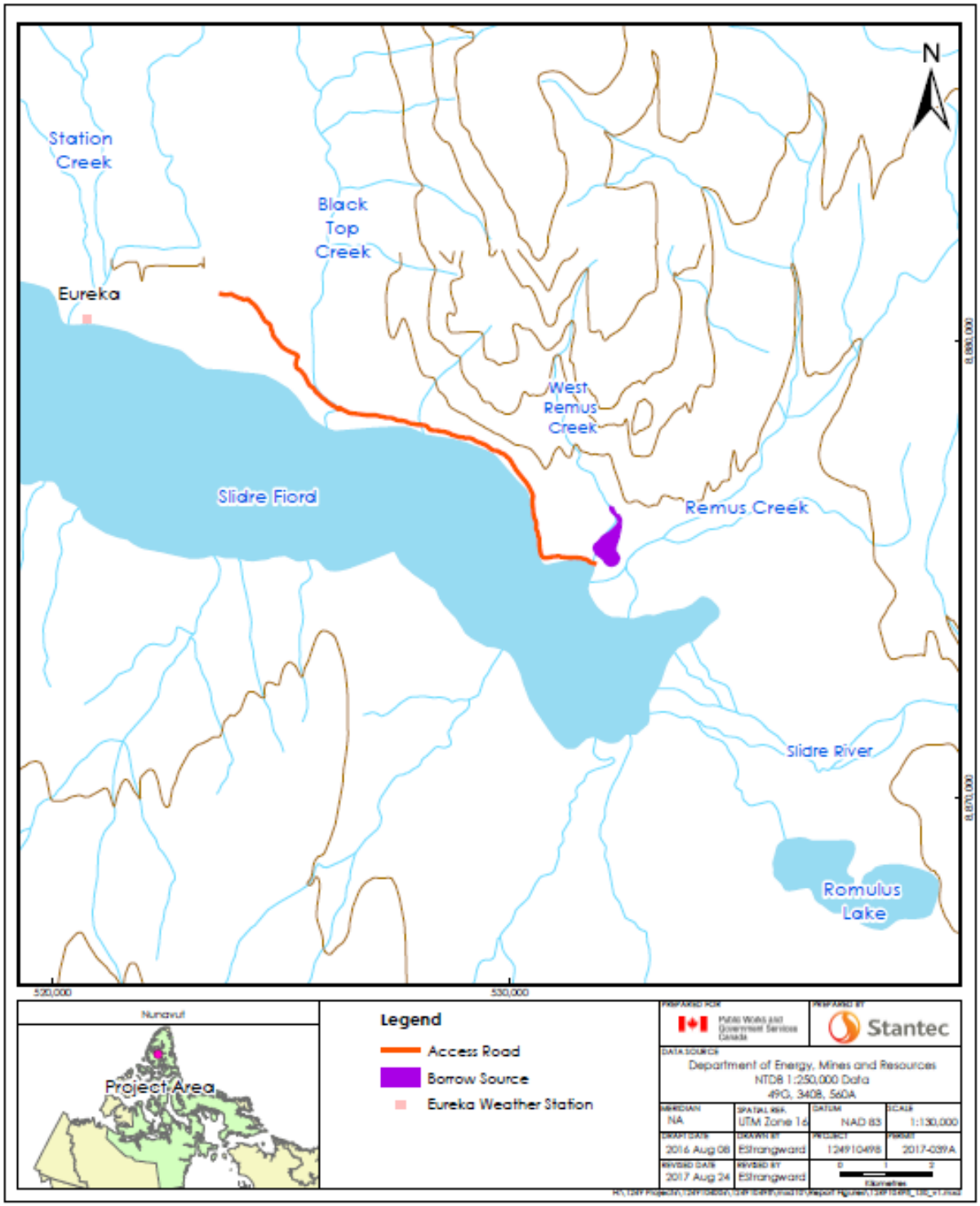
The temporary tent camp will be established in spring of 2018. It will house the contract workers at the site for the duration of the project works throughout the spring and summer months. The camp will be decommissioned in the fall of 2018. The contractor retained for the quarrying work will arrive in June 2018 and the crusher will be relocated from Black Top Creek to West Remus Creek when they arrive. The pre-existing hard-sided camp at the Eureka Runway will be used to provide lodgings for workers in future years, until completion of all slated Improvement Projects (projected to 2020).

Figure 2.1 Location of Eureka HAWS and Project Footprint



[Source: Stantec, 2017]

Figure 2.2 Location of New Quarry Site (Borrow Source) and New Access Road



[Source: Stantec, 2017]

Figure 2.3 Location of New Quarry Site (Borrow Source) and New Access Road

[Source: Nuna East, 2018]

2.1.2 Construction of New Access Road

The construction of a new 9 km access road is proposed which will extend from the proposed quarry site at West Remus Creek to the existing runway at Eureka. The road will be built following an existing "turkey trail road" ATV trail (see Figures 2.2 and 2.3). Crushed aggregate from the West Remus Creek quarry will be used to build the road.

2.1.2.1 Estimated Work Duration

Road construction will occur in the summer of 2018. The road will not be decommissioned after the project is completed. The road will remain dormant after its construction for an unknown period, until such time that runway rehabilitation, or some other projects requiring granular materials are approved.

2.1.3 Construction of Water Crossing over Black Top Creek

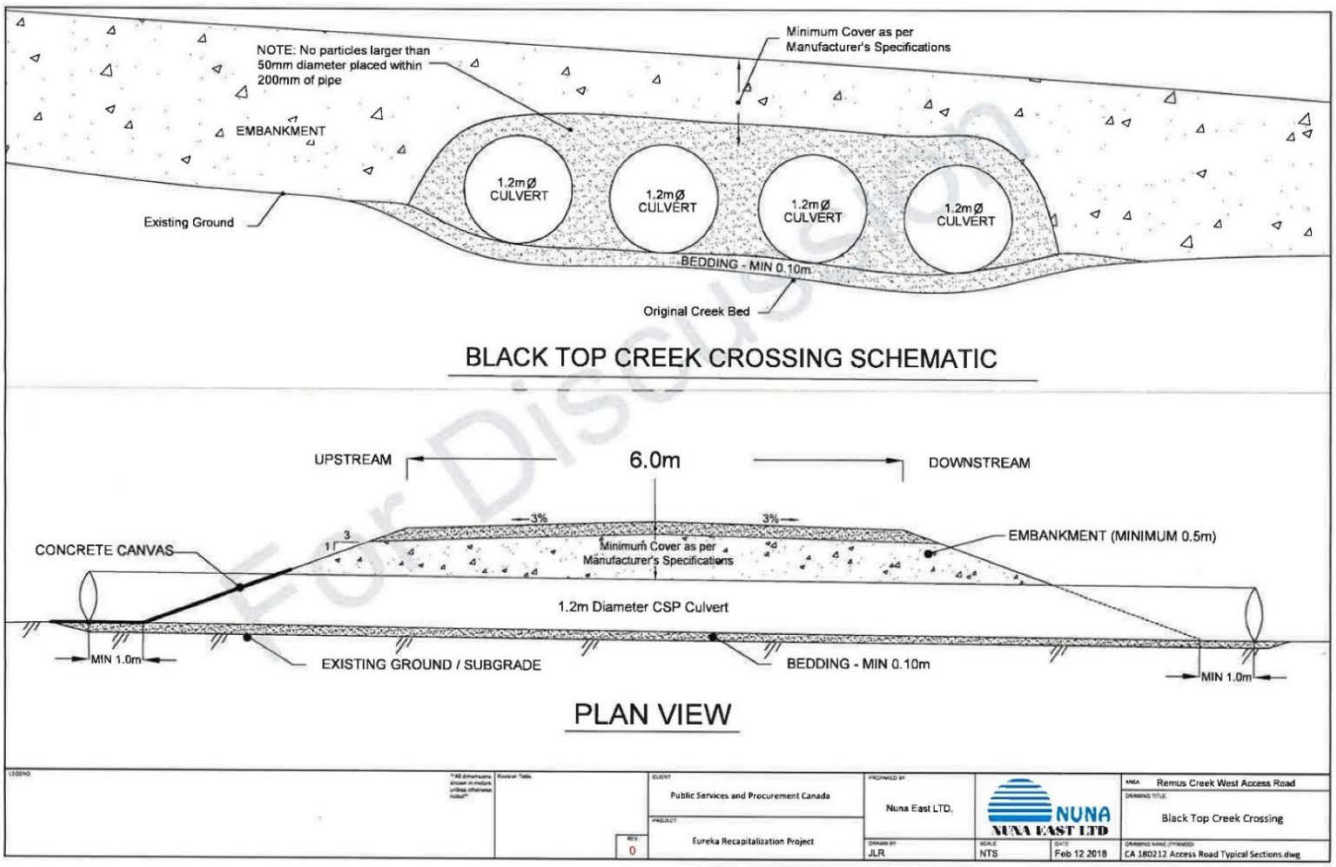
It is proposed to construct a permanent water crossing over Black Top Creek. The water crossing is proposed to have four (4) arch culverts and will be approximately 6 m in width (1.2 m in diameter

each culvert) and 50 m in length (see Figure 2.4). The purpose of the water crossing is to allow a gravel truck from the quarry site to traverse over to the airport runway. The quarry site will be accessed from 2018 until 2020, for the purposes of runway upgrade construction. It is planned to maintain the water crossing in place for the foreseeable future.

2.1.3.1 Estimated Work Duration

The permanent water crossing will be constructed in August 2018. Water flows for the creek are expected to be minimal at this time.

Figure 2.4 Black Top Creek Crossing – Water Crossing Design Schematic



[Source: Nuna East, 2018b]

2.2 Spatial and Temporal Boundaries

The three (3) project components are located within ECCC's lease holdings. Spatially, the majority of potential environmental impacts associated with the project components will be localized to the West Remus Creek area (for the creation of the new quarry site), from the West Remus Creek along the 9 km stretch of ATV trail and new road to the runway site main site (for the creation of the new access road), and at the location of crossing over Black Top Creek (construction of water crossing). Potential environmental impacts associated with the three project components will be mostly localized to these three key areas. Consequently, emphasis throughout this EIA addendum has been placed on the evaluation of effects within the near vicinity of these project components, referred to subsequently as the study area (i.e. West Remus Creek site, access road/runway site, and Black Top Creek water crossing site). Refer to Figure 2.5.

Temporally, the majority of potential environmental impacts associated with the project components will be during the period from June through to September 2018, coincident with the construction phases for the three projects. However, the construction for any given component may extend into multiple construction seasons, up until 2020.

Figure 2.5 New Access Road, New Water Crossing and New Quarry Project Sites (Study Area)

3 SCOPE OF PROJECT

Each of the three (3) project components which are mentioned and described above in Chapter 2 consists of core project activities. These are outlined in further detail in the following sections:

- Construction of New Quarry Site at West Remus Creek (Section 3.1.1);
- Construction of New Access Road (Section 3.1.2);
- Construction of Water Crossing Over Black Top Creek (Section 3.1.3).

Table 3.1 through to Table 3.3 provide a list of these core activities for each of the three project components according to the various project phases. Following each table, a further description of each core project activity is provided.

3.1 Construction of New Quarry Site at West Remus Creek

The two phases of the New Quarry project component include the construction phase and the operation phase. Decommissioning is not contemplated for the foreseeable future, and thus environmental effects from decommissioning of the quarry are not considered in this report.

This project component will generally include the following activities:

- relocating the crusher from Black Top Creek to West Remus Creek;
- extraction and crushing of aggregate;
- earthworks (excavating, grading);
- material handling (loading and dumping);
- vehicle travel; and
- refuelling of vehicles.

Table 3.1 below outlines the core project activities and associated ancillary works for the new quarry construction.

Table 3.1 New Quarry Construction Project Activities

Project Phase	Project Activities	
	Core Activities	**Ancillary Works**
Construction	• Relocating the crusher from Black Top Creek to West Remus Creek. • Aggregate extraction and crushing. • Construction of temporary camp.	• For temporary camp: Toilet facilities, waste incinerator, personal hygiene facilities, communications, kitchen, office, sleeping tents. • Storage of fuel.
Operation	Quarry for aggregate extraction of granular material for use at Eureka HAWS Improvement Projects.	None
Decommissioning	Temporary camp to be decommissioned in the fall of 2018.	None

Relocating Crusher from Black Top Creek to West Remus Creek

The crusher that presently exists at Black Top Creek will be moved to West Remus Creek in June of 2018. In this manner, the contractor may begin aggregate extraction activities in order to construct the new access road and Black Top Creek water crossing (see Sections 3.2 and 3.3).

Aggregate Extraction and Crushing

The identification of the West Remus Creek quarry site for extraction and crushing of granular material took place after it was confirmed that Black Top Creek was not a viable source of granular material. The quarry site is located near the mouth of West Remus Creek, approximately 15 km east of Eureka. The total surface area of the proposed borrow area at West Remus Creek is estimated to be 360,000 m^2 and it is expected to yield more than 325,000 m^3 of raw granular material. The current Improvement Project program is expected to require extraction of approximately 75,000 m^3 of material over an area of approximately 100,000 m^2 (Nuna East, 2018).

The quarry will be developed using a D8 Dozer, 980 loader and a 320 excavator. The dozer will cut and push material into stockpiles and windrows as appropriate such that the loader and/or excavator can more readily load the material into haul trucks. There are no drill and blast requirements. The total area that will be developed to meet the project's needs is approximately 100,000 m^2, as mentioned above. To the extent possible, the excavations will be of uniform depth over a wide area to maintain positive surface drainage. Reclamation procedures/methods will be in place to ensure cleanup, trimming and tidiness of the quarry (Nuna East, 2018).

Construction of Temporary Camp.

The construction contractor will be setting up a temporary 24-person construction tent camp at West Remus Creek for the duration of the road construction project (see Section 3.3). The proposed location is outside of the quarry limits to allow maximum access to the borrow source and to separate the personnel lodgings in a safe area away from quarry operations. An electric perimeter bear fence will be provided around the completed camp setup. The camp will be provided and operated by a reputable Northern camp supplier familiar with all regulatory requirements for this region. The camp will be setup at the start of the project in June of 2018 and demobilized at the end of the road construction phase (Nuna East, 2018).

Potable water for use by the camp will be retrieved from Remus Creek and treated prior to use in the camp. Treatment will include filtration, UV screening and offsite testing prior to use. Grey water discharge will be placed in holding/settling tanks and tested to meet guidelines for discharge to the environment. Water meeting discharge guidelines will be decanted from the tanks to an approved discharge area. The camp will be equipped with a first aid room/supplies, communications, kitchen, office and sleeping tents. Pacto toilets and a top load waste incinerator will be provided for camp and black water waste (Nuna East, 2018).

Fuel will be stored in 4,995 liters double wall containment capsules at a designated laydown area near the camp location. Fuel will then be distributed using a fuel lube truck with no greater than 4,995 liters on board at any time (Nuna East, 2018).

Consumption and refuse estimates have been provided, and are listed below, based on typical tent camp operations and assuming a 24-person camp at full capacity for 75 camp personnel days:

- Fresh water retrieved from West Remus Creek using portable gas-powered water pump fitted with fish screen to pump water from the creek to a trailer mounted tank for transport to the camp: 40,000 gallons (approximately 151,000 L);
- General Waste: 5,000 lbs (approximately 2,300 kg);
- Grey Water: 35,000 gallons (approximately 132,000 L);
- Black Water: (incinerated) 4500 lbs (approximately 2000 kg); and,
- Residual ash waste from incinerator 400 lbs (approximately 180 kg).

Note that the actual camp personnel days and duration are subject to change with respect to the finalized methods and option selected for the haul road construction.

See Figure 3.1 for proposed locations of the borrow area (quarry), temporary camp, and fuel storage area.

Figure 3.1 Proposed Borrow, Temporary Camp, and Fuel Storage Area Locations

[Source: Nuna East, 2018]

3.2 Construction of New Access Road

The two phases of the New Access Road project component include the construction phase and the operation phase. Decommissioning is not contemplated for the foreseeable future, and thus environmental effects from decommissioning of the road are not considered in this report.

This project component will generally include the following activities:

- extraction and crushing of aggregate;
- earthworks (excavating, grading);
- material handling (loading and dumping);
- vehicle travel; and

- refuelling of vehicles.

Table 3.2 below outlines the core project activities and associated ancillary works for the new access road.

Table 3.2 New Access Road Construction Project Activities

Project Phase	Project Activities	
	Core Activities	**Ancillary Works**
Construction	Access road extending from West Remus Creek to the Eureka Runway.	None
Operation	Road use for access between runway and quarry.	None
Decommissioning	Not in the foreseeable future. Road will be permanent. Will remain dormant after construction for an unknown period until such time that runway rehabilitation or other projects requiring granular materials are approved.	None

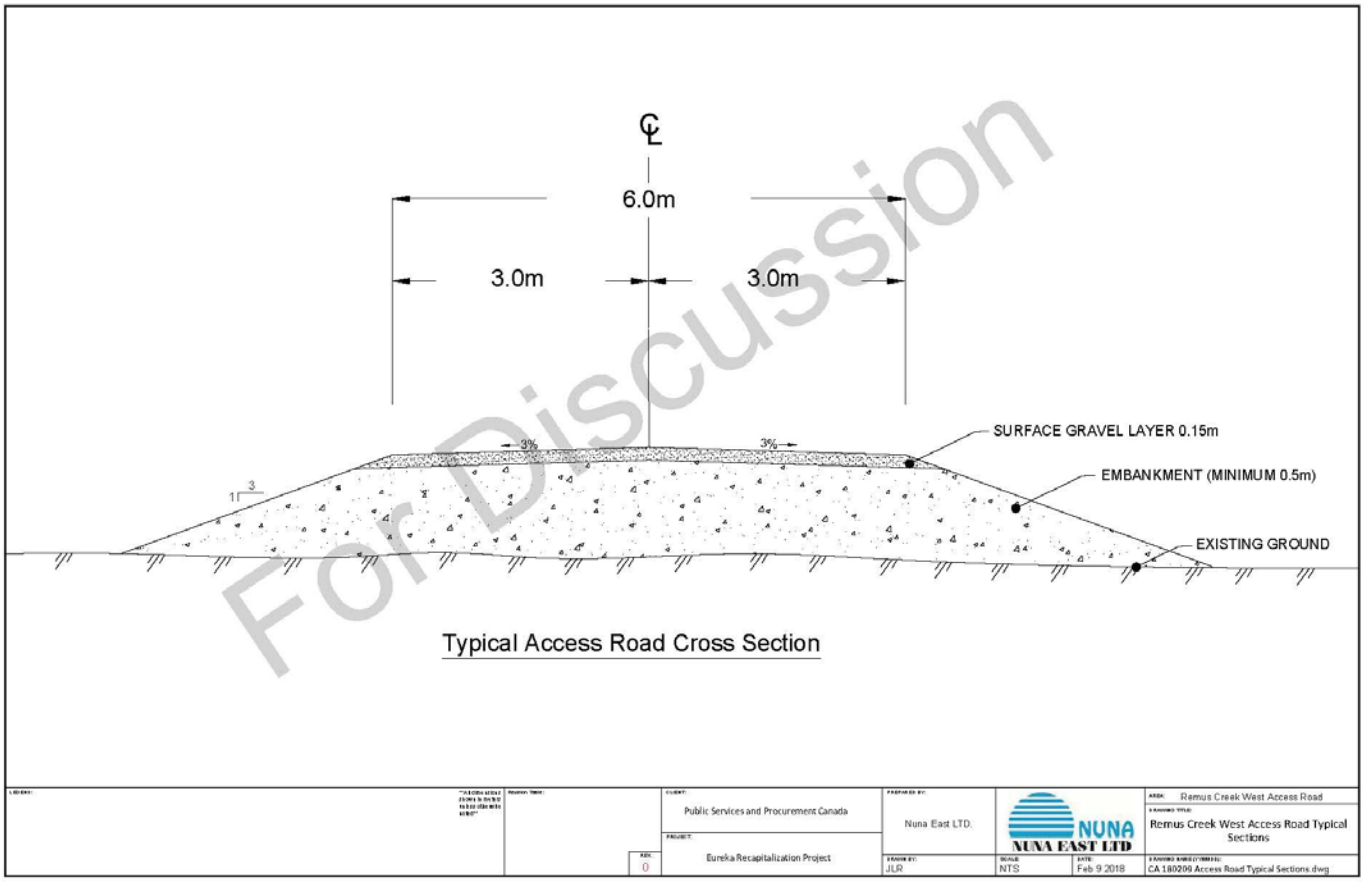
Construction of Access Road from West Remus Creek to Eureka Runway

A 9 km road will be constructed from the proposed quarry site at West Remus Creek to the existing runway at Eureka, which will follow an existing ATV route using crushed aggregate. The road width will be approximately 6 m running surface and will consist of 0.5 m minimum thickness road rill (approximately 45,000 m^3 of aggregate) and 0.15 m crushed gravel capping (approximately 10,400 m^3 of aggregate) (see Figure 3.2). The gravel will be produced from the West Remus Creek borrow area. A minimum total embankment thickness of 0.65 m will be provided.

The road will impact drainage patterns into Slidre Fjord, thus 12 culverts are slated to be strategically placed along the new road to facilitate the summer melt runoff drainage, with four (4) culverts to be placed strategically at the location where the access road will cross the Black Top Creek channel (see Figure 2.4). The road will be constructed using three (3) 30-ton haul trucks, and will satisfy appropriate safety standards. Turnouts will be provided at any locations where line of sight is less than 100 m and at a 500 m spacing along the full length of the road in order to facilitate two-way haul truck traffic while safety berms will be incorporated at all locations where it is determined that the embankment height to original ground elevation may pose a risk (i.e., low angle shoulder sloping is the traditional mitigation strategy).

General embankment fill will be placed in maximum 0.5 m thick lifts and compacted with a vibratory compactor. A minimum of 6 passes with an on-site compactor (CAT CS563) will be provided for each lift of material placed. Moisture conditioning of the embankment fill will be performed as necessary to facilitate compaction. Material for embankment construction will be extracted in-situ from the West Remus Creek borrow source or from the farmed stockpiles at the location and hauled directly to the construction work front. No sorting or selective mining of the borrow material will be required (Nuna East, 2018).

Figure 3.2 Typical Access Road Cross Section



[Source: Nuna East, 2018b]

3.3 Construction of Water Crossing over Black Top Creek

The two phases of the New Water Crossing project component include the construction phase and the operation phase. Decommissioning is not contemplated for the foreseeable future, and thus environmental effects from decommissioning of the road are not considered in this report.

This project component will generally include the following activities:

- earthworks (excavating, grading);
- material handling (loading and dumping);
- vehicle travel; and
- refuelling of vehicles.

Table 3.3 below outlines the core project activities and associated ancillary works for the construction of a water crossing over Black Top Creek.

Table 3.3 Permanent New Water Crossing Construction Project Activities

Project Phase	Project Activities	
	Core Activities	**Ancillary Works**
Construction	Construction of permanent water crossing (river crossing) across Black Top Creek.	None
Operation	Water crossing use to allow a gravel truck from the quarry site to traverse to the airport runway.	None
Decommissioning	Not in the foreseeable future. Water crossing will be permanent.	None

Construction of Permanent Water Crossing Over Black Top Creek

The footprint of the proposed water crossing is approximately 300 m^2. The water crossing is proposed to have four (4) arch culverts and will be approximately 6 m in width (with each culvert being 1.2 m in diameter) and 50 m in length (see Figure 2.4). The quarry site will be accessed from 2018 to 2020. It is planned to keep the water crossing in place for the foreseeable future.

4 DESCRIPTION OF ENVIRONMENT AND VALUED ECOSYSTEM COMPONENTS

A detailed description of the environment and valued ecosystem components (VECs) of the study area including atmospheric environment, hydrogeology, water and sediment quality, and socio-economic environment are provided in Chapter 4 of the 2016 Arcadis EIA. These details are not repeated in this addendum. Instead, the chapter focuses on aspects that are specific to the three new project components.

The existing environment serves as the baseline condition against which incremental changes and possible environmental effects associated with the project components are evaluated. The 2016 EIA presents the existing natural environment in terms of the atmospheric environment, surface and bedrock geology, hydrology and surface water resources, terrestrial and aquatic environment, and physical and cultural resources. A description of the human environment is also provided, which includes a description of Aboriginal communities and the Eureka weather station community. The environmental component headings used to characterize the existing environment follow those required under the NIRB screening process.

Valued ecosystem components (VECs) are representative species and/or environmental components that have social, ecological and/or cultural significance. Table 4.1 lists a proposed set of VECs known to be in the vicinity of the HAWS and Eureka runway. They represent most major ecological niches in the terrestrial and marine systems at Eureka and hence could be susceptible to possible environmental effects associated with the project components. Several species which have been observed and are known to be present at the HAWS and runway are also designated for special status under Species-At-Risk (SARA) legislation. Relevant VECs listed by environmental component are shown in Table 4.1.

Table 4.1 Environmental Components and VECs

Environmental Components	Relevant VECs
Atmospheric Environment	Pathway to Human Health Pathway to Non-Human Biota Health Pathway to Terrestrial Environment
Surface and Bedrock Geology	Pathway to Human Health Pathway to Non-Human Biota Health Pathway to VEC in other environmental components
Hydrology and Surface Water	Pathway to Human Health Pathway to Non-Human Biota Health Pathway to VEC in other environmental components
Terrestrial & Aquatic Environment	Representative species with social, ecological and/or cultural significance
Physical and cultural Resources	Aboriginal archaeological resources
Human Environment	Aboriginal communities' well-being HAWS residents' well being

The following sections, 4.1 to 4.6, provide a description of the existing physical environment in the vicinity of the Eureka HAWS, airstrip, and location of the three (3) project components subject to this EIA addendum: the new quarry, access road, and water crossing.

4.1 General Description of the Physical Environment

Eureka is located on Ellesmere Island, Nunavut, which is the northernmost island in the Canadian Arctic Archipelago. The Arctic Ocean surrounds the Archipelago to the north and west, with Greenland to the east and the Canadian mainland to the south. Eureka itself is on the western side of Fosheim Peninsula in northern Ellesmere Island. Eureka is located on the north side of Slidre Fjord and surrounded to the northeast and northwest by ridges that rise about 600 m above mean sea level.

The Eureka HAWS is located in the Eureka Hills Ecoregion of the Northern Arctic Ecozone on Ellesmere Island. The mean summer temperature of this ecoregion is 0.5°C and the mean winter temperature is -30.5°C, with mean annual precipitation ranging from 50 to 150 mm (http://ecozones.ca/english/region/9.html). The Eureka Hills ecoregion is classified as having a high arctic ecoclimate. It has a sparse vegetative cover consisting of moss and mixed low-growing herbs and shrubs including purple saxifrage, arctic willow, kobresia, sedge, and arctic poppy (http://ecozones.ca/english/region/9.html). Topography is rolling and ridged with extensive areas of low, dissected plateaus and gently rolling uplands cut by trench-like depressions forming drainage systems that extend to the coast (http://ecozones.ca/english/region/9.html). Permafrost is continuous, with medium ice content.

The dominant soils are Regosolic Static Cryosols and Orthic Turbic Cryosols, which have developed on colluvial, alluvial, and marine deposits (http://ecozones.ca/english/region/9.html). Wildlife in this ecoregion includes muskox, arctic hare, arctic wolf, caribou, seal, polar bear, ptarmigan, and seabirds.

While Eureka has no permanent residents, a number of research and operational staff rotate through the HAWS facility. The closest Inuit community is the hamlet of Grise Fjord, located 400 km south of Eureka at the southern end of Ellesmere Island.

Eureka's climate is typical for the Canadian Arctic Archipelago. Eureka experiences a long, dark winter and a short, intense summer with continuous daylight. The winter conditions promote a strong surface-based temperature inversion. The transition to summer occurs with a rapid warming and the breakdown of the Arctic winter vortex.

4.2 Geological Environment

4.2.1 Geology

The HAWS is situated in the Eureka Hills Ecoregion, within the Northern Arctic Ecozone. The topography in the area is rolling and ridged, and reaches altitudes of no greater than 1000 m above sea level. Underlying strata include Mesozoic and Tertiary sandstone and shale, which have large trenches cut out of them. The trenches form the sinuous, curving drainage that is apparent in the area (Phase I ESA - PWGSC, 2007). The geology of the HAWS site was observed by Columbia/Franz (2010) to be composed of silty clay, with some gravel and cobble.

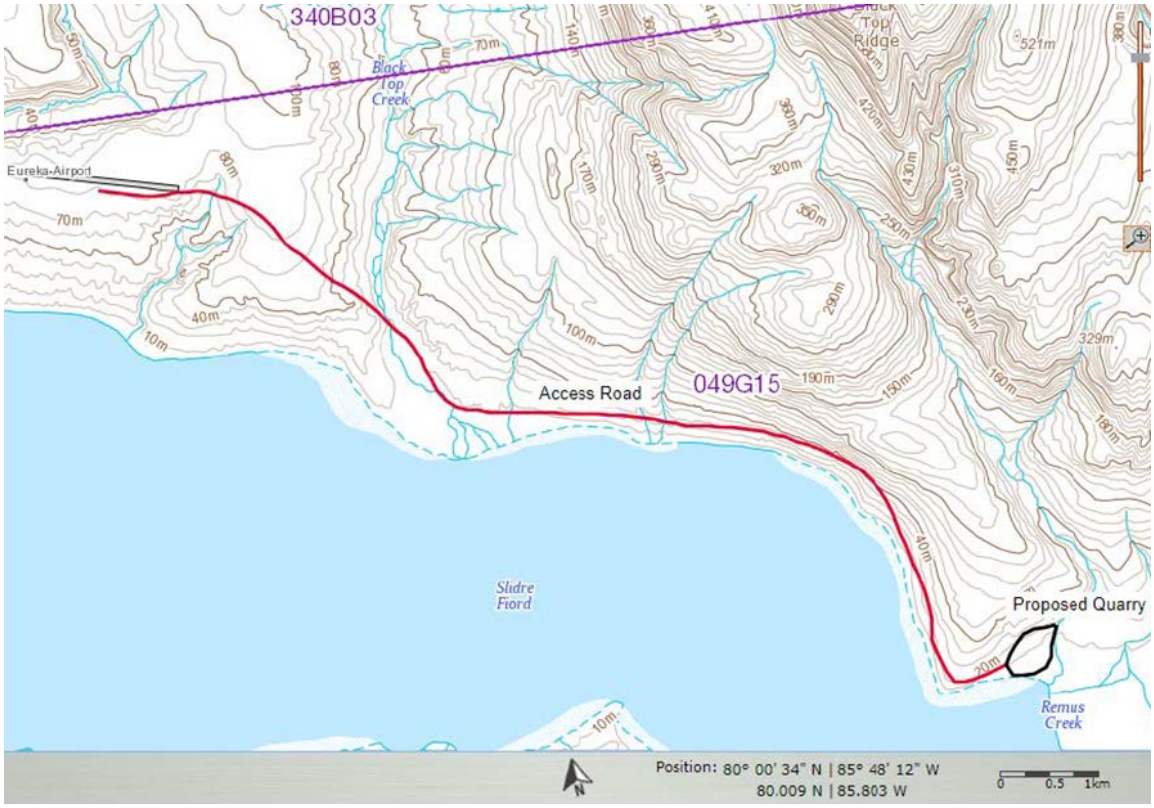
With respect to the proposed West Remus Creek quarry and access road extending to the runway, the access road will follow an existing ATV road/trail that extends east along the coast from the Black Top Creek borrow source (east of the Eureka airstrip) to the Remus Creek Valley (see Figure 4.1). The trail was constructed likely in the late 1970s or early 1980s and thus requires new construction and improvements due to its age. The access initiates at Black Top Creek, where an existing gravel operation is situated on the west side of Black Top Creek. From this borrow source, the access road to the West Remus Creek valley crosses Black Top Creek, which is a shallow, gravel-based creek that drains into nearby Slidre Fjord (Stantec, 2017).

From Black Top Creek, the access road extends across a low level plain and then rises slightly to more elevated level terrain at which point there is an excellent view of Black Top Ridge, located immediately to the north of the proposed West Remus quarry project.

As the access extends east it approaches the coastline more closely and the terrain becomes more undulating and is characterized by crossings of numerous small unnamed drainages that run into Slidre Fjiord. The access road extends east and then south to a point of land just west of West Remus Creek where the access turns east and terminates at the delta plain of West Remus and Remus Creeks (Stantec, 2017).

The West Remus Creek borrow source is situated within the West Remus Creek valley and consists of shallow fluvial gravel deposits associated with the creek (see Figure 4.1). Surficial terrain units include a fluvial channel, a large fluvial delta and fluvial plain and several fluvial terraces. The soils associated with these terrain units consist of interbedded silts, sands and gravels (WorleyParsons, 2011). West Remus Creek flows along the western extent of the borrow source, bounded by a low terrace on the west edge. The eastern boundary of the borrow source is marked by a wider plain that merges with the Remus Creek plain and is characterized by a lack of gravel/rocky deposits. The borrow source extends north into the narrower more confined West Remus Creek valley (Stantec, 2017).

Figure 4.1 Topography in the Vicinity of the Eureka HAWS Proposed Project Components



[Source: Nuna Logistics, 2018]

4.2.2 Soil Quality

Details and a description of soils and soil quality in the vicinity of the Eureka HAWS are provided in Section 4.3.3 of the 2016 Arcadis EIA.

With respect to the area of the proposed quarry at West Remus Creek, the surficial soils consist of sand, gravel, and cobbles (Nuna East, 2018).

4.3 Aquatic Environment

4.3.1 Hydrology

Details of the hydrology in the vicinity of the HAWS are provided in Section 4.4.1 of the 2016 Arcadis EIA.

Black Top Creek, the location of the proposed water crossing project component, is a minimal stream which consists of summer snow melt/run-off. West Remus Creek, the location of the

proposed new quarry, is also a minimal stream which runs during the summer season and consists of summer snow melt/run-off (PSPC, 2018).

4.4 Terrestrial and Marine Environments

The following subsections address the current terrestrial and marine environments at the project component sites. Vegetation communities and species are discussed in Section 4.4.1 and wildlife communities and species are described in Section 4.4.2.

4.4.1 Vegetation Communities and Species

Details of the vegetation communities and species at the HAWS are provided in Section 4.5.1 of the 2016 Arcadis EIA.

At Black Top Creek and West Remus Creeks, as well as along the roadway where the proposed road construction is to take place, there is sparse vegetative cover consisting of moss and mixed low-growing herbs and shrubs including purple saxifrage, arctic willow, kobresia, sedge, and arctic poppy. Note that Blacktop and West Remus Creeks are minimal streams which consist of summer snow melt/run off (freshet) (PSPC, 2018).

4.4.2 Wildlife Communities and Species

Details of the wildlife communities and species at the HAWS are provided in Section 4.5.1 of the 2016 Arcadis EIA.

Staff working at the Eureka HAWS have reported that they do not believe that Black Top Creek is fish bearing, however, this has not been confirmed. A Request for Review to Fisheries and Oceans Canada (DFO) submitted on January 29, 2018 resulted in a response from DFO indicating that the proposed water crossing construction will not result in serious harm to fish or prohibited effects on listed aquatic species at risk. As such, an authorization under the *Fisheries Act* or a permit under the *Species at Risk Act* is not required (refer to Appendix A).

4.5 Physical and Cultural Resources

4.5.1 Archaeology

An Archaeological Impact Assessment at the proposed West Remus Creek quarry location and the access road was recently completed by Stantec (Stantec, 2017). Some of this information is summarized below. Detailed information can be found in the Stantec report.

Stantec investigated 16 archaeological sites including 12 prehistoric sites, one contemporary site, and three historic sites. Of these, three (3) prehistoric sites are situated to the west of Eureka and are not relevant to the current West Remus Creek quarry and access road project component or to

the Black Top Creek water crossing project component. The remaining 13 sites were investigated relative to the proposed quarry, access road, and water crossing locations. Nine (9) of the sites are of prehistoric (native) origin pre-dating the arrival of the Europeans (pre-contact), one (1) is a contemporary site (less than 50 years old), and three (3) are historic sites (post-European contact, also containing remains of more recent activity greater than 50 years old).

Most of the sites are of high heritage value, and avoidance has been recommended. If avoidance is not feasible, further archaeological investigation is recommended, including detailed inspection and mapping, shovel testing, and archaeological excavation.

Three (3) sites exist in the proposed quarry location (one (1) contemporary and two (2) prehistoric) while three (3) exist in the proposed access road location (two (2) prehistoric and one (1) historic) (Stantec, 2017).

4.5.1.1 Pre-Contact History

General information on the pre-contact history of the project area and vicinity is described in Section 4.6.1.1 of the 2016 Arcadis EIA and more detailed information is available in the Archaeological Assessment report (Stantec, 2017).

4.5.1.2 Post-Contact History

General information on the post-contact history of the project area and vicinity is described in Section 4.6.1.2 of the 2016 Arcadis EIA and more detailed information is available in the Archaeological Assessment report (Stantec, 2017).

4.6 Construction Equipment Site Access

Access within the borrow and access road area is generally unrestricted and requires little to no preparation. The entire area is comprised of exposed sand and gravel with negligible vegetation or other organic material. An existing ATV trail is present in the location where the permanent access road will be constructed, thus this area has already been previously disturbed. Traffic patterns within the quarry will be determined to limit traffic to those specific areas required for quarry operations and to limit unnecessary travel in areas that will not be disturbed at this time (Nuna East, 2018).

5 ASSESSMENT OF ENVIRONMENTAL EFFECTS AND MITIGATION

The potential effects of the three (3) project components which are the subject of this EIA addendum have been assessed in the same manner as the four (4) Improvement Projects which were the subject of the 2016 Arcadis EIA. For further details, please refer to Chapter 5 of that report.

Essentially, the assessment of the potential effects of the project components on the environment was carried out in four (4) stages:

i. identification of project-environment interactions with potential adverse environmental effects;
ii. consideration of mitigation measures for potential adverse effects;
iii. identification of residual effects that may remain following mitigation; and
iv. evaluation of the significance of any residual effects.

Table 5.1 is a project environment interactions matrix for the three (3) new project components associated with the Eureka Runway Recap Improvement Project which are the subject of this EIA addendum.

Table 5.1 Project Environment Interactions Matrix

Project Activity	Project Phase	Project Components	Physical Environment										Biological					Socio-Economic			
			Designated Environmental Areas (i.e., Parks, Wildlife Protected Areas)	Ground Stability	Permafrost	Hydrology/ Limnology	Water Quality	Climate Conditions	Surface and Bedrock Geology	Sediment and Soil Quality	Air Quality and Climate Change	Noise	Vegetation	Wildlife	Birds	Aquatic Species	Wildlife Protected Areas	Employment	Community Wellness	Community Infrastructure	Human Health
Construction of New Quarry	**Construction** Work to begin in spring 2018 with the installation of the temporary cam runway project starting in summer 2017.	Aggregate extraction and crushing.			●	●	●		●	●	●	●	●	●	●						
		Relocating the crusher from Black Top Creek to West Remus Creek.			●		●		●	●	●	●	●	●	●						
		Construction of temporary camp.			●	●	●		●	●	●	●	●	●	●						●
		Use of temporary camp during construction period.			●				●	●	●	●	●	●	●						
		Fuel Storage.					●		●	●	●	●	●	●	●						
	Operation	Occasional use of borrow pit (aggregate extraction) area as needed on a per project basis.				●	●				●	●	●		●						
	Decommissioning	Not contemplated at this time nor in the foreseeable future, except for the temporary camp in fall 2018.	Not evaluated as part of this EIA. No project-environment interactions anticipated for tent camp dismantling should the same mitigation measures for tent camp mobilization be followed at dismantling.																		
Construction of New Access Road	**Construction** Summer 2018	Aggregate extraction and crushing.			●	●	●		●	●	●	●	●	●	●						
		Construction of access road components extending between West Remus Creek and Runway.		●	●						●	●	●	●	●					●	
	Operation	Road use for access between runway and quarry, on an as needed basis.			●						●	●	●	●	●					●	
	Decommissioning	Not contemplated at this time nor in the foreseeable future. Road will be permanent.	Not evaluated as part of this EIA																		
Construction of New Permanent Water Crossing	**Construction** Summer 2018	Construction of permanent water crossing (river crossing) across Black Top Creek.		●	●	●	●				●	●	●	●	●	●				●	
	Operation	Water crossing use to allow a gravel truck from the quarry site to travers to the airport runway, on an as needed basis, for Improvement Projects.				●	●				●	●	●	●	●					●	
	Decommissioning	Not contemplated at this time nor in the foreseeable future. Water crossing will be permanent.	Not evaluated as part of this EIA																		

6 EFFECTS OF PROPOSED PROJECT COMPONENTS ON THE ENVIRONMENT

6.1 Atmospheric Environment

6.1.1 Air Quality

6.1.1.1 Project-Environment Interactions

Activities will occur during each Project Improvement component which have the potential to increase ambient air concentrations of dust (i.e., particulate) and greenhouse gas emissions as identified in Table 5.1. The identified project components will use typical construction methods. Construction activities which may affect air quality and climate include the following:

- aggregate extraction and road construction (excavating and earth moving);
- material handling (loading and dumping);
- vehicle travel (transport of aggregate and building materials); and
- fuel combustion.

6.1.1.2 Evaluation of Effects

Air quality and emissions of greenhouse gases could potentially be affected at all phases of construction. During construction, there will be an increase in local airborne particulate (dust) and tailpipe (fuel combustion) emissions from heavy-duty construction equipment (dozer, front-end loader and excavator) operation and construction activities. The tailpipe emissions will include greenhouse gas emissions and therefore have the potential to contribute to climate change. These effects are typical of a construction site, localized, and of a temporary nature.

6.1.1.3 Mitigation Measures for Air Quality and Climate Change

In general, the project will employ standard operating procedures for equipment/machinery and ensure that regular maintenance is performed in accordance with good engineering practices or as recommended by suppliers such that the equipment is kept in good operating condition. As well, the project proponent will adhere to conditions outlined in all permits, authorizations and/or approvals.

Other activity-specific mitigation measures will include the use of appropriate exhaust emissions controls such as catalytic converters and diesel particulate filters to mitigate fuel combustion emissions from heavy equipment and vehicles. Additionally, the number of equipment/vehicle movements and travel distances will be optimized to reduce fuel consumption and minimize dust and greenhouse gas emissions. Lowering vehicle speeds on unpaved road surfaces, applying water

as well as implementing good road maintenance practices will minimize the potential for road dust emissions.

6.1.1.4 Residual Effects

A residual environmental effect caused by the project components is considered significant if it adversely affects the long-term viability of the VEC. A residual effect is considered to be not significant if the effect causes a change in the VEC that is within the range of natural variability or does not affect the integrity of the VEC in a measurable or meaningful way.

Because of the possible linkage between increased emissions of greenhouse gases and global warming, there is a potential for the project components to contribute to changes in climate in the long term, although, the nature and magnitude of these changes is highly speculative. In particular, the Canadian Environmental Assessment Agency's guide to Incorporating Climate Change Considerations in Environmental Assessment (CEA Agency, 2003) notes that climate change is a complex, global phenomenon and unlike most project-related environmental effects, the contribution of an individual project to climate change cannot be measured.

As the construction activities would be of limited frequency and duration, they are not expected to generate substantive air quality and climate change effects. With the implementation of the atmospheric environment mitigation measures (Section 6.1.1.3), no residual adverse effects on air quality and climate change are anticipated.

6.1.1.5 Significance of Effect

Not significant.

6.1.2 Noise

6.1.2.1 Project-Environment Interactions

It is anticipated that the construction activities have the potential to generate some noise and thus increase ambient noise. The identified activities will use typical construction methods. Activities which may increase ambient sound levels include the following:

- aggregate extraction and road construction (excavating and earth moving);
- material handling (loading and dumping); and
- vehicle travel (transport of aggregate and building materials).

6.1.2.2 Evaluation of Effects

Ambient sound levels in the vicinity of the project components could potentially be affected during all construction activities. During construction, there will be an increase in noise emissions from

heavy-duty construction equipment operation and construction activities. These effects are typical of a construction site, localized, and of a temporary nature. The construction noise would be situated between 3 km and 12 km away from the main HAWS residence and research facilities at Eureka, based on the location of the three project components, and is not anticipated to create a disruption to daily HAWS activities.

The physiological and ecological impacts of noise on wildlife have been reviewed in a number of contexts. Birds and mammals rely on sound for communication for reproductive and territorial purposes, communication with young, navigation, avoiding danger and finding food (US Department of Transportation[1], 2011). Increased noise from motorized recreational vehicles, construction equipment, aircraft and military exercises can result in a stress response in the wildlife that interferes with routine behaviour and may affect breeding success. Very high levels of noise, such as that near jet engines at airports, can cause acute hearing loss in wildlife. The US Dept. of Transport reports that mammals can hear in the range of <10 Hz to 150 kHz, with a sensitivity of 20 dB, while birds show greater uniformity, hearing a range of 100 Hz to 8-10 kHz, with a sensitivity of 10 dB.

The beginning of the access road on the airstrip side (to the east of the runway) will abut the airport landing strip. However, the potential impacts of noise on mammals and birds at the project locations is difficult to evaluate without knowing the distribution of species present and the noise generated by the construction activity. As stated in the 2016 Arcadis EIA, the number of flights by aircraft at the airport (and not including helicopter flights) range from a maximum of 233 flights in July of 2012 to 8 in September of the same year. Considerably fewer flights occurred in 2014, ranging from roughly 1 to >2 per day in July and September, respectively. Depending on the types of aircraft (i.e. if sound levels exceed 100 dB). Helicopters are also known to occasionally use the Eureka airport. However, there are no anticipated increases in helicopter traffic as a result of the project components. Aircraft flights could cause avoidance of the area by breeding wildlife or disruption of normal feeding and reproductive activity if nests and dens were established before flights began.

The behaviour of large mammals, such as caribou, as a result of construction activity has been reviewed by several agencies and ranges from avoidance and displacement to neutral behaviour. Examples of large scale development, such as oil and gas installations in Alaska, have shown examples of avoidance by some age classes (usually females with young) while other age groups such as bulls, show little effect and are more likely than females to be attracted to airstrips, roads and other open areas to avoid insect harassment (AMAP, 2010). Studies on Peary caribou and muskox responses to helicopter overflights (Miller and Gunn, 1979) reported that a large proportion of both species showed extreme response to helicopter overflights. Several factors affected the response, including the group size and number of young. The long-term impacts to the Peary caribou and muskox from low level flights were unclear.

[1] (https://www.fhwa.dot.gov/environment/noise/noise_effect_on_wildlife/effects/wild04.cfm; accessed Oct 2015).

The nature of the noise (e.g., duration, energy levels, attenuation) and the potential impact from the construction activities is difficult to assess, particularly in light of the amount of flight activity at the airport. It is unlikely that muskox and caribou would be significantly affected by the activity because the area affected is small and it will not impact calving grounds or known breeding sites for large mammals. Noise from the construction of the access road, water crossing, and quarry will attenuate quickly and is unlikely to affect birds or small mammals in the area, although sustained noise and activity may significantly disrupt routine feeding and breeding activity. Populations of small mammals and birds may benefit if predators avoid the area because of increased human activity and noise.

6.1.2.3 Mitigation Measures for Noise

As stated above, in general, the project components will employ standard operating procedures for equipment/machinery and ensure that regular maintenance is performed in accordance with good engineering practices or as recommended by suppliers such that the equipment is kept in good operating condition. As well, the project proponent will adhere to conditions outlined in all permits, authorizations and/or approvals, including conditions annexed to and forming part of Land Use Permit N2017N0017 (INAC, 2017).

The number of equipment/vehicle movements and travel distances will be optimized to reduce fuel consumption and minimize noise emissions. Lowering vehicle speeds on unpaved roads as well as implementing good road maintenance practices will minimize the potential for noise emissions. Steps will be taken to ensure that all heavy construction equipment are equipped with proper mufflers to reduce noise levels.

6.1.2.4 Residual Effects

A residual environmental effect caused by the project components is considered significant if it adversely affects the long-term viability of the VEC. A residual effect is considered to be not significant if the effect causes a change in the VEC that is within the range of natural variability or does not affect the integrity of the VEC in a measurable or meaningful way.

With the implementation of the mitigation measures for noise (Section 6.1.2.3), no residual adverse effects due to noise are anticipated.

6.1.2.5 Significance of Effect

Not significant.

6.2 Geological Environment

6.2.1 Hydrogeology

6.2.1.1 Project-Environment Interactions

Activities will occur during each project component which have the potential to affect the surface and bedrock geology as identified in the interaction matrix, Table 5.1. The identified project activities will use typical construction methods for Arctic environments. A quarry permit for aggregate extraction was completed for this project component. Construction activities which may result in effects to surface and bedrock geology include the following:

- aggregate extraction (excavating and earth moving);
- construction/installation of buildings and infrastructure (temporary tent camp);
- removal of buildings and infrastructure (temporary tent camp); and,
- construction of permanent access road and water crossing, to service Improvement Project areas, such as the Eureka Runway.

6.2.1.2 Evaluation of Effects

The three (3) project components are located in areas of continuous permafrost with a varying active layer dependent of location (e.g. high versus low areas, south facing areas, etc.). Creation of a new quarry via the extraction of granular material from the West Remus Creek borrow area as well as the creation of the access road can expose the underlying permafrost, resulting in melting, ground instability, and soil erosion.

6.2.1.3 Mitigation Measures

The following measures are proposed to mitigate potential adverse geological effects:

- minimize the footprint of the area to be excavated or disturbed;
- construct access road following best practices for protection of permafrost including a raised and compacted road bed;
- for the construction of the new access road, construct the embankment using a fill approach to eliminate any unnecessary disturbance of the underlying native ground and permafrost;
- for the construction of the access road, as road base material will likely be free dumped onto the surveyed roadway alignment, dozed and shaped into form and compacted in place, where any soft areas may be detected, place geotextile material as the first layer to provide underlying support for embankment material at these locations;

- conduct a complete on-site evaluation of the borrow area to determine exact measures to be taken to protect permafrost as a result of the borrow activity. Preliminary background evaluation indicates that the quarry site development will use conventional stripping methods with progressive excavation in thawed material, to protect permafrost layer. Additional depth of cut will be achieved after removal of the initial layer and subsequent thawing of freshly exposed material (Nuna East, 2018);
- reduce impacts to permafrost by minimizing the borrow area footprint and maintaining a setback from West Remus Creek and current water bodies where there are expected to be depressed permafrost zones;
- ensure workers remain on pre-established roads and trails where possible, to protect against permafrost damage;
- avoid vehicle rutting during all construction activities by ensuring access roads are built to sustain the weight of all vehicles;
- install the temporary tent worker camp on cribbing, and/or raised, as best as possible. This is so that heat generated in the camp may be allowed to dissipate in the air space underneath the structures. This will decrease heat exchange and heat loss. These measures will minimize potential negative effects to permafrost in the worker camp area; and,
- adhere to conditions annexed to and forming part of Land Use Permit N2017N0017 (INAC, 2017).

6.2.1.4 Residual Effects

ECCC has experience with project improvements at the HAWS and has successfully implemented a range of mitigation measures such as those identified above. No residual adverse effects are anticipated to the hydrogeology and specifically to permafrost stability at the project component sites.

6.2.1.5 Significance of Effects

Not significant.

6.2.2 Soil Quality

6.2.2.1 Project-Environment Interactions

Activities will occur during each project component which have the potential to affect the soil as identified in Table 5.1. The identified project activities will use typical construction methods for Arctic environments. Construction activities which may result in effects to the soil quality include the following:

- excavations and earth moving;

- aggregate extraction;
- construction of permanent access road and water crossing;
- construction/installation of buildings and infrastructure (temporary tent camp);
- removal of buildings and infrastructure (temporary tent camp);
- material handling (loading and dumping); and
- refueling of vehicles/equipment.

6.2.2.2 Evaluation of Effects

Soil quality may be affected at all three project component sites as a result of an increase of project activities, most notably as a result of fuel spills and leaks from equipment.

6.2.2.3 Mitigation Measures

The following measures are proposed to mitigate potential adverse effects on soils:

- refuelling of vehicles and equipment to occur in designated areas following all applicable regulations and guidance to prevent soil contamination, and basic petroleum spill clean-up equipment is to be kept on-site;
- take measures to ensure the temporary worker camp site is restored to its original condition when the camp is dismantled, such as total removal of all camp structures, cleanup, and ensuring minimal soil and permafrost disturbance. At the completion of the construction projects the temporary tent camp complex will be removed and transported back to Eureka station for final demobilization. The site will be cleared of debris and non-burnable garbage will be hauled and disposed of in a local landfill. Food waste will be incinerated, and dangerous goods will be placed in drums labeled appropriately with Transportation of Dangerous Goods (TDG) and DFO requirements for demobilization (Nuna East, 2018);
- manage surface water to control soil erosion through the use of silt fences/curtains;
- conduct regular inspection and remedial action to capture any erosion problems that may arise during the quarry development such as ditching and maintaining proper drainage;
- to the extent possible, the excavations will be of uniform depth over a wide area to maintain positive surface drainage;
- silt fence must be on hand and installed as necessary to mitigate silt transport from the quarry operation into nearby waterways;
- the quarry site has a natural sloping terrain and therefor a 100 m setback will be established between the quarry development and the existing water courses. Setbacks will be surveyed and staked before any construction can proceed. Positive drainage will be a natural progression in the quarry design and stripping/farming approach. Since these activities will be surveyed by grade calculation, slope values and positive drainage will be maintained.

The pit floor will also have a positive grade applied for drainage to flow and will not create a 'ponding effect'. Grades will not exceed 4% in value to avoid any adverse flow and erosion problems (Nuna East, 2018);

- consume and haul all the processed quarry material to the project location at the Eureka Runway. All products will be consumed and hauled away, no stockpiles of produced aggregate materials will remain at the quarry locations when the work is complete. A detailed and final quantity list of the quarry materials consumed will be provided at the end of the project (Nuna East, 2018);
- provide a ditch form along the inside shoulder of the road at locations as determined and based on existing topography to promote appropriate drainage to culvert crossing locations, providing for the continuous release of freshet and rain event surface water down side of the roadway grade;
- there is no requirement for site clearing, vegetation removal or topsoil salvage at the proposed quarry location. Observations at the site indicate that the quarry site is clear of vegetation and organic surficial soils (Nuna East, 2018);
- sources at West Remus Creek must satisfactorily meet the construction specifications for fuel storage; and,
- adhere to conditions annexed to and forming part of Land Use Permit N2017N0017 (INAC, 2017).

6.2.2.4 Residual Effects

With the implementation of the above mitigation measures, no adverse residual effects are anticipated.

6.2.2.5 Significance of Effects

Not significant.

6.3 Aquatic and Terrestrial Environment

6.3.1 Physical Aquatic Environment

6.3.1.1 Project-Environment Interactions

Activities will occur during each project component which have the potential to affect the hydrology and water and sediment quality as identified in Table 5.1. The identified project activities will use typical construction methods for Arctic environments. Construction activities which may result in effects to the site hydrology and water and sediment quality include the following:

- excavations and earth moving (aggregate extraction and road construction);

- construction of permanent water crossing over Black Top Creek;
- construction/installation of buildings and infrastructure (temporary tent camp);
- removal of buildings, infrastructure (temporary tent camp);
- material handling (loading and dumping); and
- refuelling of vehicles/equipment.

6.3.1.2 Evaluation of Effects

During the construction of the road crossing (water crossing) over Black Top Creek and the access road from the Eureka Runway to West Remus Creek, surface drainage from the construction activities could result in the deposition of sediments in the aquatic environment.

During all construction activities, surface water contamination could potentially occur due to leaks/spills that may occur during the refuelling of vehicles and construction machinery on site.

6.3.1.3 Mitigation Measures

The following measures are proposed to mitigate potential adverse effects on the aquatic environment:

- implement suitable erosion and sediment suppression measures to prevent sediment from entering Black Top Creek and West Remus Creek. Erosion control structures (temporary matting, geotextile silt control filter (curtains) fabric, etc.) are to be used, as appropriate to prevent erosion and release of sediment and/or sediment laden water during the construction phase, and all berms are to be graded correctly. Weather conditions must be considered when carrying out the work to ensure that erosion potential associated with wind and rainfall runoff is mitigated. Any work carried out during the freshet would require additional precautions associated with snow melt runoff and flow;
- select culvert locations for the water crossing over Black Top Creek in the field based on visual observations of surface water flow and in accordance with the natural drainage paths that currently exist;
- provide both the inlet and outlet of each culvert along the access road alignment with a geotextile apron and cobble cover layer to provide erosion protection during peak flow periods;
- provide the large diameter culverts proposed for Black Top Creek with additional upstream scour protection in the form of concrete canvas, a protective concrete material that forms to any shape and sets up in the wet;
- vehicles/machinery are to be checked for leakage of lubricants or fuel and maintained in good working order. Wash, refuel and service machinery and store fuel and other materials

for the machinery in such a way as to prevent any deleterious substances from entering the water;

- limit refuelling to designated areas only;
- keep basic petroleum spill clean-up equipment on-site;
- ensure that machinery arrives on site in a clean condition and is maintained free of fluid leaks, invasive species and noxious weeds (DFO, 2018);
- for the water crossing project, limit machinery fording of the watercourse to a one-time event (i.e., over and back), and only if no alternative crossing method is available. If repeated crossings of the watercourse are required, construct a temporary crossing structure (DFO, 2018); and,
- adhere to conditions annexed to and forming part of Land Use Permit N2017N0017 (INAC, 2017).

6.3.1.4 Residual Effects

With the implementation of the above mitigation measures, no adverse residual effects on surface water are anticipated.

6.3.1.5 Significance of Effects

Not significant.

6.3.2 Aquatic Community

6.3.2.1 Project-Environment Interactions

Some assessment work has been conducted on the local surface water bodies at the HAWS in order to determine water quality and quantity to improve water supply at the station (WorleyParsons, 2011). The evaluation of potential effects from recent construction to the aquatic community requires site specific information on the distribution and numbers of invertebrate species and fish present. Without these data, potential effects to the aquatic community are estimated from observations by site personnel and general descriptions of the water bodies.

Table 6.1 Summary of Major Surface Water Bodies Potentially Impacted by Construction

Water Body	Location	Characteristics
Black Top Creek	Approximately 5 km east of the HAWS; used as background for water chemistry surveys.	Stream draining the area to the east of the runway. Unlikely to be affected by construction activity at the HAWS, including activity in borrow area. No survey of natural biological community.
Remus Creek	Approximately 15 km east of the HAWS, on the coast of Slidre Fjord	Surficial terrain units include a fluvial channel, a large fluvial delta and fluvial plain and several fluvial terraces. The soils associated with these terrain units consist of interbedded silts, sands and gravels. No survey of natural biological community.

[Source: WorleyParsons, 2011]

All water bodies on the site are intermittent and do not flow for the majority of the year. Black Top Creek drains a large area to the east of the runway, starting in June; however, flow most likely ceases in September and any remaining water freezes. There is no evidence of anadromous fish, such as arctic char, that move into the streams in summer to breed. Based on these observations, it is unlikely that there are fish present in the reaches of the creeks adjacent to HAWS, and any impacts from physical disturbance or increased sediment loads would be on the benthic community and algal periphyton on rocks in the stream bed. West Remus creek is similar to Black Top Creek. Staff working at the Eureka HAWS have reported that they do not believe that Black Top Creek is fish bearing, however, this has not been confirmed.

Of the three major project components, the water crossing at Black Top Creek involves slight direct disturbance of the water body while part of the borrow area at West Remus Creek is slated to be located near to the western bank of the creek. Thus, movement of heavy equipment may increase sediment transport during the summer construction period.

6.3.2.2 Mitigation Measures

Despite the lack of reported fish species in Black Top Creek and West Remus Creek, mitigation measures for construction activity are to be implemented as a precaution to prevent physical disturbance to the stream beds or margins including adherence to DFO *Measures to avoid causing harm to fish and fish habitat including aquatic species at risk.* For instance, should any fish be detected, ensure that all in-water activities, or associated in-water structures, do not interfere with fish passage, constrict the channel width, or reduce flows, or result in the stranding or death of fish (DFO, 2018).

Increased movement of borrow materials or fuel from storage sites that involve transport along the stream margins may require relocation of roads or transport in the fall when the area is frozen. If changes in the stream banks and bed are observed, then construction can be delayed until fall or

conducted in spring before thaw; if need be and should time permit. Site personnel shall be instructed on the importance of not driving heavy equipment along the stream banks or bed.

Additionally, as water pulling at West Remus Creek may be required during the construction period, the most appropriate time of year to do so would be during the freshet period. Potable water for the temporary camp site will be retrieved from Remus Creek and treated prior to use in the camp. The potable water must be treated appropriately using current best practices, filtration, UV screening, and offsite testing conducted prior to use.

Grey water discharge originating from the temporary camp must be placed in holding/settling tanks and tested to meet guidelines for discharge to the environment. Water meeting discharge guidelines will be decanted from the tanks to an approved discharge area, and care must be taken not to contaminate the surrounding environment and West Remus Creek.

Fuel will be stored in 4,995 liters double wall containment capsules at a designated laydown area near the camp location. Fuel will then be distributed using a fuel lube truck with no greater than 4,995 liters on board at any time.

6.3.2.3 Residual Effects

No residual effects are expected in the aquatic system from the three project components. Construction and increased transport of vehicles may impact Black Top Creek and West Remus Creek locally, but no fish are reported to be present in these creeks.

No residual effects are expected in the nearshore marine environment from the new project components.

6.3.2.4 Significance of Effects

Impacts to the aquatic community are expected to be negligible, due to the very low productivity and diversity of the aquatic community.

The impacts to the marine system from the construction activities are not expected to be significant. New construction will not physically disturb the nearshore marine environment and will not significantly change the quality of runoff.

6.3.3 Vegetation Communities and Species

6.3.3.1 Project-Environment Interactions

The major interaction with the plant community will be physical damage to vegetation during construction and changes in the soil surface layer, leading to potential soil and permafrost erosion,

changes in surface water hydrology and thermokarst. Fugitive dust may also suppress plant growth within a limited area around construction zones.

Most of the project components are located in areas that have already been disturbed by past or existing land uses resulting in a limited presence of vegetation, such as the site of the proposed access road. As stated above, at Black Top Creek and West Remus Creeks, as well as along the roadway where the proposed access road construction is to take place (and the existing ATV trail), there is very minimal vegetation and riparian vegetation on site (PSPC, 2018).

6.3.3.2 Evaluation of Effects

The effects to the plant community are difficult to predict due to the lack of site-specific data on plant species and their density near the project component sites. The damage to the vegetation will be equal to the footprint of the construction, storage and borrow sites and the dust footprint. Although the construction areas are generally previously disturbed and/or lacking a large presence of vegetation, there is still a potential for some limited negative effects on any existing local vegetation. (Section 6.3.3.3).

6.3.3.3 Mitigation Measures

Construction in the North often takes place during winter to avoid the effects of damage to the tundra and soil. Due to the extreme conditions at Eureka, construction will be conducted during the brief summer months when most damage to tundra will occur. Damage can be reduced by covering the ground, possibly using matting, prior to construction to reduce physical disruption of the soil. Fugitive dust will be suppressed at its source (see Section 6.1.1.3 for dust suppression and mitigation details). Additionally, vehicles will be required to remain on pre-established roads/trails. Workers will be advised of sensitivity of environment and to stay off the soil/vegetation in a construction project initiation meeting. Applicable conditions annexed to and forming part of Land Use Permit N2017N0017 (INAC, 2017) must be adhered to.

6.3.3.4 Residual Effects

Damage done to the plant community during construction will be long-lasting. Recovery of the plant community in the project area will be very slow due to extreme cold and low moisture levels. It is unlikely that revegetation will be successful given the environmental conditions.

6.3.3.5 Significance of Effects

Using the process and criteria described in Section 5 above, the significance of the residual effects on site plant community is as follows:

- Magnitude: Low – Losses of vegetation are low relative to the ECCC reserve land;

- Geographic extent: Low – Limited to the temporary worker tent camp site and West Remus Creek borrow pit area;
- Duration/timing: Low – Will occur during the construction phase;
- Frequency: Low – Will occur during construction phase, a temporary condition;
- Reversibility: Medium – Affected vegetation will be slow to recover due to extreme cold and low moisture levels.

Given that all but one criterion was rated low, advancement to the second step of significance determination was not warranted. Therefore, the conclusion is that the residual adverse environmental effect is minor in nature and not significant.

6.3.4 Wildlife Communities and Species

The analysis of potential impacts to the plants and animals will depend on data available from site characterization studies (EBA Consultants 2008, Franz/SENES, 2013 a, b, c) and published similar High Arctic sites. To date, no systematic, rigorous surveys have been conducted to record the species present, their abundance and distribution or rare/sensitive plants and animal species in the area surrounding the HAWS. Site-specific information on the plant and animal species present during summer when construction activity will take place would significantly reduce the uncertainty in predicting the type of interactions expected, the species and the numbers of individuals involved.

6.3.4.1 Project-Environment Interactions

This analysis will use data from other sites and several assumptions to predict potential impacts on the ecology in and around the HAWS site during the construction phase of the project components. To date, no surveys have been conducted to record the numbers or species of common or rare plants and animal species in the area surrounding the HAWS. Site specific data on the abundance and distribution of species would significantly reduce the uncertainty in predicting the type of interactions expected, the species and the numbers of individuals involved.

Construction will occur during the summer, the time that nesting and denning occur for many bird and mammal species. A summary of the types of interactions that are known to occur at mine sites and camps across northern Canada are listed in Table 6.2. Interactions include the physical destruction of habitat and the loss of vegetation. In the Arctic, the destruction of the upper active soil layer leads to erosion of permafrost, drainage issues and the loss of soil-stabilizing plants. For birds and mammals, the interactions include behavioural changes such as avoidance and/or attraction to the site and changes in the dominant species in areas adjacent to the site.

Table 6.2 Summary of Known Interactions to Remote Mine and Camp Sites in Northern Canada

Type of Interactions	Example
Physical disturbance of habitat	• Destruction of nesting or denning sites during construction; loss of vegetation; disruption of surface layer leading to permafrost thaw and thermokarst.
Avoidance of human activity	• Presence of human activity, such as that resulting in increased noise levels, during sensitive life stages causes abandonment or disruption of daily feeding activity.
Attraction to human activity	• Response of wildlife to attractants (garbage, food) to enter site. Might also include predatory behaviour by some species which result in the animals being shot. • Bears will be attracted to the area of the temporary tent camp. A bear fence will be erected to prevent access to the camp by bears.
Chemical contamination	• Wildlife exposed to elevated levels of contaminants of concern in surface waters or though the contamination of soil and vegetation. This can occur offsite, as chemicals migrate through air or water, or on-site as wildlife move to contaminated areas.
Biological/ecological changes	• Presence of infrastructure may provide nesting or denning areas for wildlife. • Predatory species (e.g., ravens) are known to be attracted to infrastructure and prey on small mammals and birds.

6.3.4.2 Evaluation of Effects

The estimation of effects to local plant and animal species is conducted with the use of Valued Ecosystem Components (VECs), which are representative species that have social, ecological and/or cultural significance. Candidate species are selected to include representative species from different ecological niches. They may also represent specific niches or trophic status that suggests they will be good indicators of biological effects due to disturbance (e.g., physical disturbance of habitat, noise). Due to the extreme climate and harsh environment, the number of species present in the area is small and have adapted to survival under those conditions, or they migrate to the area for breeding/nesting during the summer. VECs generally include species that are actively harvested by local indigenous people to ensure that these species are given a priority for protection. VECs may also include rare/sensitive species that are also given a priority for protection if surveys have documented their presence in an area of interest.

Table 6.3 lists the set of VECs known to be in the vicinity of the HAWS, Eureka runway, Black Top Creek and West Remus Creek areas, that were selected for this analysis. They represent most major ecological niches in the terrestrial and marine systems at Eureka and hence could be affected by physical disturbance and general activity during construction. Rare/sensitive species are those that have been assigned heightened conservation status under SARA legislation.

Table 6.3 Valued Ecosystem Components used to Predict Possible Effects from Construction Activities at the Eureka HAWS

Species	Scientific Name	Description
Terrestrial Habitat		
Plants and lichen	Numerous species	Primary Producer. Grow between rock crevices and on rocks.
Rock ptarmigan	*Lagopus mutus*	Widely distributed land bird feeding on seeds.
Snowy owl	*Bubo scandiacus*	Predatory bird, nesting in far North in summer.
Nearctic collared lemming (or Peary Land Collared Lemming)	*Dicrostonyx groenlandicus*	Widely distributed small mammal; food source for upper trophic levels.
Snow bunting	*Plectrophenax nivalis*	Seed eating songbird that nests on Ellesmere Island in the summer.
Arctic fox	*Vulpes lagopus*	Predator feeds/scavenges in terrestrial and occasionally in marine systems.
Peary Caribou	*Rangifer tarandus pearyi*	Large herbivore. Important for subsistence hunting, included in traditional diet.
Muskox	*Ovibos moschatus*	Large herbivore. Important for subsistence hunting, included in traditional diet.
Marine Habitat		
Benthic Invertebrates	Numerous species	Could be exposed to run-off in nearshore environment or affected by physical disturbance, sensitive to contaminants in surface water and sediments.
Arctic sculpin	*Myoxocephalus scorpiodes*	Benthic species; predator, habitat is the littoral zone.
Arctic cod	*Boreogadus saida*	Pelagic species; widely distributed food source for upper trophic levels.
Ivory gull	*Pagophila eburnea*	Endangered species that feeds in the nearshore marine environment.
Ringed seal	*Phoca hispida*	Widely distributed; food source for polar bear.
Polar bear	*Ursus maritimus*	Top marine predator.

Table 6.4 Summary of VEC Features that may Lead to Interaction with Construction at the Eureka HAWS

Species	General Description	Breeding Behaviour	Conclusions
Terrestrial System			
Plants and lichen	• No rigorous surveys have been conducted but plant species are expected to include arctic willow (*Salix arctica*), avens (*Dryas* spp.), birch, arctic poppy (*Papaver* spp.). • No surveys of rare or conservation-sensitive plants have been conducted.		• No rare or sensitive species are known in the HAWS area. • Any local damage to plants and lichen unlikely to affect general population of species. • Very slow recovery of any disturbed of damaged areas due to low moisture and light.
Rock ptarmigan	• Small grouse-like bird widely distributed across Arctic. • Small scale migration during winter to avoid most severe climate. • Feeds on plant material (99% - e.g., birch buds, willow, avens) with some invertebrates in summer.	• Nests on dry rocky ground, nest is little more than open scrape on the ground. • 1 brood per year, possibly second clutch if first is lost. • Loss of chicks primarily due to predation and exposure. • Nest densities vary from <1 to up to 10 or more/km^2.	• Numbers are variable but the population in the area around the HAWS has not been surveyed. • Destruction of nests or impacts to breeding adults possible during construction, but unlikely to affect larger population.
Snowy owl	• Predator that nests in High Arctic and overwinters in southern/central Canada. • needs high density of small prey (e.g., lemmings) in order to breed.	• Nests are located on dry areas on tundra, usually on high mounds or hummocks. • Clutches usually from 5-10 eggs. Nests may be 1 or more km apart, with density roughly 1 nest/22 km^2.	• Nests are on raised ground and tend to be visible due to the bright white of the adults. • Destruction of a hidden nest during construction is less likely. • The low density and the low numbers that might be destroyed inadvertently will probably not impact the northern population.

Table 6.4 Summary of VEC Features that may Lead to Interaction with Construction at the Eureka HAWS (Cont'd)

Species	General Description	Breeding Behaviour	Conclusions
Terrestrial System			
Nearctic collared lemming (or Peary Land Collared Lemming)	• Small mammal of roughly 75 g. • Density varies significantly from 0.6 to 400 per ha, with peaks every 2 to 5 years. • Feeds on sedges, grasses and berries in summer. • Occupy shallow burrows under sod where soil is available.	• Breeding season is from March to September. • Average litter of 4-5. • Reproduce 2 to 3 times a year.	• Construction likely affects individual lemmings and their burrows, the number depends on the phase of the population cycle. • Significant, long-term impacts to the population are unlikely due to their high reproductive rate and wide distribution.
Snow bunting	• Medium sized songbird that nests in High Arctic. • Overwinter in southern Canada and northern US. • Feeds on seed, buds and invertebrates in summer.	• Nest in rocky areas and rock cavities; isolation in rocks reduces predation. • May use barrels, metals cans for nests. • 1 brood/year. nest densities vary but may reach 26 pairs/km^2.	• No data for Eureka on numbers, but summer construction may destroy nests or cause parental abandonment. • Pairs may also nest in litter on the HAWS site. • Impacts unlikely to affect general population.
Arctic fox	• Widely distributed across northern Canada, primarily north of 60, and population is stable. • Feed on small mammals, and scavenges kills from bears or wolves. • May scavenge around human dwellings.	• Female matures at 9 months and bears young once a year. • Litter size of usually 5-8.	• Arctic foxes are ubiquitous on northern Ellesmere, although the numbers around the HAWS are unknown. • Impacts from construction may occur from the destruction of dens. • Impacts are unlikely to have a significant impact of the fox population.
Peary Caribou	Considered under Rare/sensitive species		

Table 6.4 Summary of VEC Features that may Lead to Interaction with Construction at the Eureka HAWS (Cont'd)

Species	General Description	Breeding Behaviour	Conclusions
Terrestrial System			
Muskox	• Restricted to far north in Canada, including north Ellesmere Island. • Ruminants that feed on sedges, grasses and willows. • Population is stable and increasing in some areas. • Threats include long severe winters and deep snow, and parasitic infections.	• Females usually bear a calf every two years. • Single calf after gestation of 8 months. • Young are weaned at 10-12 months.	• Muskox are often observed near the HAWS. • Significant effects from construction activities unlikely due to avoidance by muskox and their ability to move to isolated areas.
Marine System			
Benthic Invertebrates	• Benthic community is sparse due to very low productivity in nearshore environment. • Benthic species provide food to benthic and nearshore fish, such as sculpins.		• Impacts to the benthic environment could occur from changes in water quality and sedimentation during construction; however, the current status of the nearshore environment is unknown and benthic community distribution from past activities at the HAWS is unknown.

Table 6.4 Summary of VEC Features that may Lead to Interaction with Construction at the Eureka HAWS (Cont'd)

Species	General Description	Breeding Behaviour	Conclusions
Marine System			
Arctic sculpin	• Benthic fish found in nearshore environment. • Feeds on benthic invertebrates, including algae and crustaceans.	• Spawn in the fall, with eggs found on or near the bottom. • Larvae are planktonic and usually found offshore.	• Adults are unlikely to be affected by station activity • Eggs in the nearshore environment might be impacted by increased sedimentation or changes in water quality from the site, but the area affected is expected to be low. • Residual impacts from past activities at the HAWS are unknown.
Arctic cod	• Pelagic fish found in very large numbers. • Feeds on plankton and small fish and is a major food source for seals and other marine mammals.	• Breeds under ice in the pelagic environment. • Eggs distributed in open water and the larvae feed on the epontic community under the ice.	• Pelagic species that can be very numerous but is unlikely to be close to the HAWS shoreline in large numbers. • Probability of impacts from proposed construction activity at the station is very low.
Ivory gull	Considered under Rare/sensitive species		

Table 6.4 Summary of VEC Features that may Lead to Interaction with Construction at the Eureka HAWS (Cont'd)

Species	General Description	Breeding Behaviour	Conclusions
Marine System			
Ringed seal	• Solitary seal widely distributed in marine system across the North. • Feeds on crustaceans and small fish, including arctic cod. • Northern population probably approaches 1 million individuals. • Density of 0.2 to 0.9 per km^2.	• Breeding once per year. • Delayed implantation of fetus for up to 3 months. • Pups born in snow dens on landfast ice. • 1 pup born per year.	• Interactions with construction activity at the HAWS is minimal. • Pups born in dens on landfast ice during March/April when there is no construction at site. • Adult seals can avoid activity on shore during open water season.
Polar bear	Considered under Rare/sensitive species		

Sources of Data:

Banfield, A.W.F. 1974. Mammals of Canada. University of Toronto Press.
NWT Species Monitoring InfoBase (http://www.nwtspeciesatrisk.ca/Infobase) (accessed February 2018).
Birds of North America online. Cornell Lab of Ornithology and American Ornithologists (http://bna.birds.cornell.edu.uml.idm.oclc.org/bna/) (accessed February 2018).

6.3.5 Rare and Sensitive Species

Although there is very little site-specific information about the numbers and distribution of species in the environment around Eureka, it is important to recognize that there may be sensitive bird and mammal species in the area and those with heightened conservation status. Due to their protective status, these species have been assessed individually. They are provided in Section 6.3.5 of the 2016 Arcadis EIA. The assessment from the previous EIA study is applicable to the three (3) project components which are the subject of this EIA addendum.

6.3.5.1 Mitigation Measures

Mitigation is required when it is expected that construction activities will directly impact one of the rare or sensitive species. Construction will occur during summer months when nesting and denning is at a peak. Impacts may occur from the physical disturbance of habitat or from indirect effects such as noise, human activity, dust, increased air and ground traffic. Mitigation should include identifying nesting and denning sites prior to construction and isolating them so that the following will occur:

- inform temporary workers of station protocols for the control and disposal of food and refuse to ensure that local wildlife is not attracted to the site;
- train temporary workers involved with construction to avoid contact with all wildlife and their nests (particularly with species at risk) and to report sightings to a central authority (i.e., supervisors) immediately. Movements of workers in off-hours should also be restricted to ensure nesting sites and denning areas are not disturbed;
- consider the use of trained wildlife monitors prior to, and during, construction to ensure a coordinated, appropriate response to wildlife sightings and to ensure protection of local species during construction;
- ensure that a qualified person shall be present before and during important phases of construction to facilitate protection of wildlife to avoid disturbance to birds and mammals. This person shall conduct a survey prior to commencement of construction to identify important areas and sensitive species that might be affected;
- in the event that SARA listed birds or mammals are located in the area, construction crews shall be prepared to modify, or delay, activity that might harm the protected species. For example, if nests with eggs are located for the red knot, activity in the area might be delayed until after hatching; and,
- adhere to applicable conditions annexed to and forming part of Land Use Permit N2017N0017 (INAC, 2017).

With the application of the above mitigation measures, there will be minimal impacts to SAR or critical habitat. As a result, no SARA authorizations are required.

6.3.5.2 Residual Effects

No residual effects to most species of wildlife are expected from the construction activities. The numbers of plants and wildlife that are likely to be directly affected by displacement and altered behavior (avoidance, changes in feeding and brooding behavior) is expected to be small and unlikely to affect the larger population. Rare or sensitive species should be protected, if in the area, to ensure minimal residual effects.

6.3.5.3 Significance of Effects

Significant effects are not expected to the larger population of most species because the area affected by the construction is relatively small and/or has already been disturbed (i.e., the existing ATV trail). Increased human activity might cause changes in the biological community as some species may avoid, while others may be attracted to the activity. The protection of rare and sensitive plants and animals is key to keeping the effects from increased human activity and construction to a minimum.

6.4 Physical and Cultural Resources

6.4.1 Archaeology and Cultural Heritage

6.4.1.1 Project-Environment Interaction

Further to the completion of an archaeological assessment by Stantec in 2017 in which 16 archaeological sites were investigated (12 prehistoric, one contemporary, and three historic), it was concluded that three of the sites are situated to the west of the HAWS and not relevant to the three proposed project components to the east of the HAWS. Most of the 13 remaining sites which were assessed are of high heritage value. Thus, there is some potential for the project components to interact with physical and cultural resources.

6.4.1.2 Evaluation of Effects

The archaeological assessment concluded that three (3) specific sites are in conflict with the proposed borrow source location at West Remus Creek and three (3) specific sites are in conflict with the proposed access road. They are all considered to be of high heritage value, with the exception of one site near the proposed borrow area which could not be reidentified in the 2017 assessment. The Archaeological Assessment Report is to be consulted for more details (Stantec, 2017).

6.4.1.3 Mitigation Measures

Following is a list of measures that are designed to mitigate potential adverse effects on physical and cultural resources:

- as most of the 13 sites in the vicinity of the proposed construction work are considered to be of high heritage value, careful measures will be taken to avoid these locations (as outlined in Stantec, 2017). The only exception where avoidance was not recommended is in the case of the previously identified site which could not be reidentified in the 2017 investigation;
- if avoidance is not feasible, further archaeological investigation is recommended, including detailed inspection and mapping, shovel testing, and archaeological excavation;
- avoidance measures at the proposed borrow site at West Remus Creek, where two sites are situated along the boundary of the borrow source, include restriction of the borrow source footprint to ensure a minimum 30 m buffer zone of no impact around these sites;
- avoidance measures must be taken at the proposed access road site, where three sites conflict with the road, including two prehistoric sites bisected by the existing ATV access route. No activity that could result in any additional alteration of the road shall be permitted within the site boundaries as illustrated in Stantec (2017). The third site is a historic period site with moderate heritage value that is also bisected by the road; thus, any ground disturbance activities necessary within this site area shall be restricted if possible and kept to the north side of the road;
- workers shall familiarize themselves with the five locations that are in conflict with the project activities: proposed borrow source area (two locations) and access road (three locations) at project initiation meetings, so they are aware of these locations;
- workers shall be made aware of the nature of archaeological sites and the requirements under legislation (*The Nunavut Act*) to ensure no impacts to archaeological sites. If archaeological sites are encountered by field workers, they need to ensure that the sites are not disturbed in any way, and that no artifacts or items observed at the site are collected or moved;
- if any archaeological sites or artifacts are observed by workers that do not appear to be reported on in Stantec (2017), the sites will be reported to the Nunavut Territorial Archaeologist. Reporting of newly identified archaeological sites can also be initiated by reporting the site to an archaeologist, who can confirm the nature of the site and assist in reporting the site to the Nunavut Territorial Archaeologist (Stantec, 2017).

6.4.1.4 Residual Effects

With the implementation of the above mitigation measures, no adverse residual effects on physical and cultural resources are anticipated.

6.4.1.5 Significance of Effects

Not significant.

6.5 Socio-Economic

6.5.1 Socio-Economic and Human Environment

6.5.1.1 Project-Environment Interactions

As noted in Table 5.1, there are no project component activities that would have the potential to affect components of the human environment. Two of the project components have the potential to affect community infrastructure at Eureka, namely, the construction of the permanent access road and water crossing at Black Top Creek.

6.5.1.2 Evaluation of Effects

The construction of the permanent access road and water crossing to facilitate water crossing over Black Top Creek has the potential to create a net positive socio-economic affect for the HAWS main site at Eureka, facilitating ease of transportation from West Remus Creek (the new proposed borrow site), to the runway, and to the main HAWS site. The access road is not slated for decommissioning and may benefit the community situated at the main site going forward, as well as facilitate future probable Improvement Projects at the site.

6.5.1.3 Mitigation Measures

Based on the foregoing information, no mitigation measures are recommended due to the probable net positive socio-economic effects of the project components.

6.5.1.4 Residual Effects

No adverse residual effects and net positive socio-economic effects are anticipated.

6.5.1.5 Significance of Effects

Not significant.

6.6 Summary of Mitigation Measures

Table 6.5 below summarizes the mitigation measures outlined throughout this chapter for addressing potential environmental effects associated with the project components.

Table 6.5 Summary of Mitigation Measures

Environmental Component	Mitigation Measures
Atmospheric Environment	
Air Quality	• employ standard operating procedures for heavy equipment/machinery and ensure that regular maintenance is performed in accordance with good engineering practices or as recommended by suppliers such that the equipment is kept in good operating condition; • adhere to conditions outlined in all permits, authorizations and/or approvals; • use appropriate exhaust emissions controls such as catalytic converters and diesel particulate filters to mitigate fuel combustion emissions from heavy equipment and vehicles; • optimize the number of equipment/vehicle movements and travel distances to reduce fuel consumption and minimize dust and greenhouse gas emissions; • reduce vehicle speeds on unpaved road surfaces; • apply water as well as implement good road maintenance practices to minimize the potential for road dust emissions; and, • adhere to conditions annexed to and forming part of Land Use Permit N2017N0017 (INAC, 2017).
Noise	• employ standard operating procedures for heavy equipment/machinery and ensure that regular maintenance is performed in accordance with good engineering practices or as recommended by suppliers such that the equipment is kept in good operating condition; • adhere to conditions outlined in all permits, authorizations and/or approvals; • optimize the number of equipment/vehicle movements and travel distances to minimize noise emissions; • reduce vehicle speeds on unpaved roads as well as implement good road maintenance practices to minimize the potential for noise emissions; • ensure that all heavy construction equipment are equipped with proper mufflers to reduce noise levels; and, • adhere to conditions annexed to and forming part of Land Use Permit N2017N0017 (INAC, 2017).

Environmental Component	Mitigation Measures
Geological Environment	
Hydrogeology	• minimize the footprint of the area to be excavated or disturbed; • construct required access roads following best practices for protection of permafrost including a raised and compacted road bed; • evaluate the borrow area to determine exact measures to be taken to protect permafrost as a result of the borrow activity; • reduce the impacts to permafrost by minimizing the borrow area footprint and maintaining a setback from West Remus Creek and current water bodies where there are expected to be depressed permafrost zones; • require workers to remain on pre-established roads and trails where possible, to protect against permafrost damage; • avoid vehicle rutting during all construction activities by ensuring access roads are built to sustain the weight of all vehicles; • take measures to ensure the temporary worker camp site is restored to its original condition when the camp is dismantled; • construct access road following best practices for protection of permafrost including a raised and compacted road bed; • construct embankment for the new access road using a fill approach to eliminate any unnecessary disturbance of the underlying native ground and permafrost; • for the construction of the access road, as road base material will likely be free dumped onto the surveyed roadway alignment, dozed and shaped into form and compacted in place, where any soft areas may be detected, geotextile material shall be placed as the first layer to provide underlying support for embankment material at these locations; • a ditch form shall be provided along the inside shoulder of the road at locations as determined and based on existing topography to promote appropriate drainage to culvert crossing locations, providing for the continuous release of freshet and rain event surface water down side of the roadway grade.

Environmental Component	Mitigation Measures
Geological Environment	
	• conduct complete on-site evaluation of the borrow area to determine exact measures to be taken to protect permafrost as a result of the borrow activity. Preliminary background evaluation indicates that the quarry site development will use conventional stripping methods with progressive excavation in thawed material, to protect permafrost layer. Additional depth of cut will be achieved after removal of the initial layer and subsequent thawing of freshly exposed material; • install the temporary tent worker camp on cribbing, and/or raised, as best as possible. This is so that heat generated in the camp may be allowed to dissipate in the air space underneath the structures. This will decrease heat exchange and heat loss. These measures will minimize potential negative effects to permafrost in the worker camp area; and, • adhere to conditions annexed to and forming part of Land Use Permit N2017N0017 (INAC, 2017).
Soil Quality	• refuelling of vehicles and equipment must occur in designated areas following all applicable regulations and guidance to prevent further soil contamination, and basic petroleum spill clean-up equipment is to be kept on-site; • take measures to ensure the temporary worker camp site is restored to its original condition when the camp is dismantled; • there is no requirement for site clearing, vegetation removal or topsoil salvage at the proposed quarry location. Observations at the site indicate that the quarry site is clear of vegetation and organic surficial soils; • sources at West Remus Creek must satisfactorily meet the construction specifications for fuel storage; • manage surface water to control soil erosion through the use of silt fences/curtains; • conduct regular inspection and remedial action must be in place to capture any erosion problems that may arise during the quarry development such as ditching and maintaining proper drainage; • to the extent possible, the excavations will be of uniform depth over a wide area to maintain positive surface drainage; • retain silt fence on hand and install as necessary to mitigate silt transport from the quarry operation into nearby waterways;

Environmental Component	Mitigation Measures
	• establish a 100 m setback between the quarry development and the existing water courses. Setbacks will be surveyed and staked before any construction can proceed. Positive drainage will be a natural progression in the quarry design and stripping/farming approach. Since these activities will be surveyed by grade calculation, slope values and positive drainage will be maintained. The pit floor will also have a positive grade applied for drainage to flow and will not create a 'ponding effect'. Grades will not exceed 4% in value to avoid any adverse flow and erosion problems; • it is expected that all the processed quarry material will be consumed and hauled to the project location at the Eureka Runway. All products will be consumed and hauled away, no stockpiles of produced aggregate materials will remain at the quarry locations when the work is complete. A detailed and final quantity list of the quarry materials consumed will be provided at the end of the project (Nuna East, 2018); and, • adhere to conditions annexed to and forming part of Land Use Permit N2017N0017 (INAC, 2017).
Aquatic Environment	
Physical Aquatic Environment	• suitable erosion and sediment suppression measures will be implemented to prevent sediment from entering Black Top Creek and West Remus Creek. Erosion control structures (temporary matting, geotextile silt control filter (curtains) fabric, etc.) are to be used, as appropriate to prevent erosion and release of sediment and/or sediment laden water during the construction phase, and all berms are to be graded correctly. Weather conditions must be considered when carrying out the work to ensure that erosion potential associated with wind and rainfall runoff is mitigated. Any work carried out during the freshet would require additional precautions associated with snow melt runoff and flow; • culvert locations for the water crossing over Black Top Creek will be selected in the field based on visual observations of surface water flow and in accordance with the natural drainage paths that currently exist; • both the inlet and outlet of each culvert along the access road alignment will be provided with a geotextile apron and cobble cover layer to provide erosion protection during peak flow periods; • the large diameter culverts proposed for Black Top Creek will be provided with additional upstream scour protection in the form of concrete canvas, a protective concrete material that forms to any shape and sets up in the wet;

Environmental Component	Mitigation Measures
	• vehicles/machinery are to be checked for leakage of lubricants or fuel and are maintained in good working order. Wash, refuel and service machinery and store fuel and other materials for the machinery in such a way as to prevent any deleterious substances from entering the water; • refuelling should occur in designated areas only; • basic petroleum spill clean-up equipment is to be kept on-site; • ensure that machinery arrives on site in a clean condition and is maintained free of fluid leaks, invasive species and noxious weeds (DFO, 2018); • for the water crossing project, limit machinery fording of the watercourse to a one-time event (i.e., over and back), and only if no alternative crossing method is available. If repeated crossings of the watercourse are required, construct a temporary crossing structure (DFO, 2018); and, • adhere to conditions annexed to and forming part of Land Use Permit N2017N0017 (INAC, 2017).

Environmental Component	Mitigation Measures
Aquatic and Terrestrial Environment	
Aquatic Community	• increased movement of borrow materials or fuel from storage sites that involve transport along the stream margins may require relocation of roads or transport in the fall when the area is frozen. If changes in the stream banks and bed are observed, then construction can be delayed until fall or conducted in spring before thaw; if need be and should time permit. Site personnel should be instructed on the importance of not driving heavy equipment along the stream banks or bed; • as water pulling at West Remus Creek may be required during the construction period, the most appropriate time of year to do so would be during the freshet period. Potable water for the temporary camp site will be retrieved from Remus Creek and treated prior to use in the camp. The potable water must be treated appropriately using current best practices, filtration, UV screening, and offsite testing conducted prior to use; • grey water discharge originating from the temporary camp must be placed in holding/settling tanks and tested to meet guidelines for discharge to the environment. Water meeting discharge guidelines will be decanted from the tanks to an approved discharge area, and care must be taken not to contaminate the surrounding environment and West Remus Creek; • fuel will be stored in 4,995 liters double wall containment capsules at a designated laydown area near the camp location. Fuel will then be distributed using a fuel lube truck with no greater than 4,995 liters on board at any time; • adhere to conditions annexed to and forming part of Land Use Permit N2017N0017 (INAC, 2017); • DFO Measures to avoid causing harm to fish and fish habitat including aquatic species at risk must be followed, in the event fish are detected on site during the construction period (DFO, 2018); and, • should any fish be detected, ensure that all in-water activities, or associated in-water structures, do not interfere with fish passage, constrict the channel width, or reduce flows, or result in the stranding or death of fish (DFO, 2018).
Vegetation Communities and Species	• reduce damage to the tundra by covering the ground, possibly using matting, prior to construction to reduce physical disruption of the soil; and, • adhere to conditions annexed to and forming part of Land Use Permit N2017N0017 (INAC, 2017).

Environmental Component	Mitigation Measures
Rate and Sensitive Species	• inform temporary workers of station protocols for the control and disposal of food and refuse to ensure that local wildlife is not attracted to the site; • train temporary workers involved with construction how to avoid contact with all wildlife and to report sightings to a central authority. Movements of workers in off-hours should also be restricted to ensure nesting sites and denning areas are not disturbed; • consider the use of trained wildlife monitors prior to, and during, construction to ensure a coordinated, appropriate response to wildlife sightings and to ensure protection of local species during construction; • ensure minimal disturbance to birds and mammals, by requiring a qualified person to be present before and during important phases of construction to facilitate protection of wildlife. This person should conduct a survey prior to commencement of construction to identify important areas and sensitive species that might be affected; • in the event that SARA listed birds or mammals are located in the area, construction crews should be prepared to modify, or delay, activity that might harm the protected species. For example, if nests with eggs are located for the red knot, activity in the area might be delayed until after hatching; and, • adhere to conditions annexed to and forming part of Land Use Permit N2017N0017 (INAC, 2017).
Physical and Cultural Resources	
	• as most of the 13 sites in the vicinity of the proposed construction work are considered to be of high heritage value, careful measures must be taken to avoid these locations (as outlined in Stantec, 2017). The only exception where avoidance was not recommended is in the case of the previously identified site which could not be reidentified in the 2017 investigation; • if avoidance is not feasible, further archaeological investigation is recommended, including detailed inspection and mapping, shovel testing, and archaeological excavation; • avoidance measures at the proposed borrow site at West Remus Creek must be taken where two sites are situated along the boundary of the borrow source, including restriction of the borrow source footprint to ensure a minimum 30 m buffer zone of no impact around these sites;

Environmental Component	Mitigation Measures
	• avoidance measures must be taken at the proposed access road site, where three sites conflict with the road, including two prehistoric sites bisected by the existing ATV access route, and no activity that could result in any additional alteration of the road shall be permitted within the site boundaries as illustrated in Stantec (2017). The third site is a historic period site with moderate heritage value that is also bisected by the road; thus, any ground disturbance activities necessary within this site area must be restricted if possible and kept to the north side of the road; • workers shall familiarize themselves with the five locations that are in conflict with the project activities: proposed borrow source area (two locations) and access road (three locations) at project initiation meetings, so they are aware of these locations; • workers must be made aware of the nature of archaeological sites and the requirements under legislation (The Nunavut Act) to ensure no impacts to archaeological sites. If archaeological sites are encountered by field workers, they need to ensure that the sites are not disturbed in any way, and that no artifacts or items observed at the site are collected or moved; and, • if any archaeological sites or artifacts are observed by workers that do not appear to be reported on in Stantec (2017), the sites must be reported to the Nunavut Territorial Archaeologist. Reporting of newly identified archaeological sites can also be initiated by reporting the site to an archaeologist, who can confirm the nature of the site and assist in reporting the site to the Nunavut Territorial Archaeologist (Stantec, 2017).
Human Health	
	• for general health and safety, ensure that all workers involved in construction activities wear proper Personal Protection Equipment (PPE).

Environmental Component	Mitigation Measures
Accidents and Malfunctions	
Fuel Spill Management	• inspect machinery for leakage of lubricants or fuel and to ensure that they are in good working order; • maintain basic petroleum spill clean-up equipment on-site; • refuelling of vehicles and equipment must occur in designated areas following all applicable regulations and guidance to prevent further soil contamination, and basic petroleum spill clean-up equipment is to be kept on-site; • provide permanent fuel storage on-site which will have appropriate secondary containment; • contractors must develop a contingency plan for work in an Arctic environment that includes, but is not limited to: • roles and responsibilities of intervening personnel; • a communication plan for operational personnel and regulatory agencies; • response technique for various types of spills; and, • follow-up actions.

7 ACCIDENTS AND MALFUNCTIONS

Consideration of the environmental effects of accidents and malfunctions during construction and operation was assessed as part of this EIA addendum. There are no plans for decommissioning and abandonment of the three new project components at this time. If and when this does occur, a separate evaluation of decommissioning accidents and malfunctions will be undertaken.

7.1.1 Safety Practices

There is potential for accidents or malfunctions to occur during any construction project. These include events such as, spills of construction-related equipment fuel stored on site, traffic accidents involving construction-related vehicles, structural failure of building components during construction, and personal injury resulting from a construction accident. To reduce the risk of accidents and malfunctions, the requirements of the *Northwest Territories Safety Act,* and associated Occupational Health and Safety Regulations will be adhered to. In addition, sound safety practices will be followed on the construction site. Operational safety measures such as the use of appropriate Personal Protective Equipment (PPE), including, hard hats, safety glasses, safety boots, and work gloves will be used on site. Also, building construction will be compliant with the National Fire Code and National Building Code and will conform to design and construction protocols specifically developed to minimize the potential for structural failure.

7.1.2 Fuel Spill Management and Clean-Up

Potential environmental effects associated with the construction of the project components include the spills/releases of hazardous materials (e.g. fuels and lubricants). Should spills/releases occur during the construction phase, these are most likely to be associated with the use of construction equipment. As described in previous sections, mitigation measures will be implemented to prevent and mitigate the effects of such occurrences. In addition to the mitigation measures stipulated by the NIRB Screening Decision dated 22 September 2015 and in the conditions annexed to and forming part of Land Use Permit N2017N0017 (INAC, 2017) other mitigation measures that may be employed include:

- inspecting machinery for leakage of lubricants or fuel and to ensure that they are in good working order;
- maintain basic petroleum spill clean-up equipment on-site;
- refuelling in designated areas; and,
- providing permanent fuel storage on-site which will have appropriate secondary containment.

Prior to a contract being issued for the construction of the proposed project components, contractors must develop a contingency plan for work in an Arctic environment that includes, but is not limited to:

- roles and responsibilities of intervening personnel;
- a communication plan for operational personnel and regulatory agencies;
- response techniques for various types of spills; and
- follow-up actions.

With the implementation of the applicable mitigation measures, no residual adverse environmental effects are expected to occur.

Additionally, the construction contractor will have an ongoing clean-up plan in order to keep up with the required progression of the construction work. The quarry site will be kept level and tidy on completion of the quarry activities. In the event that the quarry floor soil is contaminated, the remediation plan will be to immediately clean up the area and place the contaminated soils into drums which will be kept stored on a lined pad in preparation for transporting off site to a certified landfill. All contaminated drums will be labeled as such with TDG and DFO requirements (Nuna East, 2018).

7.1.3 Other Wastes

At the completion of the construction projects the temporary tent camp complex will be removed and transported back to Eureka station for final demobilization. The site will be cleared of debris and non-burnable garbage will be hauled and disposed of in a local landfill. Food waste will be incinerated and dangerous goods will be placed in drums labeled appropriately with TDG and DFO requirements for demobilization (Nuna East, 2018).

8 LIKELY EFFECTS OF THE ENVIRONMENT ON THE PROJECT

This section describes potential effects of the environment on the project components, primarily severe weather and climate change.

8.1.1 Severe Weather

The high Arctic presents challenges given its extreme temperatures, wind speeds and sunlight cycles throughout the year and consequently, all buildings and associated infrastructure are designed to address these severe weather conditions. ECCC is experienced with constructing, operating and maintaining its weather stations in the Arctic and specifically the HAWS. Severe weather is typically experienced outside the summer construction season when the construction activities for the project components will be undertaken; consequently, severe weather is not expected to affect the project construction activities.

Since the proposed access road and permanent water crossing over Black Top Creek are intended to remain indefinitely, they would be potentially exposed to severe weather over time. As was noted above, ECCC has extensive experience with maintaining infrastructure in the study area and will ensure that these infrastructures are well maintained to withstand severe weather conditions during their operating lifespan.

8.1.2 Climate Change

The construction of the three project components is scheduled to take place exclusively during the summer of 2018 (with installation of the temporary worker tent camp in the spring of 2018). Since the effects from climate change impacts are evaluated in the longer term (approximately 10-100 years), the Project component construction period (one season in one year) is not expected to be affected by the potential impacts of climate change.

Since the proposed access road and permanent water crossing over Black Top Creek are intended to remain indefinitely, they would be potentially exposed to effects of climate change over time. ECCC must employ a maintenance strategy, including visual investigations, monitoring, and repairs as required, to mitigate any potential adverse effects arising from climate change in the long term.

9 ASSESSMENT OF CUMULATIVE EFFECTS

Section 16(1) of the *CEAA* requires the consideration of cumulative environmental effects in relation to a project. The Canadian Environmental Assessment Agency's Cumulative Effects Assessment Practitioners Guide (Cumulative Effects Assessment Working Group and AXYS Environmental, 1999) and Operational Policy Statement (1999) provides guidance in conducting an assessment of cumulative effects to meet the regulatory requirements. According to the Practitioners Guide, a cumulative effects assessment is:

> *"…an assessment of those incremental effects of an action on the environment when the effects are combined with those from other past, existing and future actions" (pg. A1).*

As noted in the Practitioner's Guide, the identification of residual effects allows for cumulative effects to be assessed since only those project-environment interactions that result in residual effects can lead to a cumulative effect. The Guide suggests that a cumulative effects assessment for a single project under regulatory review should fundamentally accomplish the following:

1. *determine if the project will have an effect on a Valued Ecosystem Component (VEC);*
2. *if such an effect can be demonstrated, determine if the incremental effect acts cumulatively with effects of other actions, either past, existing or future;*
3. *determine if the effect of the project, in combination with the other effects, may cause a significant change now or in the future in the characteristics of the VEC after the application of mitigation for that project".*

There are four basic steps in a cumulative effects assessment:

1. identifying any adverse residual environmental effects of the proposed project (as presented in Chapter 6).

2. identifying other projects or activities that could potentially interact with the residual effects of the proposed project.

3. considering the likelihood for an interaction in terms of:
   - similar effects from other projects and activities that might contribute to those caused by the proposed project;
   - the time over which these potential interactions coincide; and
   - the geographic area in which the effects occur.

4. for the effects indicated, determining whether there is overlap in time and space, and where that occurs, the resultant overall cumulative effect and its significance.

Based on the assessment of effects in Chapter 6 of this EIA addendum, and as summarized in Table 9.2, there are no adverse residual project effects to be considered in a cumulative effects assessment. That there are no identified adverse residual project effects is not surprising for construction projects of this nature which are very limited in geographic extent and time. For example, the potential extent of the loss of vegetation is predicted to be limited to the footprint of the temporary worker camp and borrow pit excavation area.

Other projects identified (Table 9.1) that could have potentially interacted cumulatively with the three currently proposed project components are located within the existing HAWS site and infrastructure as part of the Runway Recap Improvement Project (described and evaluated in the Environmental Impact Assessment Report (Arcadis, 2016)). Of these projects, the Multi-Purpose Building has already been constructed in 2017, and the remaining construction projects are not anticipated to occur simultaneously with the three currently proposed project components. Furthermore, the 2016 Arcadis EIA concluded that there were also no adverse residual effects associated from these projects.

Thus, since there are no predicted residual effects from the three currently proposed project components, nor from the Improvement Projects previously evaluated in 2016 by Arcadis, therefore, no cumulative environmental effects are anticipated from the HAWS Improvements Project.

Table 9.1 Other Projects and Activities

Category	Projects or Activities	Description
Past or Existing Projects or Activities	HAWS Normal Operations	Includes regular operations of the station, regular maintenance activities, research activities and vehicle movements throughout the EC reserve lands.
	Construction of Multipurpose Building	Pre-fabricated steel building for cold and heated storage, and carpentry/woodworking shop located north of the main complex building. Construction work commenced 2015 and was completed in September 2017.
	Eureka Runway Normal Operations	Includes aircraft movements, refueling and vehicle movements between the runway and main site.
	Main complex	Perimeter regrading 2017.
Certain/planned projects or activities	Main complex Building Maintenance and Upgrades	Proposed maintenance and upgrades for systems/equipment within the HAWS main complex include: • Main complex transformer replacement; • Domestic Hot Water Plate Heat Exchanger; • Fresh Air Intake Preheater Main Complex. Proposed 2016-2018.
Reasonably Foreseeable Projects or Activities	Hydrogen building	Updates/improvements 2016-2019.
	Main complex	Window replacement 2018-2020.
	Existing old garage recapitalization	Updates/improvements 2016 – 2019.

Source: L. Barz (personal communications) September 10, 2015 and February 23, 2018.

Table 9.2 Project Effects on VEC

Environmental Components	Sub-components	Relevant VECs	Direct Effect on VEC
Atmospheric Environment	Air Quality (dust and climate change)	Pathway to Human Health Pathway to Non-Human Biota Health Pathway to Terrestrial Environment	Minimal localized dust during construction activities. No long-term residual effect anticipated. No long-term residual changes in climate as result of project works anticipated.
	Noise	Pathway to Human Health Pathway to Non-Human Biota Health Pathway to Terrestrial Environment	Localized effect of a temporary nature anticipated. No long-term residual effects anticipated.
Surface and Bedrock Geology	Hydrogeology	Pathway to Human Health Permafrost stability	None
	Soil Quality	Pathway to Non-Human Biota Health	None
Hydrology and Surface Water	Hydrology	Pathway to Human Health Pathway to Non-Human Biota Health Pathway to VEC in other environmental components	None
	Water Quality and Sediment	Pathway to Human Health Pathway to Non-Human Biota Health Pathway to VEC in other environmental components	Effects to surface waters expected to be localized and temporary. Small areas of physical disturbance and suspended solids may occur during construction but long-term water quality and effects to the aquatic community are not expected.

10 CONCLUSIONS OF THE ASSESSMENT

As an active and operating site, the HAWS is subject to and compliant with a number of Federal and Territorial regulations. Adherence to regulations, implementation of existing mitigation measures, in addition to those proposed within this addendum, will ensure that the proposed project components do not cause significant adverse effects on the environment.

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Personal Communications

Laura Barz. 2015. PSPC Senior Environmental Specialist, Environmental Services – Winnipeg, September 10, 2015.

Laura Barz. 2018. PSPC Senior Environmental Specialist, Environmental Services – Winnipeg, February 23, 2018.

APPENDIX A

DFO Request for Review and Response

Request for Review

A) Contact information

Name of Business/Company:

Environment Climate Change Canada

Name of Proponent:

Dominic Matte, ECCC

Mailing address:

160, chemin du Tour-de-Ilsle, Ile Ste Helene, 1st Floor, Office 126A

City/Town:

Montreal

Province/Territory:

Quebec

Postal Code:

H3C 4G8

Tel. No. :

514-496-8285

Fax No.:

Email:

dominic.matte@canada.ca

Select additional contact:
Contractor/Agency/Consultant *(if applicable)*:

Laura Barz
Public Service Procurement Canada

Mailing address:

167 Lombard Ave

City/Town:

Winnipeg

Province/Territory:

Manitoba

Postal Code:

RR3B 0T6

Tel. No. :

204-293-6530

Fax No.:

Email:

laura.barz@pwgsc.gc.ca

Is the Proponent the main/primary contact? ○ Yes ◉ No

If no, please enter information for the primary contact or any additional contact.

Please contact Laura Barz with any follow up questions. Please note, Laura is in the process of changing her last name to MacKay. If the listed email address does not work, please try laura.mackay@pwgsc.gc.ca or call 204-293-6530.

B) Description of Project

If your project has a title, please provide it.

Black Top Creek Water Crossing, Eureka, Nunavut

Is the project in response to an emergency circumstance*? ○ Yes ◉ No

Does your project involve work in water? ◉ Yes ○ No

If yes, is the work below the High Water Mark*? ◉ Yes ○ No

What are you planning to do? Briefly describe all project components you are proposing in or near water.

Construction of a temporary bridge and permanent bridge over Black Top Creek , Nunavut is proposed for Spring/Summer 2018. Black Top Creek is a minimal stream which consists of summer snow melt/run off. Staff working at the Eureka High Arctic Weather station have reported that they do not believe the Creek is fish bearing, however, this has not been confirmed. A new quarry site will be created outside of the Eureka High Arctic Weather Station. Aggregate from the quarry site will be used in the HAWS aircraft runway expansion/ maintenance project. A camp will be set up at the quarry site. As the camp and quarry site are on the East side of Black Top Creek, construction of a bridge will be required.

Temporary Bridge
Please note, it has been identified that the water flow in Black Top Creek is typically very low, where an ATV would likely be able to ford the Creek throughout the summer. If possible, we would also like to consider approval to not construct the temporary bridge, and allow daily ATV fording (1 round trip x 2 ATV) instead. All required mitigation measures would be adhered to.

If fording of ATVs is not permitted, a temporary bridge is proposed to be installed in June 2018. There should be minimal (if any) water flow at the time of construction as the ground and snow will not yet have melted. The bridge will be <2m in width and ~50m in length. Its platform and supports will be constructed of untreated dimensional lumber. The purpose of the bridge is to allow daily ATV crossings of staff to and from the HAWS site to the quarry camp. In late August, the sea lift with supplies for the main bridge will arrive. Once the main bridge is constructed, the temporary bridge will be dismantled (estimated September 2018). *

Main Bridge Construction
It is proposed to construct the main bridge over Black Top Creek in August 2018. Water flows for the creek are expected to be minimal. The bridge is proposed to have two arch culverts and will be approximately 6m in width and 50m in length. The purpose of the bridge is to allow a gravel truck from the quarry site to traverse over to the airport runway. The quarry site will be accessed from 2018-2020. It is planned to keep the bridge in place for the foreseeable future.

An environmental impact assessment is currently being written for the proposed work. Any mitigation measures and recommendations arising from the EIA will be adhered to throughout the pre, during and post construction phases. The EIA will be provided to the Nunavut Planning Commission for their review and action. Furthermore, any applicable DFO Measures to Avoid Harm to Fish and Fish Habitat (see below) will be referenced in the EIA and also adhered to.

How are you planning to do it? Briefly describe the construction materials, methods and equipment that you plan to use.

See above.

Include a site plan (figure/drawing) showing all project components in and near water.

Are details attached? ◉ Yes ○ No

Identify which work categories apply to your project.

- ☐ Aquaculture Operations
- ☐ Aquatic Vegetation Removal
- ☐ Beaches
- ☐ Berms
- ☐ Blasting / Explosives
- ☐ Log Handling / Dumps
- ☐ Log Removal
- ☐ Moorings
- ☐ Open Water Disposal
- ☐ Piers

- [ ] Boat Houses
- [ ] Boat Launches / Ramps
- [ ] Breakwaters
- [x] Bridges
- [ ] Cable Crossings
- [ ] Causeways
- [x] Culverts
- [ ] Dams
- [ ] Dewatering / Pumping
- [ ] Docks
- [ ] Dredging / Excavation
- [ ] Dykes
- [ ] Fishways / Ladders
- [ ] Flow Modification (hydro)
- [ ] Groundwater Extraction
- [ ] Groynes
- [ ] Habitat Restoration
- [ ] Ice Bridges
- [ ] Riparian Vegetation Removal
- [ ] Seismic Work
- [ ] Shoreline Protection
- [ ] Stormwater Management Facilities
- [ ] Surface Water Taking
- [ ] Tailings Impoundment Areas
- [ ] Temporary Structures
- [ ] Turbines
- [ ] Water Control Structures
- [ ] Water Intakes / Fish Screens
- [ ] Water Outfalls
- [ ] Watercourse Realignment
- [ ] Weirs
- [ ] Wharves
- [ ] Wind Power Structures

- [ ] Other Please Specify

Was your project submitted for review to another federal or provincial department or agency? (•) Yes ( ) No

If yes, indicate to whom and associated file number(s).

The project will also be submitted to the Nunavut Planning Commission. It has not yet been sent, therefore no file number is available.

C) Location of the Project

Coordinates of the proposed project Latitude: see attached map N Longitude: W

OR UTM zone: ; Easting:

Northing:

Include a map clearly indicating the location of the project as well as surrounding features.

Name of Nearest Community (City, Town, Village): Eureka, High Arctic Weather Station

Municipality, District, Township, County, Province: Nunavut

Name of watershed (if applicable):

Name of watercourse(s) or waterbody(ies) near the proposed project: Slidre Fiord

Provide detailed directions to access the project site:

Site access is only available by aircraft. Arrangements would need to be made with ECCC as they operate the HAWS station.

D) Description of the Aquatic Environment

Identify the predominant type of aquatic habitat where the project will take place.

- ○ Estuary (Estuarine)
- ○ Lake (Lacustrine)
- ○ On the bank/shore at the interface between land and water (Riparian)
- ◉ River or stream (Riverine)
- ○ Salt water (Marine)
- ○ Wetlands (Palustrine)

Provide a detailed description of biological and physical characteristics of the proposed project site.

Very minimal vegetation and riparian vegetation on site. Snow cover from September to June. On site staff report that they do not believe Black Top Creek is ever fish bearing, but we could not find any studies to confirm this.

The Eureka High Arctic Weather Station is located in the Eureka Hills Ecoregion of the Northern Arctic Ecozone on Ellesmere Island (Figure 2-1). The mean summer temperature of this ecoregion is 0.5°C and the mean winter temperature is -30.5°C, with mean annual precipitation ranging from 50 to 150 mm (http://ecozones.ca/english/region/9.html). The Eureka Hills ecoregion is classified as having a high arctic ecoclimate. It has a sparse vegetative cover consisting of moss and mixed low-growing herbs and shrubs including purple saxifrage, arctic willow, kobresia, sedge, and arctic poppy http://ecozones.ca/english/region/9.html). Topography is rolling and ridged with extensive areas of low, dissected plateaus and gently rolling uplands cut by trench like depressions forming drainage systems that extend to the coast (http://ecozones.ca/english/region/9.html). Permafrost is continuous with medium ice content.
The dominant soils are Regosolic Static Cryosols and Orthic Turbic Cryosols, which have developed on colluvial, alluvial, and marine deposits (http://ecozones.ca/english/region/9.html). Wildlife in this ecoregion includes muskox, arctic hare, arctic wolf, caribou, seal, polar bear, ptarmigan, and seabirds.

Include representative photos of affected area (including upstream and downstream area) and clearly identify the location of the project.

E) Potential Effects of the Proposed Project

Have you reviewed the Pathways of Effects (PoE) diagrams (http://www.dfo-mpo.gc.ca/pnw-ppe/pathways-sequences/index-eng.html) that describe the type of cause-effect relationships that apply to your project?

◉ Yes ○ No

If yes, select the PoEs that apply to your project.

- ☐ Addition or removal of aquatic vegetation
- ☒ Change in timing, duration and frequency of flow
- ☐ Cleaning or maintenance of bridges or other structures
- ☐ Dredging
- ☐ Excavation
- ☒ Fish passage issues
- ☐ Grading
- ☐ Marine seismic surveys
- ☐ Organic debris management
- ☐ Placement of marine finfish aquaculture site
- ☒ Placement of material or structures in water
- ☐ Riparian Planting
- ☐ Streamside livestock grazing
- ☒ Structure removal
- ☐ Use of explosives
- ☐ Use of industrial equipment
- ☐ Vegetation Clearing
- ☐ Wastewater management
- ☐ Water extraction

Will there be changes (i.e., alteration) in the fish habitat*? ◉ Yes ○ No ○ Unknown

If yes, provide description.

Installation of the 2 arch culverts could impact water flow and fish habitat. However, water levels are typically low and it is not confirmed if the creek is fish bearing.

Will the fish habitat alteration be permanent*? (•) Yes ( ) No ( ) Unknown

Is there likely to be destruction or loss of habitat used by fish? ( ) Yes ( ) No (•) Unknown

What is the footprint (area in square meters) of your project that will take place below the high water mark*?

footprint of bridge is 300 square meters

Is your project likely to change water flows or water levels? ( ) Yes ( ) No (•) Unknown

If your project includes withdrawing water, provide source, volume, rate and duration.

na

If your project includes water control structure, provide the % of flow reduction.

na

If your project includes discharge of water, provide source, volume and rate.

na

Will your project cause death of fish? ( ) Yes (•) No ( ) Unknown

If yes, how many fish will be killed (for multi-year project, provide average)? What species and lifestages?

Do not believe fish are present in creek, but cannot confirm.

Are there aquatic species at risk (http://www.sararegistry.gc.ca/species/aquatic_e.cfm) present? If yes, which ones?

No SAR are expected to be present in the creek at any time.

What is the time frame of your project?

The construction will start on 06/04/2018 and end by 09/03/2018

If applicable, the operation will start on MM/DD/YYYY and end by MM/DD/YYYY

If applicable, provide schedule for the maintenance

Temporary bridge will be constructed in June 2018. Permanent bridge constructed in August. Temporary bridge de-constructed in late August 2018.

If applicable, provide schedule for decommissioning

Are there additional effects to fish and fish habitat that will happen outside of the time periods identified above? ( ) Yes (•) No

(If yes, provide details)

Have you considered and incorporated all options for redesigning and relocating your project to avoid negative effects to fish and fish habitat?

(•) Yes ( ) No

If yes, describe.

Bridge will be located in area where water flow is minimal. Construction & deconstruction of temporary bridge will occur when water is frozen. An EIA is currently being written. Any mitigation measures from the EIA as well as DFO Measures to Avoid Harm to Fish and Fish Habitat (see below) will be adhered to.

Have you consulted DFO's Measures to Avoid Harm to Fish and Fish Habitat (http://www.dfo-mpo.gc.ca/pnw-ppe/measures-mesures/index-eng.html) to determine which measures apply to your project?

(•) Yes ( ) No

Will you be incorporating applicable measures into your project? ( ) Yes ( ) No

If yes, identify which ones. If No, identify which ones and provide reasons.

Work will be completed outside of spawning window (Sept-June). It is not believe that any fish are in the Creek, but this has not been proven. However, it is very unlikely any SAR are in the Creek at any time.

•Minimize duration of in-water work.
•Conduct instream work during periods of low flow, or at low tide, to further reduce the risk to fish and their habitat or to allow work in water to be isolated from flows.
•Schedule work to avoid wet, windy and rainy periods that may increase erosion and sedimentation.
•Design and plan activities and works in waterbody such that loss or disturbance to aquatic habitat is minimized and sensitive spawning habitats are avoided, and impacts to SARA-listed aquatic species, their residences or critical habitat are avoided.
•Design and construct approaches to the waterbody such that they are perpendicular to the watercourse to minimize loss or disturbance to riparian vegetation.
•Avoid building structures on meander bends, braided streams, alluvial fans, active floodplains or any other area that is inherently unstable and may result in erosion and scouring of the stream bed or the built structures.
•Undertake all instream activities in isolation of open or flowing water to maintain the natural flow of water downstream and avoid introducing sediment into the watercourse.
•Plan activities near water such that materials such as paint, primers, blasting abrasives, rust solvents, degreasers, grout, poured concrete or other chemicals do not enter the watercourse.
•Develop a response plan that is to be implemented immediately in the event of a sediment release or spill of a deleterious substance and keep an emergency spill kit on site.
•Ensure that building material used in a watercourse has been handled and treated in a manner to prevent the release or leaching of substances into the water that may be deleterious to fish.
•Develop and implement an Erosion and Sediment Control Plan for the site that minimizes risk of sedimentation of the waterbody during all phases of the project.
•Immediately stabilize shoreline or banks disturbed by any activity associated with the project to prevent erosion and/or sedimentation, preferably through re-vegetation with native species suitable for the site.
•Restore bed and banks of the waterbody to their original contour and gradient; if the original gradient cannot be restored due to instability, a stable gradient that does not obstruct fish passage should be restored.
•If replacement rock reinforcement/armouring is required to stabilize eroding or exposed areas, then ensure that appropriately-sized, clean rock is used; and that rock is installed at a similar slope to maintain a uniform bank/shoreline and natural stream/shoreline alignment.
•Remove all construction materials from site upon project completion.
•Ensure that all in-water activities, or associated in-water structures, do not interfere with fish passage, constrict the channel width, or reduce flows, or result in the stranding or death of fish.
•Retain a qualified environmental professional to ensure appropriate protocols are applied, and applicable permits for relocating fish are obtained and to capture any fish trapped within an isolated/enclosed area at the work site and safely relocate them to an appropriate location in the same waters. Fish may need to be relocated again, should flooding occur on the site.
•Screen any water intakes or outlet pipes to prevent entrainment or impingement of fish.

Have you considered and incorporated additional best practices and mitigation measures recommended in relevant guidelines to avoid negative effects to fish and fish habitat?

○ No ◉ Yes

If Yes, include a list of the guidelines being used to avoid negative effects to fish and fish habitat.

Mitigation measures are currently being developed by 3rd party environmental consultant during the EIA process.

Are there any relevant best practices or mitigation measures that you are unable to incorporate? ◉ Yes ○ No

(If yes, identify which ones.)

Can you follow appropriate Timing Windows (http://www.dfo-mpo.gc.ca/pnw-ppe/timing-periodes/index-eng.html) for all your project activities below the High Water Mark*?

◉ Yes ○ No

(If no, provide explanations.)

Work will be completed outside of timing windows. Attempts will also be made to conduct work when water is frozen and/or at its low flow period.

What residual effects to fish and fish habitat do you foresee after taking into account the avoidance and mitigation measures described above?

No residual effects resulting from the proposed project.

F) Signature

I, Laura Barz (print name) certify that the information given on this form is to the best of my knowledge, correct and completed.

Signature

29/01/2018
Date

Information about the above-noted proposed work or undertaking is collected by DFO under the authority of the *Fisheries Act* for the purpose of administering the fisheries protection provisions of the *Fisheries Act*. Personal information will be protected under the provisions of the *Privacy Act* and will be stored in the Personal Information Bank DFO-PPU-680. Under the *Privacy Act*, Individuals have a right to, and on request shall be given access to any personal information about them contained in a personal information bank. Instructions for obtaining personal information are contained in the Government of Canada's Info Source publications available at www.infosource.gc.ca or in Government of Canada offices. Information other than "personal" information may be accessible or protected as required by the provision of the *Access to Information Act*.

**All definitions are provided in Section G of the Guidance on Submitting a Request for Review*

Guidance on Submitting a Request for Review

This document explains the requirements for a Request for Review by DFO under the fisheries protection provisions of the *Fisheries Act*. To determine whether you should request a review, follow the steps for proponent Self-Assessment on DFO's Projects Near Water webpage (http://www.dfo-mpo.gc.ca/pnw-ppe/index-eng.html).

Incomplete Requests for Review will be returned to the applicant without review by DFO. All information requested must be provided. If you attach documents to your application with additional information, you must still provide appropriate summaries in the spaces provided on the application document or your application will be considered incomplete.

Section A: Contact Information

Provide the full legal name of the proponent and primary mailing address for the proponent. When the proponent is a company, identify the full legal registered name of the company.

If applicable, also provide the contact information of the duly authorized representative of the proponent. Please note that a copy of correspondence to Contractor/Agency/Consultant will also be sent to the Proponent.

Section B: Description of Project

This information is meant to provide background about the proposed project. All components of the proposed project in or near water, must be described.

Proponents should provide information about all appropriate phases of the project, i.e., the construction, operation, maintenance and closure phases for the proposed project.

All details about the construction methods to be used, associated infrastructure, permanent and temporary structures, building materials to be used, machinery and equipment to be used must also be provided. For example, the construction of **permanent structures** may require the construction of temporary structures such as temporary dikes, in conjunction with other associated activities like the withdrawal of water, land clearing, excavation, grading, infilling, blasting, dredging, installing structures, draining or removing debris from water. Similarly, the equipment and materials to be used may include hand tools, backhoes, gravel, blocks or armor stone (provide the average diameter), concrete (indicate if pre-cast or poured in-water), steel beams or wood.

When physical structures in or near water are proposed, provide the plan and specifications of those works which would require a review.

Section C: Location of the Project

The purpose for this information is to describe and illustrate the location of the proposed project, and to provide geographical and spatial context. The information should also facilitate an understanding of how the project will be situated in relation to existing structures.

The details to be provided must include:

- Coordinates of the project (e.g., Latitude and Longitude or Universal Transverse Mercator Grid coordinates);
- A map(s), site plan, or diagrams indicating the high water mark and the location, size and nature of proposed and existing structures (e.g., floating or fixed), landmarks and proposed activities. In a marine setting, it may be helpful to depict the approximate location of the proposed development on a nautical chart or showing the relation of the site to sea marks or other navigational aids. These plans, maps or diagrams should be at an appropriate scale to help determine the relative size of the proposed structures and activities, the proximity to the watercourse or waterbody and the distance from existing structures;
- The community nearest to the location of the proposal as means to provide a general reference point. When possible, proponents should use geographical names recognized by the Geographical Names Board of Canada (http://www.nrcan.gc.ca/earth-sciences/geography-boundary/geographical-name/11680).
- If available, provide aerial photographs or satellite imagery of the water source(s) and waterbody(ies);
- Names of the watershed(s), water source(s) and/or waterbody(ies) likely to be affected by the proposal; and
- Brief directions to access the proposed project site.

Section D: Description of the Aquatic Environment

Proponents must describe the environmental context and aquatic resources present at the proposed site. The information must identify the current state of the fish and fish habitat prior to the carrying on of the project.

It is important to include information about the fish species present, the biological, chemical, physical features present (habitat characteristics), and the fish life-cycle functions (fish characteristics).

The spatial scope for assessing fish and fish habitat should encompass the direct physical footprint of the project, and the upstream and downstream areas affected.

As an example, the following is a non-exhaustive and non-prescriptive list of some common attributes which may characterize the aquatic environment:

- Type of water source or watercourse (groundwater, river, lake, marine, estuary, etc.);
- Characteristics of the water source or waterbody could include:
  - Substrate characterization - describe the types of substrate (e.g., bedrock, boulder, cobble, gravel etc.), identify the predominant substrate type (e.g., 80% cobble, 20% gravel etc.) and provide maps of the substrate;
  - Aquatic and riparian vegetation characterization - identify the prevalent types of vegetation (e.g. rooted, submerged, emergent, etc.), identify the relative abundance of the vegetation (e.g., 10% cattails, 80% grass, 10% sedge) , indicate the predominant vegetation (e.g., by species or types) and identify the vegetation densities (e.g., type of vegetation/ area);
  - Flow characterization - specify if the flow is controlled or if it is natural, identify if the flow is permanent or intermittent, identify the current and tide (marine environment) etc.;
  - Physical waterbody characterization - identify the average depth of water for water bodies, identify bathymetry of water bodies, provide bathymetric maps where available, channel width (determine the width of the channel from the high water mark), slope ;
  - Water quality characterization - (e.g., annual or average pH, salinity, alkalinity, total dissolved solids, turbidity, temperature etc.);
  - Biological water quality characterization - (e.g., benthic macro-invertebrates, zooplankton, phytoplankton, etc.)
- Fish species characterization - identify the fish species (including molluscs, crustaceans, etc.) known or suspected to be in the area, predator prey relationships etc. Identify what source of information was used and to determine the presence of fish in that area; and
- Estimate the fish abundance - estimate the number of fish present, estimate the year class for each species etc.

There are many different methods and attributes available to characterize fish and fish habitat. Proponents must describe all sources of information used, all fish and environment sampling techniques used, all modelling techniques used and all other approaches used to define the fish and fish habitat. Proponents are encouraged to use recognized fisheries inventory methods such as those approved by DFO or provinces and territories, or scientifically defensible methodologies and techniques whenever possible.

Whenever possible, proponents should support descriptions of the aquatic environment with the use of detailed drawings, such as plans or maps and photographs of the habitat features. In an offshore marine setting, photos may not be useful to depict the proposed development site. Instead describe and/or sketch the specific features of the sea floor which may include the presence of submarine features such as canyons, cliffs, caverns, etc.

Section E: Potential Effects of the Proposed Project

The objective of this section is to identify all anticipated effects on fish and fish habitat likely to be caused by the project. Proponents should consider all mitigation or avoidance techniques.

The description must include qualitative and/or quantitative information about the predicted/potential effects to fish species and fish habitat. Some examples of likely effects may include mortality to fish, changes to the life stages of fish affected, area of habitat loss, change to flow, changes to habitat function, reduction in prey availability etc.

The spatial scope of the aquatic effects assessment would include the direct physical "footprint" of the proposed project, and any areas indirectly affected, such as downstream or upstream areas. This may also include areas in or on the water, on the shoreline, coast or bank(s) (i.e., in the riparian zone).

The assessment must include the following attributes:

- Identification of all fish species affected by the proposed project ;
- Identification of the type of fish habitat affected (e.g., spawning habitat - gravel and cobble, feeding and rearing areas - side channel slough, small tributaries, etc.), estimate of the affected area (e.g., square meters or hectares);
- Of the affected fish, identify the life stages affected (e.g., juvenile, yearling, adult etc.);
- Description of the effect (e.g., mortality to fish from entrapment, delayed migration of spawning adults, reduction in prey availability, etc.)
- Probability of the effect - this is the likelihood of the effect occurring (e.g., probability of fish strike from turbines for specific fish sizes, probability of sediment plume within a distance from source, etc., or qualitative assessment: low, medium, high)
- Magnitude of the effect - this is the intensity or severity of the effect (e.g., total number of fish affected, or qualitatively assessment: low, medium, high).
- Geographic extent of the effect - this is the spatial range of the effect (e.g., localized to 100m from the work, channel reach or lake region, entire watershed etc.); and
- Duration of the effect - this is the temporal period for which the effect will persist (e.g., duration of delay to fish migration in hours, days, months or years).

The information to be provided must also describe the methods and techniques used to conduct the assessment. As much as possible, methods and techniques used should be scientifically defensible.

The schedule should, at minimum, identify the proposed start and end dates for carrying out each proposed activity, and where applicable, identify the respective phase of the proposal; i.e., the construction, operation, maintenance and closure phases. In some cases, in order to provide additional context, it may be relevant to identify other information such as the expected life span of permanent and temporary structures.

Proponents must provide comprehensive information about all best available measures and standards that are proposed to avoid or mitigate potential serious harm.

Residual serious harm to fish is any serious harm to fish remaining after the consideration of the application of proposed measures or standards to avoid or mitigate serious harm.

It is important to clearly describe and quantify residual serious harm because DFO will use this information as part of its decision making on whether an authorization is required under subsection 35(2)(*b*) of the *Fisheries Act*.

Section F: Submission and Signature

The proponent must sign the application. A signed original of the Request for Review must be provided to the regional DFO office (http://www.dfo-mpo.gc.ca/pnw-ppe/contact-eng.html), even if an electronic copy was sent by email. Should the review of your project indicate that residual serious harm to fish is likely, the information provided in the Request for Review document can be referred to in the subsequent Application for an Authorization under Paragraph 35(2)(*b*) of the *Fisheries Act*.

Section G: Definitions

Emergency circumstance: If your project must be conducted in response to an emergency, you may apply for an Emergency Authorization. The emergency situations are:

- The project is required as a matter of national security
- The project is being conducted in response to a national emergency where special temporary measures are being taken under the federal *Emergencies Act*

- The project is required to address an emergency that poses a risk to public health or safety or to the environment or property.

Fish habitat: Means spawning grounds and any other areas, including nursery, rearing, food supply and migration areas, on which fish depend directly or indirectly in order to carry out their life processes.

High Water Mark: The usual or average level to which a body of water rises at its highest point and remains for sufficient time so as to leave a mark on the land.

Permanent alteration to fish habitat: An alteration of fish habitat of a special scale and a duration that limits or diminishes the ability of fish to use as spawning grounds for nursery or rearing, or as food supply, or as a migration corridor in order to carry out one or more of their life processes.

Subject: FW: 18-HCAA-00071, Bridge Construction, Small Creek near Slidre Fiord, Eureka High Arctic Weather Station

From: Wajmer, Nicole [mailto:Nicole.Wajmer@dfo-mpo.gc.ca]
Sent: February-20-18 10:53 AM
To: dominic.matte@canada.ca
Cc: Laura Barz <Laura.Barz@pwgsc-tpsgc.gc.ca>
Subject: 18-HCAA-00071, Bridge Construction, Small Creek near Slidre Fiord, Eureka High Arctic Weather Station

Subject: Serious Harm to Fish and Prohibited Effects on Listed Aquatic Species at Risk Can Be Avoided or Mitigated - 18-HCAA-00071, Bridge Construction, Small Creek near Slidre Fiord, Eureka High Arctic Weather Station

Dear Dominic Matte:

The Fisheries Protection Program (the Program) of Fisheries and Oceans Canada (DFO) received your proposal on January 29, 2018. We understand that you propose to:

- Construct a temporary bridge over Black Top Creek in June 2018;
- Construct a permanent bridge and four culverts over Black Top Creek in August 2018.

Our review considered the following information:

- Request for Review form and associated documents;
- Email correspondence with Laura Barz on February 19, 2018;
- Drawings of proposed project.

Construct a permanent bridge and four culverts over Black Top Creek in August 2018Your proposal has been reviewed to determine whether it is likely to result in serious harm to fish which is prohibited under subsection 35(1) of the *Fisheries Act* unless authorized. Your proposal has also been reviewed to determine whether it is likely to affect listed aquatic species at risk, any part of their critical habitat or the residences of their individuals in a manner which is prohibited under sections 32, 33 and subsection 58(1) of the *Species at Risk Act*, unless authorized.

Provided that your plans are implemented in the manner, and during the timeframe, described, the Program has determined that your proposal will not result in serious harm to fish or prohibited effects on listed aquatic species at risk. As such, an authorization under the *Fisheries Act* or a permit under the *Species at Risk Act* is not required.

Should your plans change or if you have omitted some information in your proposal, further review by the Program may be required. Consult our website (http://www.dfo-mpo.gc.ca/pnw-ppe/index-eng.html) or consult with a qualified environmental consultant to determine if further review may be necessary. It remains your responsibility to avoid causing serious harm to fish in compliance with the *Fisheries Act*, and avoid prohibited effects on listed aquatic species at risk, any part of their critical habitat or the residences of their individuals in compliance with the *Species at Risk Act*.

It is also your *Duty to Notify* DFO if you have caused, or are about to cause, serious harm to fish that are part of or support a commercial, recreational or Aboriginal fishery. Such notifications should be directed to http://www.dfo-mpo.gc.ca/pnw-ppe/violation-infraction/index-eng.html.

A copy of this letter should be kept on site while the work is in progress. It remains your responsibility to meet all other federal, territorial, provincial and municipal requirements that apply to your proposal.

If you have any questions with the content of this letter, please contact our Burlington office by email at fisheriesprotection@dfo-mpo.gc.ca. Please refer to the file number referenced above when corresponding with the Program.

Yours sincerely,

Nicole Wajmer
Fisheries Protection Biologist
Fisheries and Oceans Canada

Fisheries and Oceans Canada has changed the way new project proposals (referrals), reports of potential *Fisheries Act* violations (occurrences) and information requests are managed in Central and Arctic Region (Alberta, Saskatchewan, Manitoba, Ontario, Nunavut and the Northwest Territories). Please be advised that general information regarding the management of impacts to fish and fish habitat and self-assessment tools (e.g. Measures to Avoid Harm) that enable you to determine *Fisheries Act* requirements are available at DFO's "Projects Near Water" website at www.dfo-mpo.gc.ca/pnw-ppe/index-eng.html. For all occurrence reports, or project proposals where you have determined, following self-assessment, that you cannot avoid impacts to fish and fish habitat, please submit to fisheriesprotection@dfo-mpo.gc.ca. For general inquiries, call 1-855-852-8320.

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